Satpuda Education Society's

Arts & Commerce College

Warwat Bakal Tq. Sangrampur, Dist. Buldhana

Affiliated to Sant Gadge Baba Amravati University, Amravati

NAAC Re-accredited with "B" Grade

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On

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13th September 2024

Director of Conference

(Dr.) Shriram K. Yerankar

Chief Editor

Dr. D. K. Sherkar

Organized By

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Message from Hon'ble Chairman

I am extremely happy to know that Arts & Commerce College, Warwat Bakal is going to organize National Level Conference on "Synergy in Science: Integrating Life and Chemical Sciences". In the span of 30 years, the college has shown a remarkable progress and has contributed gloriously in the Empowerment of educationally backward area. Hearty Congratulations!

I am sure that the National Level Conference organized by the department of Science will initiate some interesting discussions and research papers will help to widen the horizon of the delegates and budding scholars. We embark on an exciting journey to explore the intersections and collaborations between life and chemical sciences. This conference represents a significant milestone in our pursuit of knowledge and understanding, and we are thrilled to be a part of it.

I would like to appreciate the sincere efforts of all the organizers, speakers, and participants for making this conference a reality. Your contributions will undoubtedly enrich our understanding of the intricate relationships between life and chemical science. As we delve into the latest research, innovations, and breakthroughs, let us remember the power of synergy and collaboration. May this conference inspire us to work together, push boundaries,and create a brighter future for all. I wish you all a productive and enriching experience at this conference.

Krushnaraoji Ingle

Ex MLA
Founder President
Satpuda Education Society, Jalgaon Jamod

Message from Hon'ble Vice Chancellor

Dr. Milind A. Barhate
Vice-Chancellor

Sant Gadge Baba Amravati University,
Amravati - 444 602, Maharashtra (India)

No. SGBAU/P-100/ – /2024

Date : 04 / 09 /2024

MESSAGE

I am happy to note that Arts & Commerce College, Warwat Bakal Dist. Buldhana is going to organize a one day National Conference on "Synergy in Science : Integrating Life and Chemical Sciences" on 13th September, 2024.

It is truly commendable that, despite being situated in a rural area, the college is taking the initiative to host a national conference of such significance.

This conference has brought together a remarkable assembly of experts, scholars, and practitioners who have shared their insights, research, and innovative practices. The knowledge and experiences captured within these pages will undoubtedly serve as a valuable resource for life sciences, physical sciences and chemical sciences.

I extend my heartfelt gratitude to all the participants for their invaluable contributions and unwavering commitment to the life sciences. I congratulate the organizing committee members and appreciate their endeavour to make this conference a grand success.

(Dr. Milind A. Barhate)
Vice-Chancellor

Dr. Shriram K. Yerankar,
Principal,
Arts & Commerce College,
Warwat Bakal, Distt. Buldhana.

Phone : Office - 0721 - 2668273, Resi. 0721 - 2668108
E-mail : vc@sgbau.ac.in Website : www.sgbau.ac.in

Message from Hon'ble Pro -Vice Chancellor

PROF. MAHENDRA P. DHORE
M.Sc. M.Phil. Ph.D. (Computer Science)
Pro-Vice Chancellor

SANT GADGE BABA
AMRAVATI UNIVERSITY
AMRAVATI - 444 602
MAHARASHTRA (INDIA)

No. : SGBAU/PVC/ 27/2024
Date : 28/8/2024

Message

It is with immense pleasure that I offer my heartfelt congratulations to Arts & Commerce College, Warwat Bakal, for hosting the one-day National Conference titled "Synergy in Science: Integrating Life and Chemical Sciences" on September 13, 2024.

It is truly commendable that, despite its rural setting, the college is spearheading a national conference of such significance. This event stands as a testament to the college's commitment to fostering interdisciplinary dialogue and collaboration. Bringing together experts from diverse fields, this conference promises to be a vibrant platform for sharing pioneering research and innovative ideas at the nexus of life sciences, physical sciences, and chemical sciences. The conference proceedings as abstract book will undoubtedly serve as invaluable resources for researchers, scholars, students, and experts in the field. I am confident that the deliberations will make a significant contribution to the advancement of scientific knowledge and practice.

My best wishes to the Principal and the organizing committee for their unwavering dedication and effort in orchestrating this esteemed event. I wish the conference immense success and eagerly anticipate the groundbreaking it will produce.

Best wishes for a highly successful and impactful conference.

Mohore 28.8.24

(Prof. Mahendra Dhore)
Pro-Vice Chancellor
S.G.B.Amravati University.

To,
Dr. Shriram K. Yerankar,
Principapal,
Arts & Commerce College,
Warwat Bakal, Dist. Buldhana.

Mob. 9423103043, Ph. Off. : 0721-2668061
website : www.sgbau.ac.in
Email- provc@sgbau.ac.in / mpdhore@rediffmail.com / dhoremp@gmail.com

Message From Registrar

Dr. Avinash M. Asanare
B. Com, B. P.Ed, M.P.Ed., M.A., M.B.A., M. Phil,
PGDHRM, DMCJ, CIS, (NET) Ph.D
REGISTRAR

SANT GADGE BABA
AMRAVATI UNIVERSITY
AMRAVATI - 444 602
MAHARASHTRA (INDIA)

23 AUG 2024

MESSAGE

I gives me immense pleasure to know that Arts & Commerce College, Warwat Bakal, Tq. Sangrampur, Dist – Buldhana is organizing a one-day National Conference titled **"Synergy in Science: Integrating Life and Chemical Science"** on 13th September, 2024 and, on this occasion, publishing an abstract book.

It is a matter of pride that, though this college is situated in the rural area, the college is hosting National Conference on the topics related to synergy in science which will bring together experts from diverse disciplines to share cutting-edge research and innovations at the intersection of life, physical and chemical sciences. I am sure that the abstract book will be beneficial to the Researchers, Students, Professors, Experts, etc. in the field of Science.

I congratulate the Principal and Organizing Committee for organizing this National Conference and wish the conference a grand success.

(Dr.Avinash Asanare)
Registrar

To,
The Principal,
Arts & Commerce College,
Warwat Bakal,
Tq. – Sangrampur,
Dist.- Buldhana

From Principal's Desk……...

"As the Principal of Arts & Commerce College, Warwat Bakal, it is my immense pleasure to welcome you to our National Conference on 'Synergy in Science: Integrating Life and Chemical Sciences'. The Science department has successfully initiated steps to organize a national conference. This conference is a testament to our institution's commitment to fostering interdisciplinary learning and research.

Satpuda Education Society's Arts & Commerce College Warwat Bakal was established in the year 1994 with Arts Faculty. Later on, the Science & Commerce Faculty was started in the year 2009. The college is providing education to the undergraduate students in Arts, Commerce and Science streams. The college recently started post graduate programs in six subjects'viz Zoology, Botany, Chemistry, Commerce, Political Science and Economics. The college has completed two cycles NAAC accreditation in 2016 & 2022 respectively with **'B'** grade.

The theme of this conference resonates with our college's ethos of promoting holistic education and exploring the intersections between different fields of science. We believe that the synergy between life and chemical sciences has the potential to revolutionize our understanding of the world and address some of the most pressing challenges of our time.

I would like to extend my gratitude to all the speakers, delegates, and organizers who have worked tirelessly to make this conference a success. Your contributions will undoubtedly enrich our understanding of the intricate relationships between life and chemical sciences.

As we celebrate the spirit of scientific inquiry and collaboration, let us remember that the true power of science lies in its ability to transform lives and create a better future for all.

I wish you all a productive and enriching experience at this conference, and I hope that the deliberations and discussions here will inspire new ideas, collaborations, and breakthroughs in the days to come. I want to take this opportunity to thanks one and all who have contributed towards the success of this conference.

Dr. Shriram Yerankar
Principal

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Studies on prevalence of cestode parasites of freshwater fish, *Mastacembellus armatus* and *Channa punctatus*

Ravi Khade
Department of Zoology,
Late Pushpadevi Patil Arts and Science College Risod, Dist. Washim
And
Amol Thosar
Department of Zoology and Fishery Science,
Dayanand Science College, Latur
And
Chhaya Khillare
Department of Zoology,
Late Pushpadevi Patil Arts and Science College Risod, Dist. Washim

ABSTRACT

The present investigation deals with the study of prevalence of cestode parasites found in intestine of fresh water fishes i.e. Mastacembellus armatus and Channa punctatus at different collection sites of Wan River and its Tributaries of Satpuda region (M.S). India for the period of one annual cycle i.e. June 2013 to May 2014. The collected parasites on closer observation they were turned out to be the genus, Senga Sp. and Polyonchobotharum Sp. The values for percentage of incidence (prevalence) were seen throughout the study period and seasonal variation were also studied during the study period.

Keywords: Cestode parasite, *Mastacembellus armatus*, *Channa punctatus*, *Senga*, *Polyoncobothrium*, Wan River.

INTRODUCTION

Fish parasitic populations are known to differ, due to variation in the environment and host population (Dobson, 1985). For most of the fish parasites it is difficult to know, whether differences such as the presence or absence of parasites prevalence, intensity, density and index of infections, are due to the environmental factors or due to differences in host species, composition and their density (Koskivara *et al.,* 1991). Prevalence of cestode parasites from *Mastacembellus armatus, Channa punctatus* and *Channa marulius* was undertaken to investigate the innate factors and morphological characters, such as season, temperature, humidity of the host.

Seasonal variation can be either regular or semi-regular. Seasonal variation is component of a time series which is defined as the repetitive and predictable movement around the trend line in one year or less. It is detected by measuring the quantity of interest for small time intervals, such as days, weeks, months, quarters or years. Seasonality can repeat on a weekly, monthly or

quarterly
basis, these periods of time are structured and occur in a length of time less than a year. Seasonal fluctuations in a time series can be contrasted with cyclical patterns. The latter occur in a period of time that extends beyond a single year, these fluctuations are usually of at least two years.

The investigation deals with studies on prevalence of cestode parasites in the freshwater fishes from Wan River and its Tributaries of Satpuda region.

MATERIAL AND METHODS

The freshwater fishes were collected from different localities of Wan River and its Tributaries of Satpuda region during the period of June 2013 to May 2014.Fishes were opened up ventrally and expose the internal part of fishes. The entire digestive system with intestine was removed and placed in Petri dish with physiological saline. Infection of parasites was treated as follows. Collected cestode were first relaxed and then fixed in 4 % hot formalin and stained using Borax carmine (Alcoholic) for morphological study. Stained parasites were dehydrated in ascending grades of alcohol, cleared in xylene, mounted in D.P.X. Drawings were made using a Camera Lucida (Francis Weesner, 1964). The parasites were identified by using the texts of Yamagutti (1959 and 1961).

Incidence of infection (Prevalence): - It is the percentage of host infected by particular species of cestode parasites. Observation is recorded annually and calculated by the following formula.

$$\text{Incidence of infection} = \frac{\text{Infected hosts}}{\text{Total hosts examined}} \times 100$$

RESULTS AND DISCUSSION

Results of present study on prevalence of cestode parasites are detailed in Table No. 1 and 2 (also Graph no. 1 and 2). The present investigation three new species of cestode parasites are found, which belongs to two species are genera *Senga,* Dollfus, 1934 i.e. *Senga micritriangularis sp. Nov*.; *Senga bothriolata sp. Nov*. and one species are genera *Polyoncobothrium,* Diesing, 1854. Such as *Polyonchobotharum hammerata* sp. Now, it was found that, high incidence of infection of all these species were recorded in summer (77.14% & 87.09% respectively) followed by winter (56.66% & 62.50% respectively) whereas infection was low in monsoon (42.85% & 42.10% respectively).

Table 1: Prevalence of *Senga sp. of Mastacembellus armatus* during June, 2013 to May, 2014.

Seasons	No. of the host Examined	No. of the host Infected	Total No. parasites collected	Incidence %
Monsoon	21	9	12	42.85%
Winter	30	17	21	56.66%
Summer	35	27	32	77.14%

Graph 1: Prevalence of *Senga sp. of Mastacembellus armatus* during June, 2013 to May, 2014.

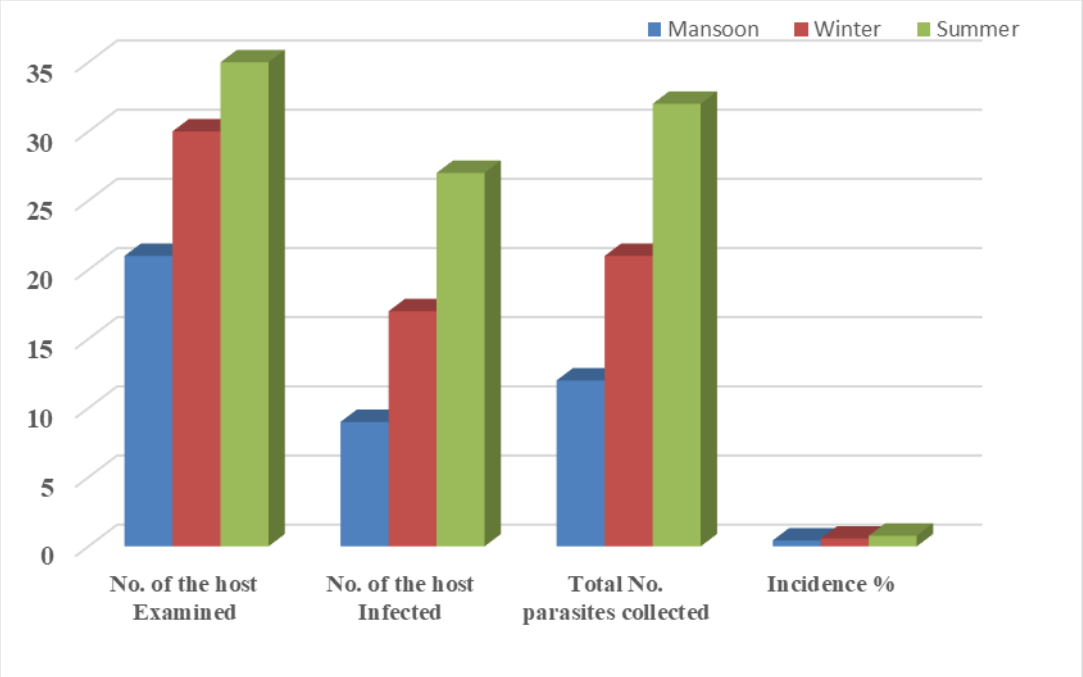
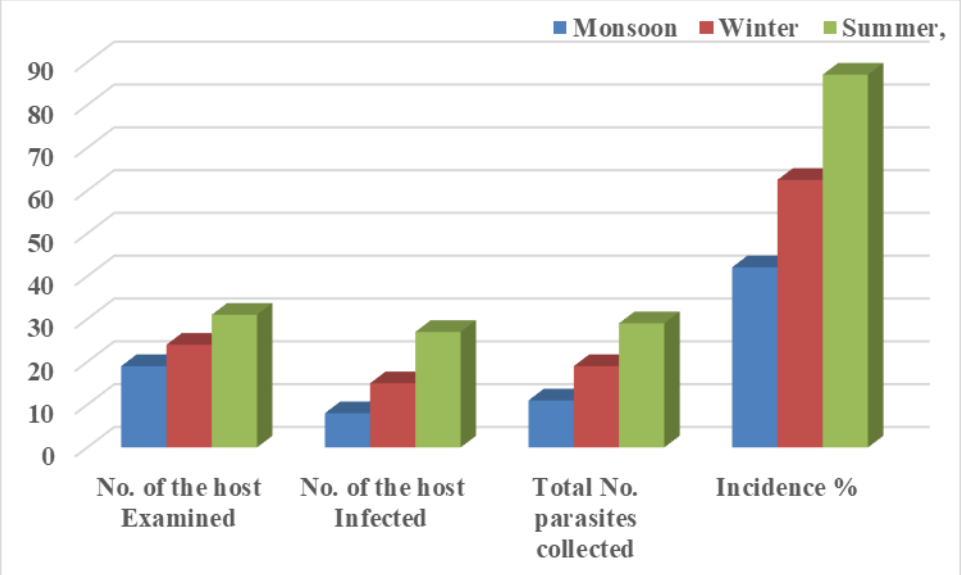


Table 2: Prevalence of *Polyoncobothrium* Diesing *sp. of Channa marulius* during June, 2013 to May, 2014.

Seasons	No. of the host Examined	No. of the host Infected	Total No. parasites collected	Incidence %
Monsoon	19	8	11	42.10
Winter	24	15	19	62.50
Summer	31	27	29	87.09

Graph 2: Prevalence of *Polyoncobothrium* *Diesing* *sp. of Channa marulius* during June, 2013 to May, 2014.



CONCLUSION

In the present study, recorded data shows high incidence of infections of all the cestode species were recorded in summer (Feb., 2014-May, 2014) followed by winter (Oct., 2013- Jan., 2014) where as low in monsoon season (June, 2013 –Sept., 2013). The results clearly indicate that environmental factors and feeding habitat influence the seasonality of parasitic infection either directly or indirectly.

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Study of External Morphology of Dung Beetle (Order - Coleoptera)

Suhas M. Pidhekar
Department of Zoology
And
N. B. Kutemate
Department of Botany
And
Jyoti N. Sharma
G. S. Science, Arts and Commerce College Khamgaon, Dist-Buldhana

ABSTRACT

Beetles are coming under the Order Coleoptera that is the largest order in the phylum Arthropod. They are found all over the world but are quite common in tropics than in temperate region. Scarabaeid beetles act as nature's scavengers as they employ themselves everywhere in clearing the ground of offensive materials Scarab beetles belonging to super family Scarabaeoidea under order Coleoptera includes 12 families, 43 subfamilies, 118 tribes and 94 subtribes throughout the world, during the present study member of family Scarabaeidae were identifying by studying their morphological characters. The member of family Scarabaeidae are mostly collected in the early morning and the late evening, near or under the cow dung and collected by hand picking method with forceps and take photograph. 7 species of sub family Scarabaeinae are identified in and around the G.S. College campus area. Thegenus Onthophagus from subfamily – Scarabaeinae are found more in number in the study area. Antenna having lamillate forms and having 5-6 segments with widely separated antennal insertions. Their antennae have three enlarged segments (club) at the end. Antennae of this beetle are made up of the scape, funicle (formed by 5 segments), and club.

Keyword: Scarabaeidae, *Onthophagus,* lamellate, Coleoptera, Arthropoda, Antennae

INTRODUCTION

Beetles are coming under the Order-Coleoptera that is the largest order in the phylum Arthropoda. Coleoptera is an order of insects commonly called beetles. The order Coleoptera may contain the largest number of described species of any insect order. They are found in almost every habitat. The heaviest known insect is a scarab beetle. Scarabaeidae is one of the largest and economically important groups of Coleoptera, which can easily be separated by their characteristic lamellate antennae. Rollers form balls from a dung pat which they roll and bury the balls in the ground for feeding and breeding, while tunnelars make vertical chambers underground near the dung pat and make their nests with the help of dung pat whereas dwellers breed in dung pats itself (Halffter, Edmonds, 1982). Scarab beetles belonging to superfamily Scarabaeoidea under Order Coleoptera includes 12 families, 43 subfamilies, 118 tribes and 94 subtribes throughout the world,

Smith ABT (2006). The super familyScarabaeoidea comprises a large, diverse and cosmopolitan group of beetles which are fungivores, herbivores, necrophages, coprophages, saprophages, and sometimes carnivores in feeding habit (Jameson, Ratcliffe, 1960). The main objective of the present study is to gain the knowledge of external morphology of Dung beetles in and around the G.S. College campus area Khamgaon.

Scarabaeidae (dung beetle):

A large group of small to large beetles. Beetles of this family are popular with collectors because of their bright colors and the large horns in some groups. The size of these beetles varies greatly, from 1.9 mm to 15 cm. The body is round, thickest, the head projecting forward as a flat plate, beneath which are the mouth parts. The prothorax frequently features projections, and the head may have a process, spine, or several teeth along the front edge. The tough, textured elytra fully cover the abdomen, except for the pygidium. The legs are large and powerful, the tibiae broadened and spined at the apical half, the tarsi slender. In the larger species the fore tarsi are commonly absent. The robust spherical body, the larger broadened legs, the plate like head, the spines or projections on head and prothorax are extremely characteristic, and the bodily structure is specially modified in connection with the peculiar habits. Head and prothorax with horn. Antennae 8-10 segmented. They feed upon dung and roll the dung ball to suitable place. The eggs are enclosed in a small ball of dung in the underground chamber and the nest is guarded by the female.

Scarabaeinae

Member of this subfamily and the next subfamily Aphodiinae dung beetles have hind legs situated for back on body, nearer tips of abdomen than middle legs or about midway between; antennal club is usually hairy. Unlike aphodine dung beetles, these dung beetles (Scarabaeinae) have a pygidium that is partly exposed and a small scutellum that is usually not visible. Dung beetles and tumble bugs are robust, 2-30mm long nearly 2 inches, and generally dull black, some are colorful. Adult provide larvae with a stored food supply of a fecal pellet; larvae feed on this exclusively. The Subfamily Scarabaeinae currently includes around 5700 valid species united in 227 genera and 12 tribes. Of these, the tribe Onthophagini is the most diverse and includes 2500 species, slightly under half of the described species in the entire Scarabaeinae (Davis *et al.,* 2008)

External Morphology

Beetles are generally characterized by a particularly hard exoskeleton and hard forewings (elytra). The beetle's exoskeleton is made up of numerous plates called sclerites, separated by thin sutures. The general anatomy of a beetle is quite uniform, although specific organs and appendages may vary greatly in appearance and function between the many families in the order. Like all insects, beetle's body is divided into three sections: the head, the thorax and the abdomen.

Fig 1: External morphology of dung beetle (dorsal and ventral view)

Head

The head, having mouthparts projecting forward or sometimes downturned, is usually heavily sclerotised and varies in size. The eyes are compound and many display remarkable adaptability. Beetle's antennae are primarily organs of smell. Mouth part comprises the mandibles and appears as large pincers on the front of some beetles. The mandibles are a pair of hard, often tooth-like structures that move horizontally to grasp, crush, or cut food or enemies. Two pairs of finger-like appendages are found around the mouth in beetles, serving to move food into the mouth. These are the maxillary and labial palp. In many species the mandibles are sexually dimorphic, with the males enlarged enormously compared with those of females of the same species.

Fig 2: Head part of dung beetle

Thorax

The thorax is segmented into the two discernible parts, the pro- and _Pterothorax. The Pterothorax is the fused meso and metathorax, which are commonly separate in other insect species, although flexibly articulate from the pro thorax. There are three pairs of legs presents on the thorax region of the beetles, legs are jointed and segmented. Wings, the elytra are connected to the Pterothorax and are not used for flight, but tend to cover the hind part of the body and protect the second pair of wings. They must be raised in order to move the hind flight wings. A beetle's flight wings are crossed with veins and are folded after landing, often along these veins, and stored below the elytra. In some beetles, the ability to fly has been lost. Many have the two elytra fused

together, forming a solid shield over the abdomen.

Fig-3: Shows thorax

Abdomen

The seven to eight segments of abdomen are behind the metathorax, each with a hole for breathing and respiration, called a spiracle. The skeleton composing three different segmented sclerites, dorsal lateral and ventral called tergum, pleura and the sternum respectively. The sternum is the most widely visible part of the abdomen, being a more or less sclerotised segment. The abdomen itself does not have any appendages.

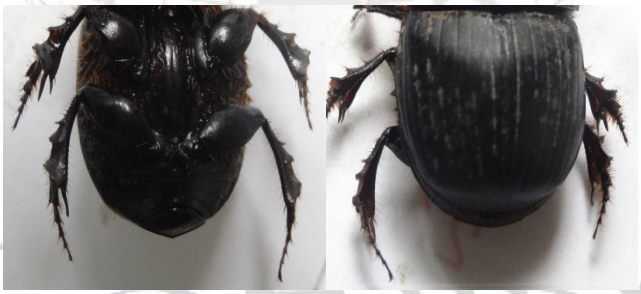

Fig 4: Abdomen of dung deetle (Dorsal and Ventral view)

Legs

Middle and hind tibia slender, often curved, not substantially enlarged apically, middle and hind tibia enlarged apically or foretibia slender and elongated, with four teeth on outer margin. Basal hind tarsal segment not enlarged apically, elongated, as long as tibial spur Onthophagusforetibia broad and apically widened, with three or four teeth on outer margin. If four teeth, basal hind tarsal segment enlarged apically, not slender.

Fig. 5: Legs of dung Beetle

MATERIALS AND METHODS

The beetles used in this observation were collected from cattle faeces of pasture land situated near G. S. College Campus Khamgaon and from different sites of around G. S. College Campus. Most of the beetles were collected during the night time and early in the morning directly by hand pick method. After collection they put in the bottle contained the 70% of alcohol. The collected scarab beetles were sorted and preserved in labeled container of 70% alcohol. After killing immediately take on the petriplate and keep proper position so their legs and mouth parts and their identifying character could be seen under the microscope and photographs are taken (Chandraand Gupta, 2012). The particular species *(Onthophagustaurus)* the beetles were taken live to the laboratory where they were decapitated in daylight.

OBSERVATION AND RESULT

1. **Scarabaeidae dung beetle:**

Family	**Scarabaeidae**
Subfamily	**Scarabaeinae**
Tribes	**Aphodiini**
Genus	***Garreta***
Species	***mundus***

Fig-6: *Garreta mundus*

Characters-These beetles feed in dung, the larvae being found in the dung mass. They are small, brown or black species, cyclindrical in form and readily confused with the carabids of the scaritine division**.** (Wiedemann, 1819). Body size 1.5 cm, antenna are lamellate.
Geographical distribution: India: Bihar, Chhattisgarh, And Maharashtra.

2.

Family	**Scarabaeidae**
Subfamily	**Scarabaeinae**
Tribes	**Onthophagini**
Genus	***Onthophagus***
Species	***dama***

Fig.7:*Onthophagusdama*

Characters- Member of this subfamily and the next subfamily Aphodiinae dung beetles have hind legs situated for back on body, nearer tips of abdomen than middle legs or about midway between; antennal club is usually hairy. **(**Fabricius, 1775) Dung beetles and tumble bugs are robust, 2-30mm long nearly 2 inches, and generally dull black, some are colourful. Antenna islamellate. ***Onthophagusdama*** **(Fabricius, 1798)**

Distribution: India: Arunachal Pradesh, Assam, Bihar, Karnataka, Madhya Pradesh, Maharashtra, Sikkim, Tamilnadu and West Bengal, Bhutan and Nepal. Feeding habit: Coprophagous.

3. **Family** **Scarabaeidae**
Subfamily **Scarabaeinae**
Tribes **Coprini**
Genus ***Catharsius***
Species ***sagax***

Fig. 8: ***Cathariussagax*** (Quenstedt, 1806)

Characters- Closely similar to C. molasses L., but of rather smaller average size, with the elytra generally a little less dull and sooty, and the head without the smooth shining area adjoining the eye on each side. Male: Rather narrower in shape, with the cephalic horn less erect and situated farther forward upon the head, and the upper margin of the thoracic declivity straighter, its lateral angles sharp but not at all produced. Length, 23-36 mm.; Breadth, 14-20 mm

Distribution: India: Bhutan, Bengal, Calcutta, Burdwan, Bihar, Pusa, Chapra. Manoti, Mandla District. Punjab: Bombay: BasseinFort, Gwalior. Southern India: Nilgiri Hills, Shembaganur, Palni Hills.

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4. **Family** **Scarabaeidae**
Subfamily **Scarabaeinae**
Tribes **Onthophagini**
Genus ***Onthophagus***
Species ***taurus***

Fig 10: ***Onthophagustaurus***

Characters: ***Onthophagustaurus*** can reach a length of 5.5–11 mm (0.22–0.43 in). These small beetles are oval shaped the color is usually black or reddish-brown. Sometimes the pronotum has a

weak metallic sheen. Males have on the heads a pair of long protrusions or horns that they use to fight with each other to gain mating rights with females. Some males do not have horns. ***Onthophagustaurus*** can pull a **weight of 1141 times** its own body mass and is considered the strongest animal on earth.

Economic value: **Dung beetles** have been utilized in the breakdown of manure on sheep and dairy farms worldwide

5. **Family** **Scarabaeidae**
Subfamily **Scarabaeinae**
Tribes **Coprini**
Genus ***Onitis***
Species ***subopacus***

Fig. 11*: Onitissubopacus* (Arrow, 1931)

Characters-Dung beetles and tumble bugs are robust, 2-30 mm long nearly 2 inches, body shape is cylindrical, antenna is lamellate, and the elytra are green in colour, there are 2 pairs of depression on the thorax.

Geographical distribution: India: Bihar, Chhattisgarh, Haryana, Himachal Pradesh, Madhya Pradesh, Maharashtra, And Western Ghats.

6. **Family** **Scarabaeidae**
Subfamily **Scarabaeinae**
Tribes **Onthophaginis**
Genus ***Onthophagus***
Species ***gazella***

Fig. 12*: Onthophagusgazella*

Characters- Belong to the sub family Scarabaeina, body size is 1.4 cm and body shape are elongated oval, types of antennas are lamellate (Fabricius, 1787)**.**

Geographical distribution: India: Andhra Pradesh, Chhattisgarh, Delhi, Gujarat, HaryanHimachal Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, and Tamil Nadu.

7.	**Family**	**Scarabaeidae**
	Subfamily	**Scarabaeinae**
	Tribes	**Onthophagini**
	Genus	***Onthophagus***
	Species	***spinifex***

Fig. 13: ***Onthophagusspinifex***

Characters-Belong to the sub family Scarabaeina, body size are 1.4 cm and body shape are elongated oval types of antennas are lamellate (Chandra and Ahirwar, 2007)**.**

Geographical distribution: India: Andhra Pradesh, Chhattisgarh, Delhi, Gujarat, Haryana, Himachal Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, and Tamil Nadu.

DISCUSSION

The present study represented **7 species** of scarab beetles of family Scarabaidae, from G. SCollege Campus Khamgaon. The College campus is spread in area of 97 hectares. Genus - *Onthophagus*from subfamily – Scarabaeinae are found more in number in the study area. The first report on the diversity and composition of dung beetle community structure, in one of the protected areas viz. Melghat Tiger Reserve reported by Thakare, *et al.,* (2000). The subfamily Scarabaeinae is reported to be dominating (71.59%) the total population of the beetles and includes 24 species which are distributed in 11 genera and 8 subgenera under five major tribes viz. Coprini, Onitini, Oniticellini, Onthophagini and Sisyphini. Abundance and distribution of Scarabaeinae beetles in a given locality is mainly influenced by a variety of biotic and abiotic factors including, fauna, flora, solar radiation, temperature (Fincher *et al.,* 1970).

CONCLUSION

The plant biodiversity is well maintained and there is grazing fields for cattle in G. S. College Campus, Khamgaon. The cow dung is the habitat for the Scarabaeidae (dung beetles), in which it growing their initial stage under the cow dungs. Through their dung consumption and relocation activities, dung beetles are involved in the ecological functions of parasite suppression, secondary seed dispersal, nutrient cycling these insects exhibit a range of specialized physical traits that enable them to thrive in environments where dung is a primary resource. Key features such as robust forelimbs for digging, specialized mouthparts for feeding, and often a rounded body shape for efficient rolling of dung balls reflects their unique ecological niche. Additionally, variations in body size, color, and the development of horns in some species are influenced by factors such as habitat, competition, and reproductive strategies. The study of dung beetle morphology not only provides insights into their survival mechanisms but also contributes to a broader understanding of evolutionary processes and the complex interactions within ecosystems.

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Effect of Magnesium Nanoparticles on Growth Performance of Fish *Channa punctatus* (Bloch, 1793)

Shraddha R. Sarap
Department of Zoology,
Government Vidarbha Institute of Science and Humanities, Amravati, Maharastra, India.
And
Yashashree A. Gadhikar
Department of Zoology,
Government Vidarbha Institute of Science and Humanities Amravati, Maharastra, India.

ABSTRACT

Nanoparticles shows novel characteristics such as large surface area great activity and high reactionary efficiency. Nanoparticles involves in detection of biological agents, illnesses and harmful materials are a significant goal for biomedical diagnosis. Some nanoparticles, such as iron oxide, selenium zinc, copper, silver and magnesium oxide play a crucial role in aquaculture development. Magnesium (Mg) is an essential element for fish. Generally, fish can obtain Mg from both water and feed with each species having a different dietary requirement. The Mg content of freshwater and seawater are significantly different. Thus, unlike saltwater fish, freshwater fish cannot intake sufficient Mg to meet their needs in a freshwater environment. Magnesium oxide nanoparticles have various advantages, compared to other metal nanoparticles including minimal expense nontoxic biocompatible, stable under harsh processing conditions, significant biomedical application and strong antimicrobial activity. Mg is involved in magnesium homeostasis, bone development, nucleic acid metabolism, antioxidant defence and immunological reaction.

Hence, in the present study, Channa punctatus was utilized as the model organism, because it is widely distributed in Amravati district. The impact of magnesium oxide nanoparticles on growth performance of Channa punctatus was carried out in present research study.

Key words: Channa punctatus, Nanotechnology, Magnesium Nanoparticles.

INTRODUCTION

Magnesium (Mg) is an essential element for fish. Generally, fish can obtain Mg from both water and feed with each species having a different dietary requirement. The Mg content of freshwater and seawater are significantly different. Thus, unlike saltwater fish, freshwater fish cannot intake sufficient Mg to meet their needs in a freshwater environment (Ling Zhang et.al,2023)

Nanoparticles shows novel characteristics such as large surface area great activity and high reactionary efficiency. Nanoparticles involves in detection of biological agents, illnesses and

harmful materials are a significant goal for biomedical diagnosis criminological investigation and environmental monitoring and among metallic nanoparticles, iron oxide, selenium, zinc, copper,

silver and magnesium oxide play a crucial role in aquaculture development.

Magnesium oxide nanoparticles have various advantages, compared to other metal Nanoparticles including minimal expense nontoxic biocompatible, stable under harsh processing conditions, significant biomedical application and strong antimicrobial activity without photoactivation MgO is a functional material with a wide range of use in various areas and has good bactericidal performance in aquatic environment Mg is involved in magnesium homeostasis, bone development, nucleic acid metabolism, antioxidant defence and immunological reaction. More importantly, imbalanced magnesium homeostasis has been demonstrated to be an important trigger for impaired glucose metabolism, since Mg acts as a co-factor for several glycolytic enzymes, such as hexokinase, phosphofructokinase and pyruvate kinase and also for several subunit of electron transport chain, which is involved in the regulation of energy metabolism, carbohydrate oxidation and glucose transport.

OBJECTIVES

For the present study, *Channa punctatus* was utilized as the model organism, because it is widely distributed in Amravati District. The impact of magnesium oxide nanoparticles on growth performance of*Channa punctatus* was carried out in present research study.

METHDOLOGY

Synthesis of nanoparticles-

The Magnesium oxide nanoparticles are synthesized using the method described by sundrajan et al. Magnesium nitrate, sodium hydroxide and starch are the chemicals purchased from Merck. Magnesium oxide nanoparticles were prepared by wet chemical method using magnesium nitrate and sodium hydroxide as precursors and soluble starch as a stabilizing agent. Starch act as a stabilizing agent and also prevents the agglomeration of nanoparticles.... Starch (0.1% concentration) solution was prepared in 100ml of distilled water and Magnesium nitrate (0.1m) was added to the above solution. Then the solution was kept under constant stirring using a magnetic stirrer for complete dissolution of contents. After complete dissolution 0.2M sodium hydroxide solution was added in drops along the sides of the container with stirring for 2 hours and allowed to settle for 24 hours.

The supernatant liquid was then discarded carefully and the remaining solution was centrifuged for 10 minutes. The centrifuge was washed three times using distilled water to remove the by product and the excessive starch that bound to the nanoparticles. The nanoparticles of magnesium hydroxide were placed in a furnace at 700°C for 4 hours. During this process conversion of magnesium hydroxide into magnesium oxide takes place.

The following reaction explain the formation of magnesium oxide nanoparticles.

$Mg(No_3)_2.6H_2O+2NaOH \rightarrow Mg(OH)_2 + 2NaNO_3$

$Mg(OH)_2 \rightarrow MgO+ H_2O$

The fish selected for present experiment purpose was *Channa punctatus* which is commonly known as Snakehead fish. They were collected from local market and acclimatized to laboratory condition for at least4-5days.

Classification of the selected experiment fish-

- Phylum-Chordata
- Subphylum-Vertebrata
- Subclass- Actinopterygii
- Order- Anabantiformes
- Genus- *Channa*
- Species- *punctatus*

Fig. *Channa punctatus.*

Fish Diet-

The total of three diets were prepared. Among them, fish meal, casein and gelatin are protein source, corn starch is carbohydrate source and fish oil, and soybean oil in equal amounts are fat source. The feed ingredients were weighted and mixed proportionally. Trace ingredients such as MgO nanoparticles and premix were mixed.

Water was added in the corresponding ratios. After mixing all the ingredients, the feed was made into small pellets. The experiment feed was later dried at room temperature 37°C

Fish were feed to visual satiety two times daily for 2 weeks for Each control as well as an experimental groups.

Contains	Control	Experiment No. 1	Experiment No. 2
Protein	28%	38%	38%
Fat	3%	3%	3%
Fiber	4%	5%	5%
Moisture	10%	12%	12%
MgO Nanoparticles	0	7.5mg	15mg

Table 1: Feed and MgO NPs given to control and experimental group

Experimental Procedure

In the current study, a consistent size of *Channa punctatus* were chosen, and the fish were placed in anaquarium with a capacity of 15 litres. Three aquariums were arranged i.e. one for the control, second was named experiment 1 and third as experiment2. Threefishes werekept in each aquarium. The fish fed was prepared as given above, and was feed two times daily between 10 to 11 am and 4 to 5 pm for 1 hour each. The fish's weight and length were measured daily. The experiment part was carried out for 15 days. On 15th day the fishes are scarified for collecting blood for haematological parameter.

Growth performance

The growth performance was estimated by using the standard method as represented. A percentage weight gain is determined by using of following equation.

$$\text{Percentage weight gain} = \frac{\text{Final-Initial weight}}{\text{Initial weight}} \times 100$$

OBSERVATIONS

Growth performance: -

The average growth performance of fish in terms of weight(g) and length (cm) for the two weeks was recorded as given in the table below.

Aquarium No.	Weight Day 1	Weight Day 15	Length Day 1	Length Day 15
Control				
Fish	78 gm	81.5 gm	21 cm	21.5 cm
Expt-1				
Fish 1	77 gm	77 gm	18.5 cm	21 cm
Fish 2	77 gm	79 gm	21.5 cm	22.5 cm
Expt-2				
Fish 1	75 gm	75 gm	19 cm	21 cm
Fish 2	75 gm	78 gm	20 cm	21.5 cm

Table:2 Growth parameters: Length and weight of *Channa* on day 1 and day 15th of control and experimental groups

RESULT

The results showed that the values obtained in the experiment 2 groups were slightly increased, in compared to values obtained in the control and experiment 1. There was significant difference in all parameters of the experiment. The values recorded in the exposure groups were somewhat higher than in the control as the control group did not receive magnesium nanoparticles. As shown in table 2 the growth performance of control and MgO nanoparticles feed showed that there was an increase in length and weight of the fish .In control group where a normal feed was given the length was observed to increase by 0.5 cm in 15 days whereas in experiment 1, MgO nanoparticles were feed 7.5 mg daily for 15 days which resulted in an increase in length by 2.5 cm and in experiment 2 the length was observed to be varied by 1.5cm which is more than the control but lower than experiment group 1.

The weight recorded for the control and experiment groups also showed an increased value then the control. The weight of fish in control group had increase by 1.5 gm whereas experimental 1 showed increase by 2 gm and experiment 2 group by 3 gm respectively.

CONCLUSION

In conclusion, we found that the feed of the Magnesium oxide nanoparticles increased the growth and haematological parameters. MgO Nanoparticles supplementation at 15 mg has enhanced the growth performance and haematological factors of *Channa punctatus.* Therefore, MgO NPs could be a potential growth-promoting micronutrient for aquaculture enhancement.

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Review of Lonar Crater's Water Quality

Dr. M. R. Tandale
Department of Zoology,
Shri Vyankatesh Arts, Commerce and Science College, Deulgaon Raja,
Dist. Buldhana-443204

ABSTRACT

The third-largest naturally occurring saltwater lake in the world is located in the Lonar Crater (19o58'N and 76o31'E). Wet terrain with significant biodiversity is the Lonar Crater. The usual microbial flora and fauna found in the lake brine require more investigation to determine their wetland significance and as an Indian Ramsar Site. Physico-chemical parameters were examined during the research period, including temperature, pH, electrical conductivity, TDS (total dissolved solid), free CO2, carbonates (CO3) and bicarbonates, hardness, chlorides, salinity, and the hardness of calcium and magnesium. The physical configuration of the crater and its relative ecological and geographic isolation shape its limnological state in a distinctive way. The ecosystem's remarkable ecological qualities are highlighted by its peculiar and climatic seclusion. The current review examines physico-chemical parameters in order to determine the pollution level and determine the eutrophication state of Lonar Crater Lake. The analysis of the lake's hydrological situation shows that salinity varies in the summer and throughout the rainy season as eutrophication advances.

Keywords: Lonar Crater, Lake, Physical, Chemical, parameter.

INTRODUCTION:

Lonar Crater ***($19^0$58'N and 76^o31'E)*** Lake is a unique meteoritic crater in basaltic rock, Dabhade (2015), It lies in a nearly circular depression surrounding on all sides by steeply rising escarpments. The lake basin is closed on all sides and therefore has no outlet. The lake brine is known for its high salinity and alkalinity, micro-ecosystem, a wide range of plant and animal life, Dabhade (2013). The saline lake, marshy areas around it, freshwater streams, natural and manmade plantations, (Kodarkar 2007), Tandale and Khawal (2022) crop fields and the remnants of the original forest and scrub referred to above, all provide special niches for plants and animals, Malu (2002).Lonar Lake has a localized temperature system as it is being subterranean hollow closed from all sides Dabhade (2006), Malu *et al.,* (2007); the lake basin is partly screened from direct sun light at different places and at different times of the day Dabhade (2006), Tandale (2020).

MATERIAL AND METHOD

Four sampling station selected For the Present work these are S1, S2, S3, and S4 East, south, west and north. Monthly Water sample were collected from four different sampling sites in the periods of One Year. Water parameters ware analyzed by Titrometricmethod mentioned in Clesceri et*al*., (1998).

RESULTS AND DISCUSSION

The most important physical parameter Temperature of Four sampling sites was measured during the study period minimum temperature ranges from 23C^0 and maximum to 31 C^0. At sampling site S1 minimum temperature 23 C^0 and maximum was 28C^0DuringTemperature was gradually increases during this season. In sampling site S2 Minimum 23C^0 and Maximum 28C^0. At Sampling Site S3 minimum temperature was recorded 24C^0 and Maximum was 30C^0. At sampling site S4 minimum temperature was 25C^0 and maximum 31C^0. Slight fluctuation was their due to changing time of sampling Dabhade and Tandale (2016).

During the study period Ph of four sampling site was recorded 10 which is alkaline. The pH values of the lake water are generally higher than 10 and occasionally reaching 12 by Shinde *et al.,* (2013). TDS (Total Dissolved Solid) during the study period Minimum TDS was found to 4.2 ppt. and Maximum was 8.3 ppt. At sampling site S1 minimum was 4.3ppt. And maximum was 7.6 ppt. At sampling site S2 minimum was 4.2 ppt. and maximum was 7.6 ppt. At Sampling Site S3 minimum TDS was recorded 5.1 ppt. and Maximum was 7.8 ppt. At sampling site S4 minimum TDS was 5.8 ppt. and maximum 8.3 ppt. during the month of Jan to Jun it was increases. Electrical conductivity during study period minimum Electrical conductivity was found to be 9.4 mS and Maximum was 16.4mS, highest values recorded in the month of May. DO (Dissolved oxygen) during study period minimum was 0.3 mg/L and maximum was 5.1 mg/L little fluctuation is observed due to time of sampling. In sampling site S1 minimum DO was 0.6 mg/L and maximum was 4.8 mg/L. At sampling site S2 minimum was 0.7 mg/L and maximum was 5.1 mg/L. At S3 minimum was 0.5 mg/L and maximum was 4.6 mg/L. in sampling site S4 minimum DO was 0.3 mg/L and maximum was 4.6 mg/L.

Free CO_2 was absent in four sampling sites during the study period. $C0_3$ (Carbonates) Due to absent of free CO_2 that may be converted in to carbonates or Bicarbonates along the four-sampling site minimum carbonates was 360 mg/L and maximum was 1740 mg/L. In sampling site S1 the minimum $C0_3$ was 440 mg/L and maximum was 1740 mg/ L. At site S2 minimum was 400 mg/L and Maximum was 1686 mg/L. at sampling site S3 minimum was 400 mg/L and maximum was 1644 mg/L. At site S4 minimum was 360 mg/L and Maximum was 1576 mg/L. During the month of Jan to Jun Carbonates was increases. Highest value observed in month of Jun and lowest was observed in Jan, Tandale and Dabhade (2014).

HCO_3 (Bicarbonates) during the study periods minimum value of Bicarbonates was 724 mg/L and maximum was 2284 mg/L. In sampling site S1 minimum was 880 mg/L and maximum was 2184 mg/L. at sapling site S2 minimum was 732 mg/L and maximum was 1854 mg/L. Bicarbonates value was increases from month of March to May and little fluctuation in month of February and then it can again increase from month of March. At sampling site S3 the minimum value was 724 mg/L in month of Jun and maximum was 2072 mg/L. In sampling site S4 minimum value of Bicarbonates was 762 mg/L and maximum was 2284 mg/L. In all four sampling site values are fluctuated due to the time of sampling.

Total Hardness in four sampling sites in the study periods was 52 mg/L to 162 mg/L. At

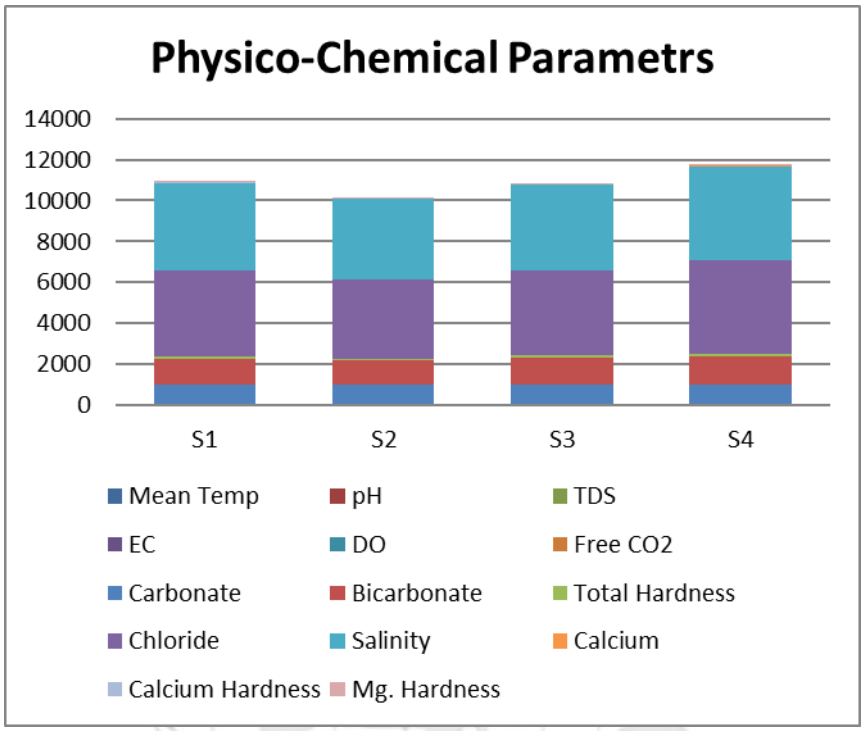
sampling site S1 minimum value of Hardness was 64 mg/L and maximum was 128 mg/L. At S2 it was 52 mg/L and maximum was 144 mg/L. At S3 minimum was 52 mg/L and maximum was 146 mg/L. at S4 minimum was 56 mg/L and maximum was 162 mg/L.

During the study period minimum chloride was 3282.6 mg/L and maximum was 5537.29 mg/L. At sampling site S1 minimum was 3282.6 mg/L and maximum was 5537.29 mg/L. In sampling site S2 minimum was 3566.27 mg/L and maximum was 4140.5 mg/L. At S3 minimum was 3984.58 mg/L and maximum was 4565.96 mg/L. in sapling site S4 minimum was 4027.1 mg/L and maximum was 5168.6 mg/L, Tandale and Dabhade (2014). Permissible value of chloride is 250 mg/l, **also** found about 3248.9 mg/l, which is above the maximum permissible level of 1000mg/l. High chloride waters may also produce a laxative effect.

Lonar crater is well known about their alkalinity and salinity, Malu *et al.,* (2007), During this study periods the minimum value of salinity was 6023.7 mg/L and maximum was 10160.9 mg/L. At sampling site S1 minimum salinity was 6023.7 mg/L and maximum was 10160.9 mg/L. At sampling site S2 minimum was 6437.14 mg/L and maximum was 7597.9 mg/L. At S3 minimum was 7192.19 mg/L and maximum was 8378.5 mg/L. In sampling site S4 minimum value was 7389.7 mg/L and maximum was 9484.3 mg/L. was recordedsalinity from 8460 mg/L to 10250 mg/L. Calcium during study periods lowest value of Calcium was 20.2 mg/L and highest was 70.7 mg/L. In sapling site S1 minimum value of calcium was 21.88 mg/L. and maximum was 53 mg/L. At sampling site S2 minimum value of calcium was found to be 23.5 mg/L and maximum was 70.7 mg/L. At S3 minimum was 21.8 mg/L and maximum was 36.2 mg/L. At sampling site S4 minimum was 20.2 mg/L and maximum was 45.45 mg/L. Highest calcium value is recorded in month of February and Lowest was in month of Jun. Calcium Hardness During the study periods minimum value of calcium Hardness was 5.04 mg/L and maximum was 17.64 mg/L. At sampling site S1 minimum value of calcium hardness was 5.46 mg/L and maximum value was 13.23 mg/L. At sampling site S2 minimum was 5.88 mg/L and maximum was 17.64 mg/L. At S3 minimum was 5.46 mg/L and maximum was 9.03 mg/L. At sampling site S4 minimum value of calcium hardness was 5.04 mg/L and maximum was 11.34 mg/L. Highest value recorded in month of February.

Magnesium Hardness During the study periods minimum value of magnesium was 10.48 mg/L and maximum was 37.3 mg/L. at sampling site S1 minimum value of Mg. hardness was 12.38 mg/L. and maximum was 29.6 mg/L. At sampling site S2 minimum was 11.048 mg/L and maximum was 33.1 mg/L. At sampling site S3 minimum value was 10.48mg/L and maximum value was 33.6 mg/L. at sampling site S4 minimum value was 11mg/L and maximum was 37.3 mg/L.

Graph Plate No. 1: Physicochemical Parametrs of Lonar Crater



CONCLUSION

Lonar Crater Lake is a wet land of important biodiversity. It is extremely important for waterfowls, ducks, cranes, and many other migratory birds and microscopic organisms. The hydrological study reveals deteriorating changes leading towards Eutrophication led to reduction of flora fauna and macrophytes and increase in pathogenic organisms.It is necessary to compile the available data together, so that the remedy for the conservation of the Crater will be possible only through comprehensive conservative measures which will be conceived during the project work.The lake brine: supports typical microbial flora and fauna need to be investigated to access its value of wet-land due torecognized as Ramsar Site of India.

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Diversity of Ant Fauna from Selected Habitats of Akot Region, Maharashtra (India)

Joshi P. S.
Shri Shivaji Arts, Commerce and Science College, Akot, MS, India
And
Shelekar A. L.
Shri Shivaji Arts, Commerce and Science College, Akot, MS, India
And
Chhaba S. G.
Smt. Radhabai Sarda Arts, Commerce and Science College, Anjangaon-Surji, MS, India
And
Pande S. R.
Shri Jagadamba Mahavidyalaya, Achalpur, Maharashtra, India
And
Deshmukh S. D.
Arts and Commerce College, Warwat-Bakal, MS, India.

ABSTRACT

The present study is the assessment of ant diversity among selected habitats from Akot region of Maharashtra (India). During study, employed all-out search method for the collection of ants form February to March 2024. During study period, about nine species of ants belonging to five subfamilies were identified among different habitats. These subfamilies are namely Dolichoderinea, Formicinae, Myrimicinae, Pseudomyrimicinae and Vaspodae. The observed species were Tapinoma melanocephalum, Componotus sericeus, Paratrechina longicornis, Monomorium pharaonic, Chremotogaster hespera, Pheidole spathifera, Solonopses geminate, Tetroponeria nigra and Monomorium indicum. All the species were cosmopolitan in distribution and found at all the studied habitats. A habitat comparison of ant species occurrence showed highest agriculture field, Succession area followed by market field while lowest in residential area.

Key words: Akot Region, Ant Fauna, Diversity, India, Maharashtra

INTRODUCTION

The most wonderful mystery of the life may well be the means by which it created so much diversity from so little physical matter. The biological diversity of the earth and its origins has long been a source of amazement and curiosity. Current interest in diversity centers both on why there are so many species and on how diversity impacts population and ecosystem processes. However, the accelerating effects of human activities on biodiversity and the possibility that the loss of biodiversity might impact ecosystem functioning renewed interest in the effects of diversity on

ecosystem processes and on ecosystem services essential to society (Joshi *et al.,* 2016).

Among all the fauna of this universe, the ants are eusocial insects of the order Hymenoptera and family Formicidae and, along with the related wasps and bees, belong to the order Hymenoptera. Ants evolved from vespoid wasp ancestors in the Cretaceous period. More than 13,800 of an estimated totals of 22,000 species have been classified. They are easily identified by their geniculate (elbowed) antennae and the distinctive node-like structure that forms their slender waists (Moreau *et al,* 2006).

Ants form colonies that range in size from a few dozen predatory individuals living in small natural cavities to highly organised colonies that may occupy large territories and consist of millions of individuals. Larger colonies consist of various castes of sterile, wingless females, most of which are workers (ergates), as well as soldiers (dinergates) and other specialised groups. Nearly all ant colonies also have some fertile males called "drones" and one or more fertile females called "queens" (gynes). The colonies are described as superorganisms because the ants appear to operate as a unified entity, collectively working together to support the colony (Akesson and Wehner, 2002).

Ants have colonised almost every landmass on Earth. The only places lacking indigenous ants are Antarctica and a few remote or inhospitable islands. Ants thrive in moist tropical ecosystems and may exceed the combined biomass of wild birds and mammals. Their success in so many environments has been attributed to their social organisation and their ability to modify habitats, tap resources, and defend themselves. Their long co-evolution with other species has led to mimetic, commensal, parasitic, and mutualistic relationships (Kautz *et al.,* 2013).

Ant societies have division of labour, communication between individuals, and an ability to solve complex problems. These parallels with human societies have long been an inspiration and subject of study. Many human cultures make use of ants in cuisine, medication, and rites. Some species are valued in their role as biological pest control agents. Their ability to exploit resources may bring ants into conflict with humans, however, as they can damage crops and invade buildings. Some species, such as the red imported fire ant are regarded as invasive species in other parts of the world, establishing themselves in areas where they have been introduced accidentally (Dejean *et al.,* 2005; Boudinot *et al.,* 2022).

In this concern, present investigation aims to study the ecology, diversity and distribution of the ants in selected habitats from Akot Region, Maharashtra (India)

MATERIALS AND METHODS

Study area: Akot is a city in the Vidarbha Region that is the district headquarters of the Akola district in the Indian state of Maharashtra. Akot is located at 21.1°N 77.06°E. It has an average elevation of 345 metres (1132 feet). The climatic condition of this district is characterized by a hot summer, well-distributed rainfall during the south-west monsoon season, and generally dry weather during the rest of the year. The cold season is from December to February. The average annual rainfall in the district is 796.6 mm (31.37 inches). During summer, the mean daily

maximum temperature was 42.3^{0}C and the minimum was 27.4^0 C, and it decreased toward winter with a mean daily maximum temperature of 27.6^{0}C and a minimum of 15.1^{0}C (Akola Gazetteer 2022).

Species Collection and Identification: During study, employed all-out search method for the collection of ants form February to March 2024. Ants were hand collected using a brush and forceps during daytime from 11 AM to 4 PM twice in every month, with careful notes of their locality, habitat and relative visual abundance (Gadagkar*et al.,* (1993). Ant species were listed and each species was counted to calculate and compared the composition, richness, species diversity indices, indices of dominance, including similarity indices among different habitat types. During study, the ants were identified by using microscope / magnifying lens based on available literature (Bingham, 1903; Holldobler and Wilson, 1990; Bolton, 1994; Krebs, 1999; Mathew and Tiwari, 2000). Color images were created with digital canon camera of 16x multiple zooms.

Diversity Analysis: The diversity and similarity indices where analyses were performed with using PAST Ver. 4.03. The similarity association matrix upon which the cluster was based was computed using the nearest neighbour pair linkage algorithm of Euclidean distance index for the presence and absence data (Hammer *et al.,* 2001). The differences between the diversity and evenness indices among different study months were statistically analysed using analysis of variance. The statistical analyses were performed following Zar (1999) using the SPSS version 10 (SPSS Inc., Chicago, IL, USA; Kinnear and Gray 2000).

RESULTS AND DISCUSSSION

Species Composition: During study period, about nine species of ants belonging to five subfamilies were identified among different habitats. These subfamilies are namely Dolichoderinea, Formicinae, Myrimicinae, Pseudomyrimicinae and Vaspodae. The species were *Tapinoma melanocephalum, Componotussericeus, Paratrechina longicornis, Monomorium pharaonic, Chremotogasterhespera, Pheidole spathifera, Solonopses geminate, Tetroponeria nigra* and *Monomorium indicum.* All the species were cosmopolitan in distribution and found at all the studied habitats.

Table 1: Ant fauna among different habitats from Akot region

Subfamily	*Species*	Residential area	Succession area	Agriculture area	Market area
Dolichoderinea	*Tapinoma melanocephalum*	+	+++	+++	+
Formicinae	*Componotussericeus*	++	+++	++	++
	Paratrechina longicornis	++	+++	+++	+++
Myrimicinae	*Monomorium pharaonic*	++	++	++	++
	Chremotogasterhespera	+++	+	++	++
	Pheidole spathifera	++	++	++	+++
	Solonopses geminate	++	++	++	++
Pseudomyrimicinae	*Tetroponeria nigra*	+	++	++	+++
Vaspodae	*Monomorium indicum*	+++	+	+	++

Observed sub-family and species composition of ants among different habitat from Akot region is represented in Table 1.

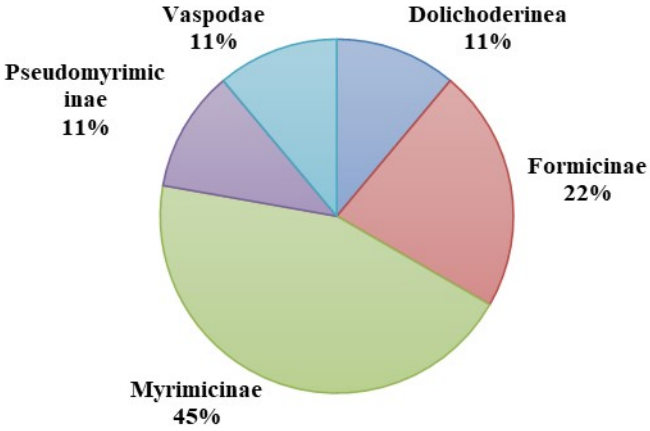

Figure 1: Sub-family composition of ants from Akot region

Species Diversity: During study period, about nine species of ants belonging to five subfamilies were identified among different habitats. A habitat-based comparison of species diversity attributed in ants in Akot region revealed that faunal diversity was highest at agriculture fields and succession area. A trend in Mean % Abundance was noted to be nearly similar to that of Shannon Diversity though Species Richness and Species Equitability shows contradictory pattern (Table 4.2).

Table 4.2: Ant diversity among different habitats from Akot region

Indices	Residential area	Succession area	Agriculture area	Market area
Species Dominance[a]	0.1235	0.1247	0.1191	0.120
Species Diversity[b]	2.139	2.132	2.160	2.155
Species Evenness[c]	0.9435	0.937	0.9632	0.9584
Species Richness[d]	2.768	2.717	2.717	2.67
a = Mean percent abundance of snake populations was significantly different ($p<0.05$). b = Diversity values of snake populations was significantly different ($p<0.05$). c = Species equitability among different months was significantly different ($p<0.05$). d = Species richness among different months was significantly not different ($p>0.05$).				

A habitat comparison of ant species occurrence showed highest Market area followed by agriculture field and succession area while lowest in residential area. A dendrogram developed by Euclidean distance cluster analysis is observed to be multifaceted and showed variation in level of similarity in the number of ant species. The habitat accounted with minimum to moderate number of species belong to one cluster, whereas rest of the habitat with moderate to maximum number of species formed another cluster (Figure 2).

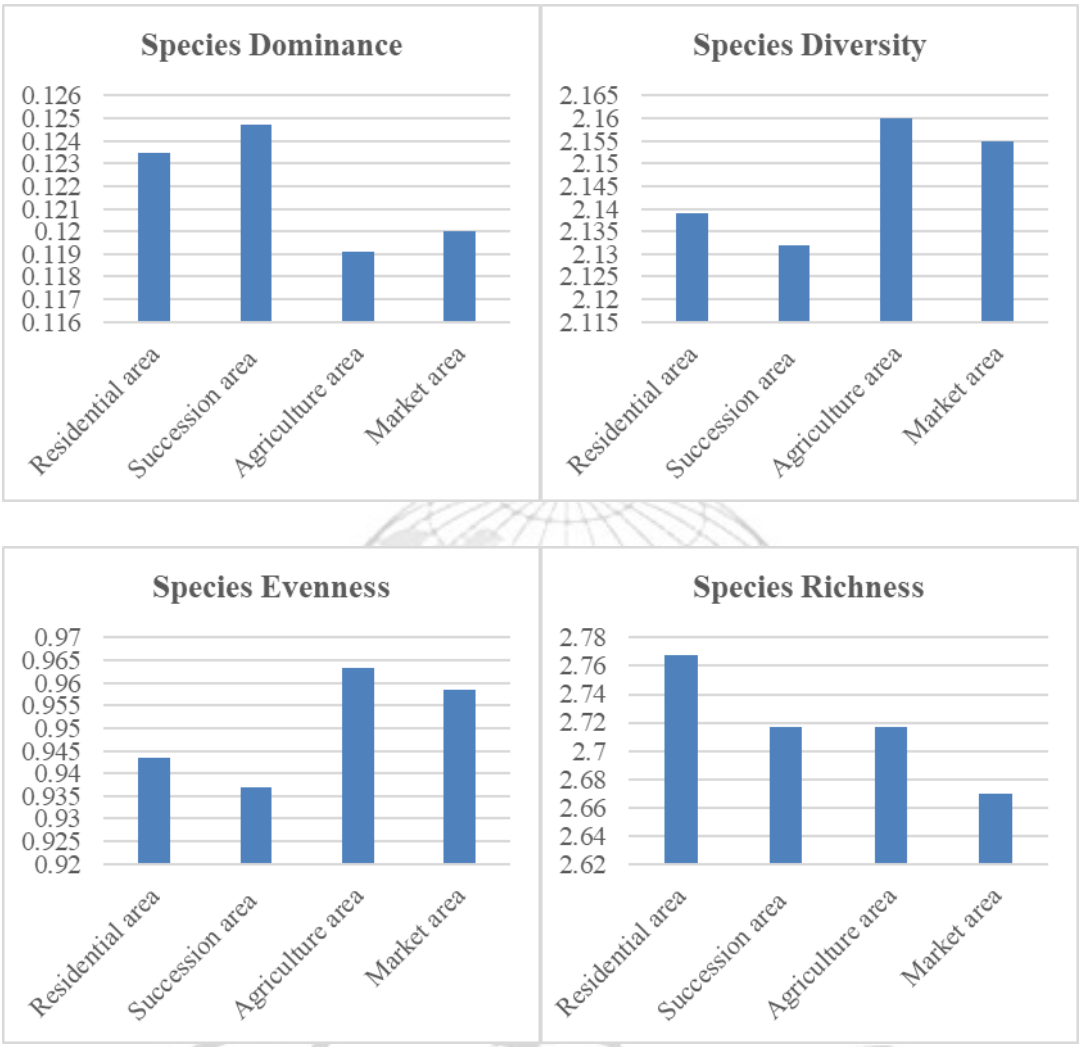

Figure 2: Ant diversity among different habitats from Akot region

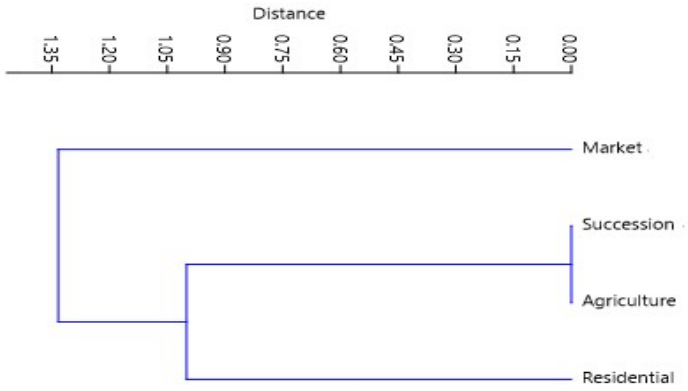

Figure 3: Dendrogram showing similarity in number of ant species composition among the studied habitat

During study period, about nine species of ants belonging to five subfamilies were identified among different habitats. These subfamilies are namely Dolichoderinea, Formicinae,

Myrimicinae, Pseudomyrimicinae and Vaspodae. The species were *Tapinoma melanocephalum, Componotussericeus, Paratrechina longicornis, Monomorium pharaonic, Chremotogasterhespera, Pheidole spathifera, Solonopses geminate, Tetroponeria nigra* and *Monomorium indicum.* All the species were cosmopolitan in distribution and found at all the studied habitats.

Ants are important components of ecosystems not only because they constitute a great part of the animal biomass but also because they act as ecosystem engineers. All the known species of ants are eusocial (Gadagkar*et al.,* 1993). Environmental changes have an impact on macroarthropod abundance (Pearson and Derr, 1986; Adis and Latif, 1996). Many ant species are highly sensitive to the microclimate fluctuations and to habitat structure, and thus respond strongly to environmental change. Therefore, as locations get affected by human activity the distributions of ant also get varied (Anderson, 1990; Alonso *et al.,* 2000).

Agriculture fields and succession areas represents higher number and diversity of ant. Then as the disturbance gets increased the pattern of ants also gets changed with its diversity. The residential area shows low diversity due to increasing disturbance. The variety of plants including tallest trees, shrubs, climbers and herbs with many types of grasses found planted there. Flowering plants also attracted the ants for nectar. Kumar *et al.* (1997), Pachpor and Ghodke (2000) and Savitha *et al.* (2008) have concluded that if there is abundant and verity of trees, habitats supported high diversity of ants. The habitat variables such as canopy and litter can provide an ideal habitat for ants (Anderson, 2004).

From present study it can be concluded that ants get attracted toward suitable environment and avoiding disturbed area. Akot region is represented with various suitable habitat that attracted the ant fauna. These finding of the present study is in well agreement of recent works by Chavhan and Pawar. (2011), Ramachandra (2012), Khot *et al.* (2013), Nagariya and Pawar (2014), Ghait and. Kale (2015), Sonune and Chavan (2016), Momin *et al.* (2017), Ratnaparkhi and Kale. (2018), Khan (2019), Chavan *et al.* (2020), Kale and Ghait (2021) and Akhila and Keshamma (2022).

CONCLUSION

During study period, about nine species of ants belonging to five subfamilies were identified among different habitats. From observations. It can be concluded that when ants found suitable environment, they get attracted toward that location avoiding disturbed area. Akot region is represented with suitable habitat that attracted the ant fauna. As ants are important components of ecosystem. Furthermore, ants are the bio-indicators of nature, habitat and environment. more work is necessary to conclude more information about ecology of ants from Akot region of Maharashtra (India).

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Study of Water Quality of Chandrabhaga River at Asha –Manisha Temple Station, Daryapur, Amravati Maharashtra

Jayeshri R. Ingle
G. S. Science, Arts and Commerce College, Khamgaon
Dist. Buldana, Maharashtra

ABSTRACT

In order to assess the quality of water in river Chandrabhaga at Asha-Manisha temple of Daryapur tahasil, the water was analysed for different physical and chemical parameters for a period of one year. Various physical and chemical parameter like temperature, conductivity, turbidity, pH, Free CO_2, total dissolved solids, total alkalinity, dissolved oxygen, biochemical oxygen demand were studied. The results reveal that seasonal variation and anthropogenic activities along the bank of river leads to changes in physico-chemical properties of water in river.

Keywords: - Physico chemical parameters, Chandrabhaga River, Water Quality, DO, CO_2, Chloride, Phosphates.

INTRODUCTION:

Water is a versatile liquid which allows the chemistry of life to take place. It is required for existence of life as it is an essential component of all biological processes. Earth is a water planet as it has water sources covering about 75% of the planet. The percentage of water is more but availability of water is less as only little water is fresh and maximum water is saline. The amount of water that can be used to satisfy human need is very little so water must be used courteously. The use of water by mankind is endless whether for household domestic purpose or for drinking recreational, industrial purpose. This multipurpose liquid is easily available free of charge. Every activity for which wateris used pollutes water. The growing population, rapidly growing industries and different agricultural activities are some reasons that pollute water. Pollution of fresh water bodies is a matter of serious concern throughout the world. It is the need of the hour to think about river water pollution and to control pollution using proper scientific study of water bodies. In India the physico-chemical characteristics of river water has been studied by many researchers and workers (Singh 2010), (Sharma S.*et al.,* 2011), (Sujithia, P.C. *et al.,* 2012) and (Sonawane, V. 2021). The present investigation involves the analysis of physico-chemical parameters of Chandrabhaga River at Asha-Manisha Temple in Daryapur tahasil. The water of River Chandrabhaga at Asha-Manisha Temple people uses for drinking in different holy purposes and irrigation.

MATERIAL AND METHODS:

Water samples were collected for physico-chemicalanalysis for six months from January

2023 to June 2023 from River Chandrabhaga at Asha-Manisha Temple station in Daryapur tahasil. The water characteristics viz., Temperature, pH was determined on thespot of sampling station with the help of portable water analysis kit and others were mostly tested within 24 hours of collection. The physico-chemical properties were determined by Standard methods for the examination of water and wastewater analysis (APHA, 1975). Preservation of water samples whenever necessary was done at 4°C. Water was collected in polythene bottle of 1 litre size and the instruments were use of accuracy and chemical used were of analytical reagent grade.

RESULT AND DISCUSSION:

The physico-chemical characteristics of all samples are temperature, Total hardness, Alkalinity, Chloride content, TDS, pH, Free CO2, BOD and DO. It has been found that parameters of Chandrabhaga River at Asha-Manisha Temple are in the limit but less amount of dissolved oxygen was observed at station. The water samples were collected for a period of six months (Jan 2023 to June 2023). The results of the monthly variation in the physico-chemical parameters of Chandrabhaga River at Asha-Manisha temple station are summarized in table 1.

Temperature

The water temperature of Chandrabhaga River at Asha-Manisha Temple ranged between 24.7^0C to 25.1^0C. The variation is mainly related with the temperature of atmospheric and weather condition. The fluctuation of water sample temperature usually depends on the season, sampling time, as well as the temperature of the effluents pouring into the river (Jayaraman *etal*., 2003).

Total Hardness

Total hardness of water range between 68.2 to 72.7mg/l was determined at Asha-Manisha Temple. The regular addition of large quantities of sewage, detergents, large scale human interference and due to utilization of carbonate and bicarbonates by aquatic plants variation in hardness is observed. Although hard water has no known effect on health but is unsuitable for domesticuses (Wolf et al, 2013). Water of Chandrabhaga River at Asha-Manisha Temple is suitable for domestic and drinking purposes dueless hardness.

Alkalinity- Alkalinity of Chandrabhaga River at Asha-Manisha Temple ranges from 176mg/l to 182mg/l. Increase in alkalinity may be due to increase in of organic matter, sewage and localized use of detergents (Mitchell andMarshall, 1973). More washing activity is observed at site-3 hence maximum alkalinity is observed at this sight.

Chloride content- The chloride content of water ranges from 8.4 mg/l to 9.1 mg/l in Chandrabhaga River at Asha-Manisha Temple of Daryapur Tahasil. Increase percentage of chloride was probably due to amount of sewage discharge in the river, similar observation has been made by Khanna and Bhutani (2003).

Total Dissolved Solid- TDS of sample water ranged between 206.12 mg/l to 654.26 mg/l. The rise of TDS is due to cloth washing, discharge of domestic waste and temple waste. Near the study site at Asha-Manisha Temple washing, domestic and temple waste were dumped. Addition of ionic

waste in form of sodium, potassium, carbonates to river sediments increase TDS values. Similar finding is also observed by Pankaj Kumar *et al.,* (2015) in river Varuna.

pH- Ph values in Chandrabhaga River at Asha-Manisha Temple show a range between 7.47 to7.64. Due to loads of organic pollution cause an increase in Ph values. Similar finding is also observed by (Aggarwal and Arora 2012 and Deshmukh, *et al*., 2020).

Free CO2 – The amount of CO2 increases fromsite-1 to site-3 in Chandrabhaga River at Asha-Manisha Temple. Hosetti et.al (1994), have reported minimum values atupstream station and maximum at downstreamstation due to discharge of stream of citysewage, in river Panchaganga at Kolhapur (M.S.). The range of CO2 in river is between 3.54mg/l to 4.16 mg/l.

Biochemical Oxygen Demand- The BOD valuesinChandrabhaga river at Asha-Manisha Temple ranges between 4.3mg/l to 4.9mg/l. The biochemical oxygen demand also indicates the amount of organic compounds in water as measured by the volume of oxygen required by the bacteria to metabolize it under aerobic condition. For more organic matter, more oxygen is required by bacteria for its decomposition. This results in release of organic nutrients in water bodies resulting in death of organisms thriving on water (Jonasson *et al.,*2012).

Dissolved Oxygen- The DO values varied according to the rate of respiration and decomposition of organic materials in the water. Pollution process tends to deplete the DO in thewater Mason (1989). The DO values in Chandrabhaga River at Asha-Manisha Temple were observed between 7.6 mg/l to 8.1 mg/l. The DO and BOD values show an inverse relationwith each other.

Phosphates- The value of phosphate in Chandrabhaga River at Asha-Manisha Temple ranged between 0.27 mg/l to0.32 mg/l. The domestic activities of the population near by thebank of river results in to increase in the percentage of phosphates in water. In river basin farming and use of cow dung as manure by farmers during summer season pollute the river and constitute the major source of phosphate in river water at station S-3. Mukharjee *et.al.*, (1994), Agrawal and Kannan, (1996) in river Mandakini have described that, the detergents increase the phosphate load in the fresh water bodies.

Table – 1 Average results of physico-chemical parameters of Chandrabhaga River at Asha-Manisha Temple of Daryapur Tahasil.

Sr.No	Parameter	Sampling months in Year 2024					
		Jan 2024	Feb 2024	March 2024	April 2024	May 2024	June 2024
1	Temperature in 0C	27.84	28.42	30.57	32.91	35.87	34.64
2	Total Hardness in mg/l	64.2	69.8	66.4	70.5	74.6	71.3
3	Alkalinity in mg/l	51.67	39.53	43.51	45.04	45.85	40.81
4	Chloride content in mg/l	30.89	34.24	32.58	36.82	35.64	31.43
5	TDS in mg/l	206.12	301.45	462.38	542.28	654.26	453.57
6	Ph	7.51	7.47	7.53	7.58	7.64	7.54

7	Free CO2 in mg/	12.94	12.89	13.17	13.24	17.62	9.08
8	BOD in mg/l	28.38	34.63	43.54	46.27	49.93	38.59
9	DO in mg/l	5.6	5.4	5.2	4.8	4.1	3.7
10	Phosphate in mg/l	1.64	1.76	1.89	1.90	2.08	1.97

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Study on Diversity of Rotifers in Yeldari Dam Parbhani (M.S.), India

Walale M. P.
P. G. and Research Department of Zoology,
R. A. Arts, Shri M. K. Commerce and Shri S. R. Rathi Science College,
Washim-444505.
And
Rathod S. D.
P. G. and Research Department of Zoology,
R. A. Arts, Shri M. K. Commerce and Shri S. R. Rathi Science College,
Washim-444505.
And
M. R. Tandale
Department of Zoology,
Shri Vyankatesh Arts, Commerce and Science College, Deulgaon Raja,
Dist. Buldhana-443204

ABSTRACT

The most significant dam in the Parbhani District, the Yaldari Dam supplies water for both agricultural and drinking purposes. Since dams are built based on river flow, as is well known, they alter both biotic and abiotic elements in comparison to wild rivers, and each river's reaction to a dam is unique. Small, soft-bodied freshwater invertebrates known as rotifers have been used to determine if a body of water is tropical or not. In the aquatic food chain, they are one of the species that serve as a connection between primary producers and consumers. Rotifers were subjected to a quantitative evaluation from February 2019 to January 2020. A total of sixteen species of rotifers were collected from the Yeldari dam throughout the research period. They were most prevalent in the winter and least prevalent in the monsoon. It is imperative to conserve this body of water because it may expose fascinating rotifer wildlife.

Keywords: Yeldari dam, Diversity, Rotifers, Zooplanktons.

INTRODUCTION

Fresh water bodies have so many benefits, research on both natural and artificial freshwater lakes has lately attracted significant attention. Zooplanktons occupy a pivotal place between the autotrophs and other heterotrophs. In aquatic environments, plankton is a vital part of fish diet, and it plays a crucial role in the food chain in freshwater ecosystems. Rotifers appear to be the most sensitive zooplankton sensors of water qualities. Small animals known as pseudocoelomates, or rotifers, live in a range of aquatic environments. Wallace et al. (2006); Pejler (1995). Rotifers may be found in both lotic and lentic settings. Sharma (2008). They have been widely used in assessment of aquatic pollution due to their sensitivity to small changes in environment, short generation time, parthenogenic mode of reproduction. Rotifers play an integral role in the aquatic

food chains due to their qualitative and quantitative occurrence Vanjare (2013). The occurrence of rotifers is affected by the complex interaction of various physical, chemical, geographical, biological and ecological parameters. The rotifer fauna of freshwater bodies has a potential values bio-indicators of changing the tropic condition. Some rotifers are highly specialized but most are opportunistic feeders since they consume and assimilate different types of food. They play important role in indicating the presence or absence of certain fishes and they also provide the basic information of entire ecology and the current condition of the water body. Rathod and Walale (2022)

MATERIAL AND METHODS

The Yeldari dam which is located 15 km distances away from Jintur city in the Yeldari village (rural area) at the GPS latitude N 190 43' 12.4'' Latitude N 190 43' 12.4" Longitude E 760 43' 55". Yeldari dam is fresh water body built on Purna River which is sub-Basin of Godavari River. This dam has spread on large agricultural area there are so many villages were coming under this dam during construction i.e. Kinhi, Kawatha, Amberwadi, Bamni, Wazar and Sawangi, Sonsawangi and Belkhi The present study has been undertaken 1st time on Yeldari dam to know the climatic changes as per the sites and species richness. Limnological survey of Yeldari dam: proposed research is undertaken to study the limnology yeldaridam; to fulfill the objectives of proposed research work, plankton samples will be collected from four different sampling sites.

Sampling site: 1 located on east direction of dam.

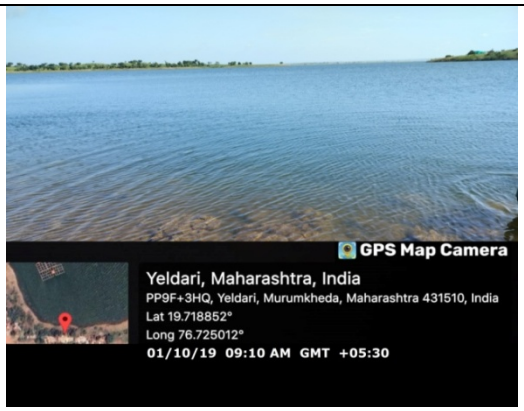
Sampling site: 2 located on west direction of dam.

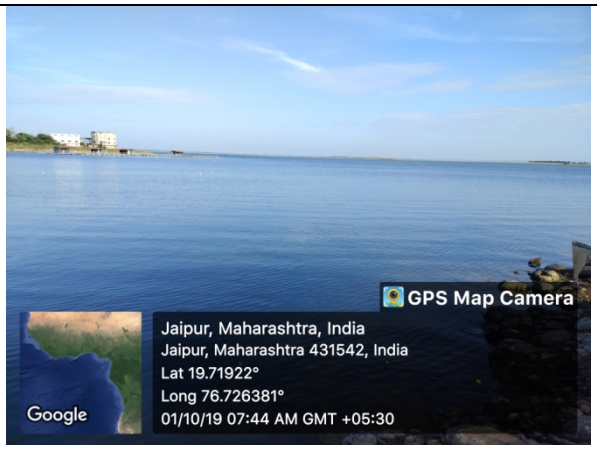
Sampling site: 3 located on north direction of dam.

Sampling site: 4 located in south direction of dam.

Plankton sample will be collected from four different sampling sites, collected plankton sample analyzed in to the laboratory of P. G. and Research Department of Zoology R. A. College Washim. All collected sample will be analyzed by following the methods suggested in APHA (1998) and Dhanpathi (2000).

Sampling Stations:

	
S1	**S2**

	
S3	**S4**

RESULTS:

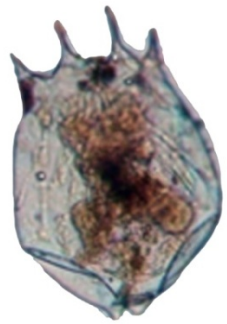
Rotifer

During study periods the mean Rotifer diversity ranges from 0.75±0.5 to 10.25± 1.2583 in 2019 and in 2020 it was 0.75±0.9574 to 10.00 ±2.1602. Comparative study of all sampling sites in both years calculated by 't' value ranges 0 to 2.828. In rotifer total 6 genera are recorded including 18 species. Rotifera species were recorded more in winter season than monsoon and summer. Maximum number of rotifers found in the month of January in both the years and minimum in May. Calculated 'f' value was 0.967386 throughout study period. Rotifers are chiefly fresh water forms and presence of rotifer in abundance is indicate suitable condition for their survival. Dhanapati (2000) inrotifera species *Keratella sp.* and *Brachionus sp*. were abundant reported by Kedar *et al.,* (2008) in abundance in Rishi Lake, Karnja in various water bodies of Central India Kaushik and Sexena (1995) have also reported genus Brachionus in abundance. Occurance of genus *keratela* with *Brachionus* indicate nutrient rich status of water body. According to Goel and Charan (1991) *K. tropica* and *Brachionus calyciflorus* are the pollution tolerant species and indicate accumulation of organic matter and theses species reported dominant in polluted fresh water *Brachionussp*., and *Filinia*sp. were superior indicators of eutrophic waters and probably *Brachinus*sp. alone can determine the eutrophic status of water body. Rotifera are most significant group in the Zooplankton community. Saler (2004), Barrabin (2000), Aboul-Ezz *et al*. (1996). Rotifers are reported as the faster growth in eutrophic water bodies Cajander, (1983). Rotifers especially *Brachionus* sp. were recorded at higher density in two eutrophic lakes. Ismail and Adnan, (2016). They opinioned that in eutrophic waters rotifer are not visible to predatory fishes due to turbid and low transparency water and small size of Rotifers. Similar results were also observed by Barrabin (2000) and Saler (2004). The feeding habits of the rotifers along with the high nutrient level. This is well in agreement with the observations of Sharma B.K., and Sharma (2019), Bais and Agrawal (1995), Rotifer is a dominant group in present investigation which indicates the mesoeutrophic nature of the lake. Similar observation was made by many researchers

by [32-37]. Solanke and Dabhade (2016), Dabhade and Chhaba (2019), Balamurugan S, *et.al.* (1999), Adeyemi *et.al., (*2009)

PHYLUM ROTIFERA
ORDER: PLOIMIDA
FAMILY I: BRACHIONIDAE
1.*Brachionus caudatus* (Barrios and Daday, 1894)
2.*Brachionus diversicornis* (Daday,1883)
3.Brachionus durgea (Dhanpathi, 1974)
4. Brachionusfalcatus (Zacharias, 1998)
5. Brachionusplicatilis (Muller,1786)
6. Brachionuscalyciflorus (pallas 1776)
7. Brachionuscalyciflorusf.amphiceros (Ehrenberg 1838)
8. Brachionuscalyciflorusvarhymani (Dhanpathi, 1974)
9. Brachionus*calyciflorusf.borgerti (Apstein 1907)*
10.Brachionus foricula f. typicus-urawensis (Sudzuki,1955)
11.Keratella tropica (Apstein,1907; Berzing,1955)
FAMILY II : ASPLANCHNIDAE
12.. *Asplanchna sp.*
13.Asplanchna sieboldi
14.Asplanchna brightwelli
FAMILY III: FILINIDAE
15.Filinia opoliensis, contracted
16.Filinia longiseta, contracted.
FAMILY IV: LECANNIDAE
17.Lecane (M) cornuta

			
Brachionus forticula	*Asplanchna brightwelli*	*Aplanchna sieboldi*	*Asplanchna sp.*

			
B. calyciflorus ABC	*Calyciflorus* B	*B. calyciflora*	*B. calyciflora amphicera* B

			
Brachionus durgae	*Brachionus calyciflorus f. borgerti* A	*Brachionus caudatas*	*Brachionus diversici-mics A*

			
Bra.diversiconis	*B. diversicornis*	*Bran. falcatus*	*Brachionus plicatilis*

			
Eosphora najas	*Filinia longiseta*	*Filinia opoliensis*	*Karatella tropicana*


Lecane (M) cornuta

CONCLUSION:

The rotifers variety in the aforementioned experiment remains predominant during the whole inquiry time, revealing that the wetland is ideal for aquaculture. In light of the significance of the study, zooplankton contributes significantly to the expansion of the local fisheries industry and serve as a vital source of food for significant local fish species. The current dam is starting to eutrophicate. Therefore, action must be made for the conservation and upkeep of the freshwater dam since safeguarding biodiversity is crucial and necessitates maintaining current knowledge of the diversity of aquatic animals.

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Preliminary studies on Telamonia dimidiata (simon 1899) Salticidae spiders in agriculture field in PKV region from Akola district (Maharashtra)

M. M. Shegokar
PG Department of Zoology,
Shri Shivaji Collegeof Arts, Commerce and Science Akola
And
P. P. Ade
PG Department of Zoology,
Shri Shivaji Collegeof Arts, Commerce and Science Akola

ABSTRACT:

Spiders are predatory Arthropods.present study of spiders from Akola District.Akola district is situated in the middle east of Maharashtra state, this district is situated between north 20.17 to 21.16 latitude & east 76.7 to 77.4 longitude. Akola district is 5428 sqkm. Salticidae (Jumping spiders) is the largest family of spider, Salticidae spiders are ubiquitous in terrestrial ecosystems & are familiar to humans as they are also found in human dwellings & home gardens. Salticidae are generally nocturnal species. Currently 49,159 species of spiders in 4,207 genera of 128 families are known from the world. Taking into account the number of species, family Salticidae is the largest family with 6334 species in 659 genera (World spider catalog 2021). Spiders play an important role in insect pest control without any harm to agroecosystem. Recently in agricultural fields sustainability have ledto increased interested in spiders as biological pest control agents. During the study, TelamoniadimidiataSalticidae spiders act as pest controlcreature, which feeds on crop destructive insects.

Indian jumping spider:

Fauna consists of 181 species in 62 genera (Siliwal et al, 2005). Jumping spiders of Maharashtra are represented by 29 species in 18 genera. Telaminiadimidiata two species are recorded in Akola district.

Keywords: Salticidae spiders, Spiders Diversity, Agriculture field.

INTRODUCTION:

Spiders are predatory and prey on variety of insects belong to order Araneae of class Arachnida & phylum Arthropoda spiders are the largest order of Arachnids & rank seventh in total species diversity among all orders of the organisms, spiders are found in every habitat in the world, temperate forests, scrubland, deserts, mountains region tropical areas exception of polar regions.

Salticidae (Jumping spiders) is the largest family of spider, Salticidae spiders are ubiquitous in terrestrial ecosystems & are familiar to humans as they are also found in human dwellings & home gardens. Salticidae are generally nocturnal species. (Li & Jackson 1996). They are well known for their complex vision-based behavior, which include elaborate mating behaviors, Araneophagy and mimicry (Jackson 2009, Forster 2010) being predators. They have

important role in the biological control of pest species (Marc 1999).

Salticidae Spiders have eight legs, chelicerae with fangs generally able to inject venom & spinnerets that extrude silk their front four legs generally are larger than the hind legs. The legs of jumping spider allow it to jump 25 times their body size which lets them jump far & capture their prey.

Jumping spiders are among the easiest distinguish from similar spider families because of the shape of the cephalothorax and their eye patterns. The families closest to salticidae in general appearance are the Corinnidae (distinguished also by prominent spines on the back four legs) The Oxyopidae (the lynx spiders, distinguished by very prominent spines on the all legs) and the Thomisidae (the crab spiders, distinguished by their front four legs,which are very powerful) .The jumping spiders generally larger front legs are used partly to assist in grasping prey and in some species, the front legs and pedipalps are used in species – recognition signaling.

Salticidae spiders have four pairs of eyes: Three secondary pairs that are fixed & a principal pair that is movable. They have very good vision centered in their Anterior Median Eyes. (AME) these eyes are able to create a focused image on the retina which has up to four layers of receptor cells in it (Harland & Jackson, 2000) physiological experiments have shown they may have up to four different kinds of receptor cells, with different absorption spectra, giving them the possibility of up to tetrachromatic colour vision with sensitivity extending in to ultra-violet range. It seems that all Salticids, regardless of whether they have two, three or four kinds of Colour receptors are highly sensitive UV light (Peaslee & Wilson, 1989).

Salticidae spiders have fascinating courtship dances, where the male waves his forelegsdisplay his colourful, chelicerae & drums the ground in rhythmic patterns eggs are laid in silken cocoons in small crevices throughout the summer.

Currently 49,159 species of spiders in 4,207 genera of 128 families are known from the world. Taking into account the number of species, family Salticidae is the largest family with 6334 species in 659 genera (World spider catalog 2021).

Indian jumping spider:

Fauna consists of 181 species in 62 genera (Siliwal et al, 2005). Jumping spiders of Maharashtra are represented by 29 species in 18 genera. Asarkar, G. M. & Ade, P.P. reported only two species of Salticidae spider from Agroecosystem of Akola district.

Akola district is known for rivers like Katepurna, Purna, Morna, Uma on the basis of that farmers is growing their crops in agro-based fields spiders are found in every ecosystem like urban ecosystem, agro ecosystem, forest ecosystem etc. These spiders feed on insects, hence they have an economic importance therefore proposed study will be made on Diversity of Salticidae spiders in Akola district.

Description-

Telamonia dimidiata (Simon 1899) is two striped jumpers found in various Asian tropical rain forests, infoliated in wooded environments. And also found in agroecosystem. Female can

reach a body length of 9-11 mm and males can reach a length of 8-9mm. The female is light yellowish, with a Cephalus and red rings surrounding the narrow black rings around the eyes. Two longitudinal bright red strips are present on the opisthosoma. The male is very dark with white markings and red hairs around the eyes. *Telamonia dimidiata* produces no toxin significant to humans.

Telamonia dimidiata, Salticidae Spiders have two main body parts from front to back, cephalothorax and an abdomen. The former of this is to fused sections head and thorax that include the brain, mouth, venom system and stomach. It's also where the limbs attach. The abdomen contains the lungs, heart, reproductive system, spinnerets and digestive tract, spiders have open circulatory system.

MATERIAL AND METHODS:

To Study Area:

Akola district is situated in the middle east of Maharashtra state, this district is situated between north 20.17 to 21.16 latitude & east 76.7 to 77.4 longitude. Akola district is 5428 sq km. The district is divided in to seven Talukas, as Akola, Akot, Balapur, Murtijapur, Telhara, Patur, Barshitakli. Akot &Telhara have parts of has Melghat tiger reserve, Barshitakli has well known Katepurna wildlife sanctuary spider collection is adopted in different selected sampling spots. The detailed descriptions of the collection techniques are as follows-

(i) **Sweep Netting –** This sampling method is applied to collect the foliage spiders from low level vegetation of shrubs (up to 2 m in height). The sweep net consists of a 90 cm handle; 40 cm ring and the collection are poured on white canvas. The net was emptied at regular intervals to avoid loss and destruction of the specimen. During sampling time sweep net was moved back and forth to cover all ground layer herbs and shrubs till all vegetation in the sampling plots were swept thoroughly.

(ii) **Ground Hand Collecting** – Ground Hand collection involved the collection of spider samples from ground to knee level. This method of sampling is used to collect the spiders, which are found to be visible in the ground, litter, in broken logs, rocks etc.

(iii) **Aerial Hand Collecting** – Aerial Hand collection involved the collection of spiders samples from knee level to arm length level. This method accessed web-building and free-living spiders on the foliage and stems of living or dead shrubs, high herbs, tree trunks etc.

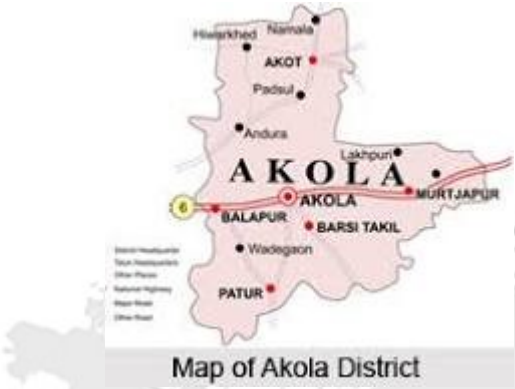
(iv) **Vegetation Beating**: The method is employed to accesses spiders living in the shrub, high herb vegetation, bushes, and small trees and branches. The spiders are collected by beating the vegetation with a stick and collecting the samples on a cloth (1m by 1.2 m).

(v) **Litter sampling:** Litter i.e. deciduous from the ground were collected by hand and was put in a big tray. Litter sampling involved sorting of spiders from the litter collection tray. With the above methods of collections, the spiders were collected and observed under stereo-zoom binocular microscope (for small/tiny spiders) wherever necessary in the field itself. Later all the spiders were photographed by Canon 60 D with macro lens in their natural habitat.

Preservation

After collection of specimens, Spider collected in 70% alcohol for measurements of legs and study of pedipalp and epigynum.

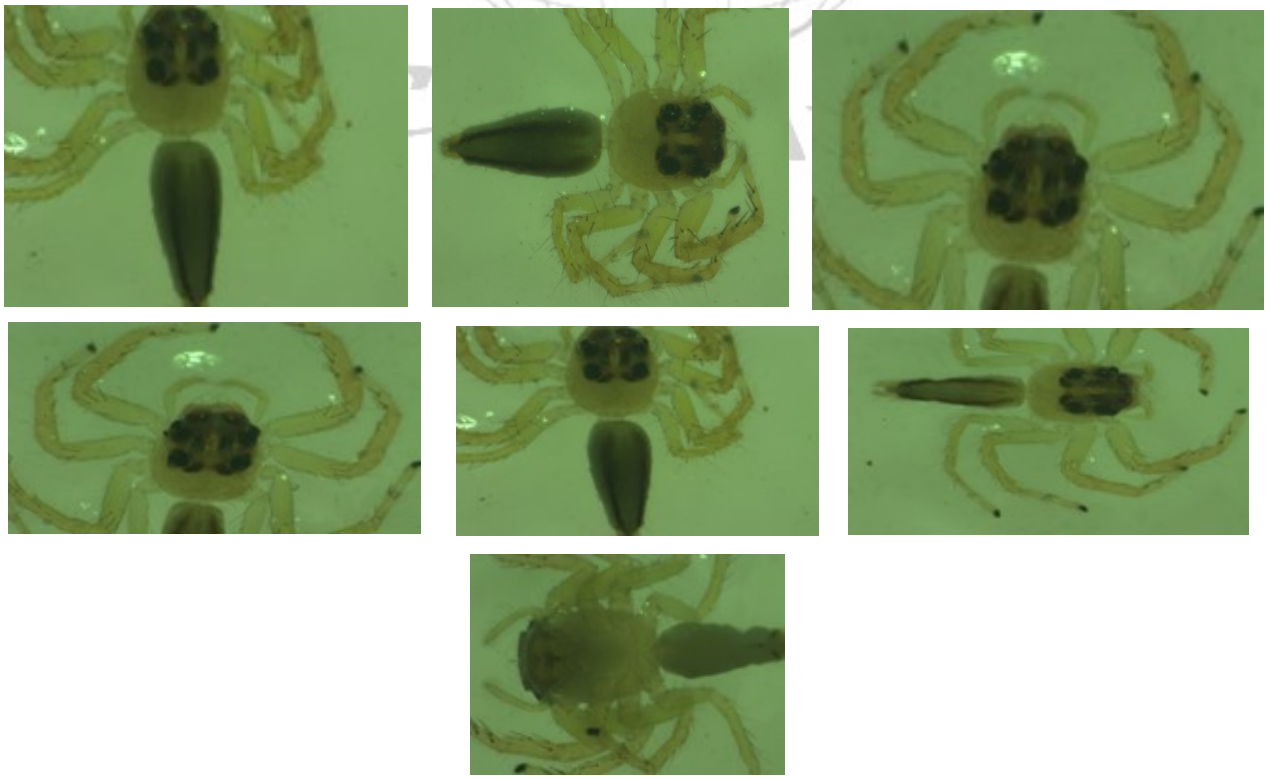
Photography Collected spiders were photographed and identified by the digital camera and later were released into their habitat.



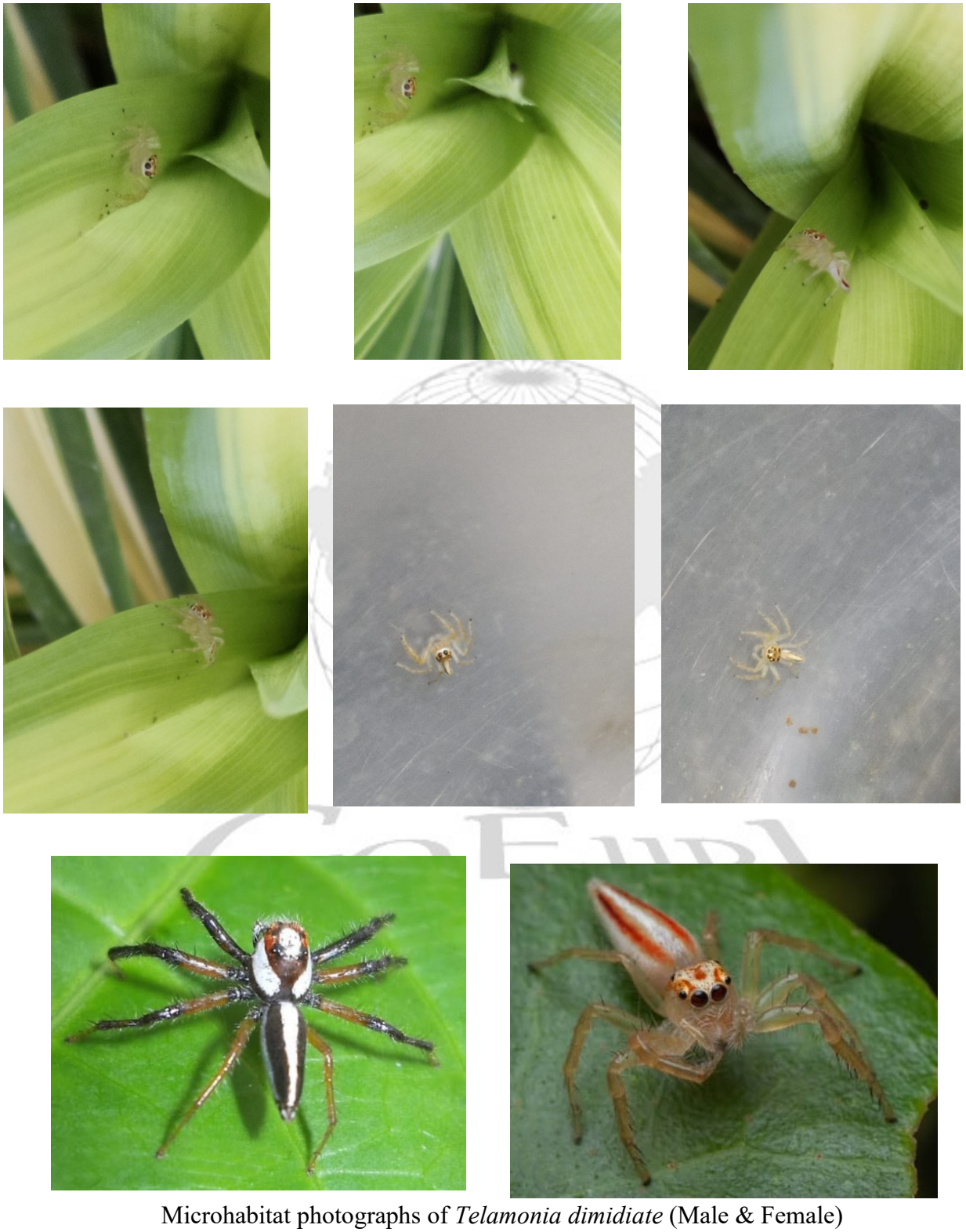
Map of Akola District

Table-*Telamonia dimidiata* Salticidae spiders in Akola District

Family- Salticidae	Genus	species
	Telamonia	dimidiata (male)
	Telamonia	dimidiata (female)



Photograph shows dorsal and ventral views of *Telamonia dimidiata*



Microhabitat photographs of *Telamonia dimidiate* (Male & Female)

RESULT AND CONCLUSION:

During the present study, *T. dimidiata* two species are recorded in Akola District Spiders directly capture the insect pest and feeds on it. Spiders are important Biocontrol agent in nature. *T. dimidiata* have a major impact on the Arthropods community in these areas, use of silk retreats as well as records of predation by these spiders, and prey on other spiders. *T. dimidiata*

two species are recorded in Akola District.

The result shows that spiders are sensitive to small changes in environment especially vegetation topography and climate change.

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Effect of High Temperature on Millipede Haemolymph

Mahatkar P. D
G. S. Gawande Mahavidyalaya, Umarkhed, Yavatmal. Maharashtra
And
Deshmukh S. V.
Department of Zoology
R. D. I. K. and K. D. College, Badnera, Amravati. Maharashtra

ABSTRACT

The present study was undertaken to understand the effect of high and low temperatures on the haemolymph organic components of the male millipede M. importatus and A. tanjoricus. The observations show that exposure of millipedes to high and low temperature affects the haemolymph organic components. After exposure to high temperature the haemolymph total proteins, total carbohydrates and total lipids show a gradual decrease. After exposure to low temperature, these components' concentration gradually increases.

Keywords: - Millipedes, *Mordonius importatus*, *Anoplodesmus tanjoricus*, Haemolymph.

I. INTRODUCTION:

Millipedes are known as ideal indicators for Biogeography and for studying evolution (Spelda, 1996). Because they have a very low tendency to spread out. They either survive in an area or they become extinct but they do not migrate. This feature makes it special, and the thermal relationship of millipedes is of considerable interest to biologists and physiologists. Millipedes are found in moist and humid environmental conditions and climate change affects the survival of millipedes. Scanty rainfall increases in temperature and decreases in moisture can have direct effect on the survival of Diplopoda fauna. The present study on the effect of high and low temperature on organic components of millipede *M. importatus* and *A. tanjoricus.*

II. MATERIAL AND METHODS:

The millipede *Mordonius importatus* were collected from the rural area around Amravati city, (Maharashtra, India) and *Anoplodesmus tanjoricus* were collected from the fields and houses of Anjangaon (Bari) village, about 15 kilometres away from Amravati, (Maharashtra, India). All these collected millipedes were kept in glass containers with moist soil. For acclimatization millipedes were kept in an incubator at a high temperature (40˚C) for 5 days, 10 days and 15 days. The same procedure has been followed for low temperature (12˚C). To study the organic components of haemolymph, the haemolymph was collected with the help of a syringe needle by pricking the head and the drop of haemolymph was collected.

III. OBSERVATION AND RESULTS:

During the present study, experiments were carried out to investigate organic components in the haemolymph like total protein, total lipid and total carbohydrate in male millipede,

Mordonius importatus and *Anoplodesmus tanjoricus*. The table shows the concentration of total protein, total carbohydrate and total lipid in the haemolymph of male millipede *M. importatus* and *A. tanjoricus* at room temperature and the effect of high temperature (40˚C) and low temperature (12˚C) on it.

IV. DISCUSSION:

In the both male millipedes (*M. importatus & A. tanjoricus*) shows higher levels of total protein and total carbohydrates as compared to total lipids. The haemolymph of male millipede *Arthrosphaera lutescen* also shows higher levels of total protein and total carbohydrates as compared to total lipid (Sundara Rajulu 1972). Sundara Rajulu (1976) observed remarkable similarity between the insects and the diplopoda as well as in the onychophoran species in the presence of a high concentration of total protein. Temperature is one of the important ecological factors to which the living organism must adjust to live successfully in this environment. Millipede can sustain within temperature range from 0˚C – 40˚C. Temperature plays a major and important role in regulation physiology of millipede. After exposure of millipedes to the high temperature (40˚C) for 5 – 15 days, the level of the total protein, total carbohydrates and total lipid was gradual decreases as compared to control (room temperature). And after exposure of millipedes to the low temperature (12˚C) for 5 – 15 day the level of the total protein, total carbohydrates and total lipid was increases as compared to control. These observations are in agreement with Sundara Rajulu (1972 &1976) in millipede *Arthrosphaera lutescen* and Radha Pant (1979) in insects. The organic components of haemolymph were decrease probably due to decrease in metabolic activity as well as low activities of enzymes.

V. CONCLUSIONS:

After exposure to high temperature, the level of organic components of haemolymph was decreases probably due to decrease in metabolic activity. After exposure to low temperature, the level of organic components of haemolymph was increases probably due to increase in metabolic activity.

Temp--erature	Proteins				Carbohydrates				Lipid			
	Control	5 Days	10 Days	15 Days	Control	5 Days	10 Days	15 Days	Control	5 Days	10 Days	15 Days
Low (12˚C)	1023.83 ± 10.02	784.2 ± 5.658 *	764.6 ± 1.600 *	757.8 ± 1.405 **	755.8 ± 2.564	1007.7 ± 2.458	995.66 ± 1.306 *	766 ± 1.316 *	876 ± 1.535	1817 ± 3.243 ***	1002.1 ± 1.516	889.9 ± 0.737 *
High (40˚C)	1023.83 ± 10.02	1383.83 ± 1.121 **	1172.1 ± 2.287 *	799.7 ± 3.571	755.8 ± 2.564	878.7 ± 2.251	1266.7 ± 1.358 *	908.4 ± 1.886	876 ± 1.535	1726.33 ± 1.381	2121.1 ± 2.651 **	1945.3 ± 2.145 **

Table 1: -Heamolymph organic component in the millipede *Mordoniusimportatus* and effect of Low temperature (12˚C) as well as high temperature (40˚C) on it (values expressed in

mg/100 ml). Values are mean ± SE of five individual observations M – Male

Tempe-rature	Proteins				Carbohydrates				Lipid			
	Control	5 Days	10 Days	15 Days	Control	5 Days	10 Days	15 Days	Control	5 Days	10 Days	15 Days
Low (12˚C)	1242 ± 12.50	719 ± 3.79	595 ± 9.25	381* ± 24.94	720 ± 20.39	900 ± 5.82	752 ± 17.95	609* ± 21.01	740 ± 80.62	1766 ± 60.16	1032 ± 46.54	315*** ± 7.64
High (40˚C)	1242 ± 12.50	1351 ± 25.86	1044 ± 31.26	868** * ± 13.39	720 ± 20.39	805 ± 16.52	1313 ± 17.66	1054* * ± 27.21	740 ± 80.62	1540 ± 25.19	2320 ± 20.83	1641** * ± 34.47

Table 2: -Heamolymph organic component in the millipede Anoplodesmustanjoricusand effect of Low temperature (12˚C) as well as high temperature (40˚C) on it (values expressed in mg/100 ml). Values are mean ± SE of five individual observations M – Male

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Abundance and Morphology of *Varanus bengalensis* (Bengal monitor lizard) From Buldhana District

Thakur A. C.
Shri Shivaji Arts Commerce and Science College Motala, District- Buldhana

ABSTRACT

The present study provides the detail status about the diversity of Varanus bengalensis (Bengal monitor lizard) in Buldana district of Maharashtra. Buldana is the westernmost district of Vidarbha region in Maharashtra, situated in the Tapi and Godavari basins Indian reptiles does not provide a basis for direct verification of the information presented. The present study has been carried out during 2020-2022 in the study area like grass land, rocky area, forest area, village and town area. The presence of the Varanus bengalensis (Bengal monitor lizard) varies in different months indicating the Buldhana has positive environmental setup for the Varanus bengalensis (Bengal monitor lizard)

Keywords- Buldhana, Maharashtra, *Varanus bengalensis,* diversity.

INTRODUCTION

Lizards have gained recent attention as potential model organisms for studying evolutionary and ecological questions because of their unique body form and their ectothermic nature. They play a significant role in any ecosystem because they form a vital part of the food chain as a prey as well as a predator. Buldana district is situated in Amravati division of Maharashtra state in Western India. The name of district is derived from the district headquarter. Buldana is probably a corrupt form of *Bhil Thana,* (Central Provinces District Gazetteers. 1910) that means 'The place of Bhils' (Buldana Gazetteers 2014). Buldana district is situated at the westernmost border of Vidarbha region of Maharashtra and is 500 km from the state capital, Mumbai. Buldana district lies between 19°51' and 21°17' N. latitude and 75°57' and 76°59' E. longitude. The district has a total area of 9745 square kilometers.

REVIEW OF LITERATURE

The aim of the present review of the herpetology related literature is for providing a general background regarding the important development in the field of lizard diversity related studies. Understanding lizard diversity is essential for assessing their role and influence in ecological systems. Rigorously collected demographic data can reveal important aspects of a species' ecology. The handbook of Indian Reptiles by Daniel (1983) As well many researchers had also given their valuable contribution in enrichment of knowledge about lizards in Indian environment like Murthy (1985) had given the classification and distribution of the Reptiles in India as well as he studied the rare snakes of India. Tikedar and Sharma (1992) are proving to be valuable contribution to the reptile's study; Das (1997) published checklist of the Reptiles of India with English Common name. Wadatkar (2003) documented the herpetofauna of Amravati university

campus. Sharma (2007) studied the fauna of India and the adjacent countries. Giri and Bauer (2008) observed a new ground-dwelling *Hemidactylus* (Squamata: Gekkonidae) from Maharashtra.Joshi (2014) studied the basking activity of monitor lizard during 18 to 24 October of 2014 from an agriculture field of Jalgaon (Jamod), District Buldhana of Maharashtra (India). Kakde and Thakur (2015) studied the diversity of wall lizards from Buldhana.

METHODOLOGY

The present study was carried out during 2019-21 in Buldana district. This study aims to analyze the Remote Sensing (RS) and Geographical Information System (GIS) based distribution of the *Varanus bengalensis* (Bengal monitor lizard) in Buldana Region. With the advent of GIS-based spatial statistical software tools, data intensive techniques like trend-surface analysis or fractal analysis, etc. was employed in studies (Julián 2008). The obtained details of GIS were analyzed quantitatively to determine the bio-geographic regions of *Varanus bengalensis* (Bengal monitor lizard) diversity. The Buldana district has diverse habitat. During study, Pilot survey was made by 'Visual encounter method' as well by employing randomized walking (Joshi, 2014) and interviewing the native people (Gayathri *et al.,* 2016). Selected area was randomly explored on the basis of possibility of availability of the species. The different important details like natural history and behavior were recorded carefully which includes the habitat, habit, food, mode of activeness that is Nocturnal or Diurnal; reproduction tactics like mating season, mating behavior, mating, period and mode of breeding, size of egg cluster and number of young born, etc. were also recorded in nature. After detection, specimen was identified with the help of visible structural features. For identification and comparative studies of observed specimens, keys and methods suggested by Daniel (2002), Das (2003) and Ahmed *et al.,* (2007) were adopted. IUCN status of each encountered species was categorized on basis of Molur *et al*. (1998), Kumbhar *etal.* (2013); Alexander and Jayakumar (2014). As local (vernacular) names are according to native people of study area, so they may be varying from area to area.

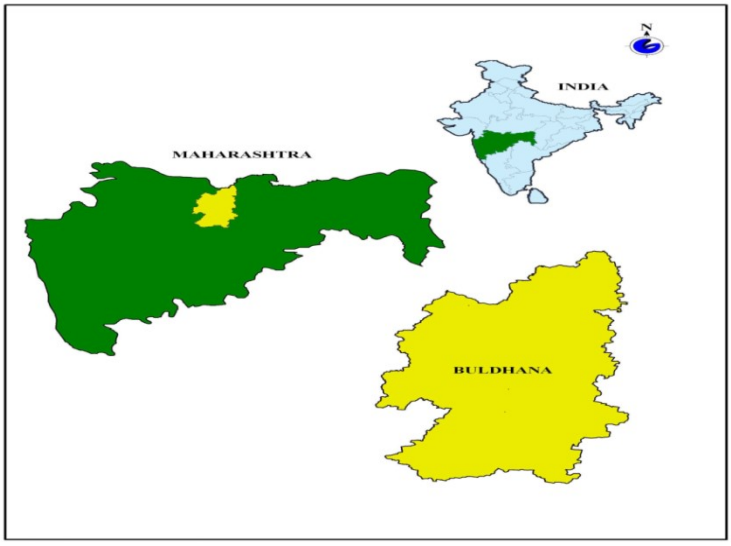
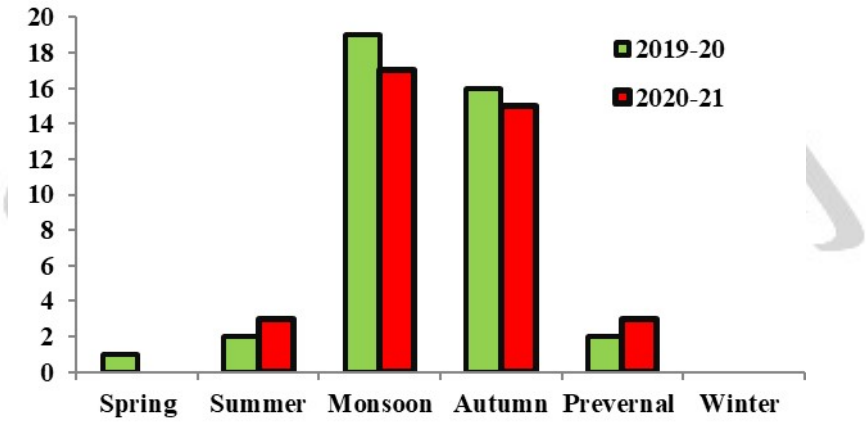


Figure: Location of Buldana District, Maharashtra, India

OBSERVATION

Species was frequently observed with its basking activity. It reaches nearly 175 cm with a snout-to-vent length (SVL) of 75 cm and a tail of 100 cm. Males are generally larger than females. Heavy individuals may weigh nearly 7.2 kg. The number of ventral scales varies from 80 to 100. Young monitor lizards are more colourful than adults Young have a series of dark crossbars on the neck, throat and back. The belly is white, banded with dark crossbars and are spotted with grey or yellow. On the dorsal surface of young monitors, there are a series of yellow spots with dark transverse bars connecting them. As they mature, the ground colour becomes light brown or grey, and dark spots give them a speckled appearance. They are usually solitary and usually found on the ground, although the young are often seen on trees. Basking activity is more common. The main breeding season is June to September. Males, however, begin to show combat behaviour in April. Females dig a nest hole in level ground or a vertical bank and lay the eggs inside, filling it up and using their snouts to compact the soil. The females often dig false nests nearby and shovel soil around the area. They sometimes make use of a termite mound to nest. A single clutch of about 20 eggs laid. The eggs hatch in 168 to nearly as long as 254 days. About 40 to 80% of the eggs may hatch. They mostly fed on beetles, grubs, orthopterans, scorpions, snails, ants and other invertebrates. Vertebrate prey comparatively rare, and included frogs, fish, lizards, snakes and rodents. Bengal monitors are also scavengers.

Figure: Overall occurrence of species



Varanus bengalensis

RESULT AND DISCUSSION

The patterns of species distribution across geographical areas can usually be explained through a combination of historical factors such as: speciation, extinction, continental drift, and glaciations. Through observing the geographic distribution of species, we can see associated variations in sea level, river routes, habitat, and river capture. Additionally, this science considers the geographic constraints of landmass areas and isolation, as well as the available ecosystem energy supplies (Trewick, 2016). In the present study, total 78 individuals were reported out of which 40 were reported during February 2019 to January 2020 while 38 were reported during February 2020 to January 2021. The monthly fluctuation in occurrence was also observed. During the study period maximum occurrence was reported in monsoon and autumn while minimum reported during winter

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Habitat Preferences of Spiders in Yavatmal Forest Ecosystems

Prof. Rahul Sinha
Department Zoology,
Indira Mahavidyalaya, Kalamb, Dist.- Yavatmal Maharashtra
And
Dr. Suwarna Zilpe
Department of Zoology,
Smt. Radhabai Sarda Arts, Commerce & Science College,
Anjangaon Surji, Dist. Amravati, Maharashtra – 444705

ABSTRACT:

This study investigates the habitat preferences of spider species in various forest ecosystems of Yavatmal district, Maharashtra. The research aimed to assess the diversity and distribution of spiders across different forest habitats, including dense forests, open woodlands, and forest edges. Data was collected using standard pitfall traps, leaf litter sifting, and visual search methods across 12 sites during the monsoon and post-monsoon seasons of 2023.

The study identified a total of 78 spider species belonging to 15 families, with Araneidae and Salticidae being the most dominant. Dense forests exhibited the highest species richness with 58 species, while open woodlands and forest edges supported 43 and 35 species, respectively. The analysis revealed that microhabitat factors such as leaf litter depth, canopy cover, and moisture levels significantly influenced spider distribution. Species richness was positively correlated with canopy cover and moisture levels, while leaf litter depth played a crucial role in determining species composition.

The study highlights the importance of conserving dense forest habitats in Yavatmal to maintain spider diversity. The findings also suggest that forest management practices that preserve leaf litter and maintain canopy cover are essential for sustaining spider populations. These results contribute to our understanding of habitat preferences in spiders and can inform conservation strategies in similar forest ecosystems.

Keywords: - Spider diversity, habitat preferences, Yavatmal district, forest ecosystems, species richness

INTRODUCTION:

The Yavatmal District in Maharashtra, India, is known for its rich and diverse forest ecosystems, which include dense forests, open woodlands, and forest edges. These habitats are home to a wide range of flora and fauna, contributing to the overall biodiversity of the region. Among the various organisms present, spiders play a critical role as predators, controlling insect populations and contributing to the ecological balance of these ecosystems. Spiders are an integral part of the forest food web. They regulate the population of herbivorous insects, thus preventing overgrazing of vegetation and aiding in plant conservation. Moreover, spiders themselves serve as

prey for other animals, making them a key component of the forest ecosystem's trophic dynamics. Due to their sensitivity to environmental changes, spiders are often used as bioindicators to assess the health of ecosystems. Their presence and diversity can provide valuable insights into the condition of their habitats.

Understanding the habitat preferences of spiders is crucial for several reasons. Firstly, it aids in the identification of specific environmental factors that support high spider diversity, such as microhabitats with abundant leaf litter, optimal moisture levels, and sufficient canopy cover. Secondly, knowledge of these preferences can inform conservation strategies aimed at preserving or restoring habitats that are critical for maintaining spider populations and, by extension, the broader ecosystem. This study focuses on exploring the distribution and habitat preferences of spider species across different forest ecosystems in Yavatmal District. By examining the variety of habitats from dense forests to more open and fragmented areas, this research seeks to identify the key factors that influence spider diversity and distribution. The findings of this study will not only contribute to the scientific understanding of spider ecology in the region but also provide practical information for forest management and conservation efforts in Yavatmal and similar regions.

OBJECTIVES:

- To assess the diversity of spider species across different forest habitats in Yavatmal.
- To identify the key environmental factors influencing spider habitat preferences.
- To investigate seasonal variations in spider populations and their habitat use.
- To examine the role of microhabitats within each forest type in supporting spider diversity.
- To evaluate the impact of anthropogenic activities on spider communities in different forest habitats.
- To explore the potential of spiders as bioindicators of forest ecosystem health.
- To provide recommendations for forest management practices that support spider conservation.

HYPOTHESES:

Dense forests will have higher spider species richness compared to open woodlands and forest edges. The first hypothesis is grounded in the ecological principle that more complex and stable habitats, such as dense forests, tend to support greater biodiversity. Dense forests typically offer a wider variety of microhabitats, including higher levels of canopy cover, abundant leaf litter, and consistent moisture levels, all of which are crucial for the survival and reproduction of spider species. The structural complexity of dense forests provides numerous niches, reducing interspecific competition and allowing for a greater number of species to coexist. In contrast, open woodlands and forest edges, which are often more exposed to environmental fluctuations and human disturbances, may offer fewer suitable habitats and thus support lower species richness. This hypothesis posits that the richness of spider species will be significantly higher in dense forests due to the favorable and diverse environmental conditions they provide.

Environmental factors such as canopy cover, leaf litter depth, and moisture levels significantly influence spider distribution.

The second hypothesis is based on the understanding that spiders, like many other arthropods, are highly sensitive to their environmental conditions. Canopy cover, for instance, plays a critical role in regulating temperature, humidity, and light levels within a habitat, all of which can affect spider behavior and habitat selection. A denser canopy can provide protection from extreme weather conditions and predators, making it an ideal habitat for many spider species. Similarly, leaf litter depth is important because it offers shelter, hunting grounds, and breeding sites for ground-dwelling spiders. The depth and quality of leaf litter can directly influence the abundance and diversity of spiders that rely on this microhabitat. Moisture levels are also crucial, as spiders need a certain level of humidity to prevent desiccation and to support prey availability. This hypothesis suggests that variations in these environmental factors will have a significant impact on where different spider species are found within the forest ecosystems of Yavatmal, with species distribution patterns closely aligned with the availability and quality of these key habitat features.

METHODOLOGY:

The research was conducted across 12 forest sites in Yavatmal District, carefully selected to represent three distinct forest habitats: dense forests, open woodlands, and forest edges. These habitats were chosen to ensure a comprehensive assessment of spider diversity and to allow for comparisons between different environmental conditions within the district.

Data Collection

To gather data on spider diversity and distribution, three standard methods were employed:

Pitfall Trapping: This technique involves placing small containers (pitfall traps) at ground level, which are partially filled with a preservative liquid. These traps are designed to capture ground-dwelling spiders that accidentally fall into them while moving across the forest floor. Pitfall traps are particularly effective for sampling spiders that are active at ground level and are commonly used to assess the abundance and diversity of these species.

Leaf Litter Sifting: This method involves collecting leaf litter from the forest floor and sifting it through a mesh to separate spiders and other small invertebrates from the debris. Leaf litter sifting is crucial for studying spiders that live within or beneath the litter layer, as it allows researchers to extract and identify species that are not easily detected by visual searches or pitfall traps.

Visual Searching: Researchers conducted systematic visual searches within each study site, focusing on various microhabitats such as under logs, within tree bark, and among vegetation. Visual searching is a versatile method that complements the other techniques by capturing species that are arboreal (living in trees) or that are too agile to be captured by traps.

Environmental Variables Measurement

At each of the 12 sites, key environmental variables were measured to assess their influence on spider distribution:

Leaf Litter Depth: The depth of leaf litter was measured at multiple points within each site. Leaf litter provides crucial habitat for many spider species, offering shelter, hunting grounds, and a stable microclimate.

Canopy Cover: Canopy cover was quantified using a densiometer, which measures the percentage of the sky obscured by foliage. Canopy cover is an important factor as it influences light levels, temperature, and humidity, all of which can affect spider behavior and habitat suitability.

Moisture Levels: Soil moisture was measured using a moisture meter to determine the availability of water within each habitat. Spiders are sensitive to moisture levels, and areas with higher humidity are often more suitable for a wider range of species.

Data Analysis

Once data collection was completed, statistical analyses were performed to explore the relationships between environmental variables and spider species richness:

Species Richness and Composition Analysis: The number of spider species (species richness) and the types of species (species composition) were analyzed for each habitat type. Comparisons were made between dense forests, open woodlands, and forest edges to determine which habitats supported the highest diversity.

Correlation and Regression Analysis: Statistical methods such as correlation and regression analysis were used to identify significant relationships between environmental variables (leaf litter depth, canopy cover, moisture levels) and spider diversity. These analyses helped to determine which factors were most influential in shaping spider communities across the different forest habitats.

Seasonal Variation Analysis: Data from both the monsoon and post-monsoon seasons were compared to assess how seasonal changes affected spider populations and their habitat use.

OBSERVATION:

The study documented a total of 78 spider species belonging to 15 different families across the various forest habitats in Yavatmal District. These findings highlight the rich spider diversity present in the region and provide insights into how different habitats support varying levels of species richness.

Species Richness in Dense Forests: The study revealed that dense forests exhibited the highest species richness, with a total of 58 species recorded. This high level of species richness can be attributed to the complex and stable environmental conditions typically found in dense forests. Dense forests offer a variety of microhabitats, such as thick leaf litter, high humidity, and extensive canopy cover, which provide ideal conditions for a wide range of spider species. The structural complexity of dense forests allows for greater niche differentiation, reducing competition and supporting a higher diversity of species.

Species Richness in Open Woodlands: Open woodlands were found to support 43 species of spiders, making them the second most diverse habitat type in the study. While open woodlands are less structurally complex than dense forests, they still provide a variety of habitats that can

support a moderate level of spider diversity. The presence of scattered trees and shrubs in open woodlands creates a mosaic of microhabitats, where spiders can find suitable conditions for hunting, web-building, and shelter. However, the lower canopy cover and more variable environmental conditions in open woodlands may limit the number of species that can thrive compared to dense forests.

Species Richness in Forest Edges: Forest edges supported 35 species, the lowest species richness among the habitats studied. Forest edges are transitional zones between forests and adjacent habitats, often characterized by greater exposure to environmental fluctuations, such as higher temperatures, increased wind, and lower humidity. These conditions can be challenging for many spider species, particularly those that rely on stable microclimates. Additionally, forest edges are more susceptible to human disturbances, such as agricultural activities or logging, which can further reduce habitat quality and, consequently, species richness.

Common Spider Families: Across all habitats, the families Araneidae and Salticidae were the most commonly observed.

Araneidae, commonly known as orb-weavers, are well-known for their large, circular webs. These spiders are highly adaptable and can be found in a variety of habitats, from the dense canopies of forests to more open spaces. Their ability to build webs in diverse environments and capture a wide range of prey likely contributes to their prevalence across all the studied habitats.

Salticidae, or jumping spiders, are another highly diverse and widely distributed family. Known for their excellent vision and active hunting behavior, jumping spiders do not rely on webs but instead use their agility to hunt prey. Their adaptability to different microhabitats and their generalist hunting strategies allows them to thrive in various environments, from dense understory layers to open, sunlit areas at the forest edge.

RESULT:

The analysis of the data revealed several key findings regarding the relationships between environmental factors and spider diversity across different forest habitats in Yavatmal District:

Correlation Between Species Richness and Environmental Factors: The analysis demonstrated a positive correlation between spider species richness and two key environmental factors: canopy cover and moisture levels. This means that as the extent of canopy cover and moisture levels increased, the number of spider species also increased. Dense forests, characterized by a high degree of canopy cover and consistent moisture, supported the highest diversity of spider species. The dense canopy helps to create a more stable microclimate by reducing temperature fluctuations and maintaining higher humidity levels, which are favorable for a wide range of spider species. Similarly, higher moisture levels in these environments provide essential conditions for spiders, including adequate humidity to prevent desiccation and support the availability of prey.

Impact of Leaf Litter Depth on Species Composition: Leaf litter depth was identified as a significant factor influencing spider species composition. The depth and quality of leaf litter provide crucial habitat features for many spider species, especially those that dwell on or within

the forest floor. A greater depth of leaf litter often supports a more diverse array of spider species by offering more shelter, hunting grounds, and breeding sites. The presence of thick leaf litter can enhance the structural complexity of the habitat, allowing various spider species to occupy different microhabitats and niches.

Habitat-Specific Findings:

Dense Forests: These areas, with their high canopy cover and moisture levels, were found to support the greatest diversity of spider species. The complex habitat structure of dense forests provides numerous niches and stable conditions that are conducive to high spider diversity. The combination of abundant leaf litter, high humidity, and a well-developed canopy creates an ideal environment for a wide range of spider species.

Open Woodlands: While supporting a moderate level of spider diversity, open woodlands generally had lower canopy cover and moisture levels compared to dense forests. This reduction in environmental stability likely contributes to the lower species richness observed in these habitats.

Forest Edges: The lowest species richness was observed in forest edges. The more exposed conditions at the edges, characterized by less canopy cover and potentially lower moisture levels, create a less favorable environment for many spider species. Additionally, forest edges often experience higher levels of disturbance and environmental variability, which can further reduce spider diversity.

CONCLUSION:

This research highlights the critical role of dense forest habitats in supporting high spider diversity in Yavatmal District. The findings emphasize that conservation efforts should prioritize the protection of dense forests and their microhabitats, such as leaf litter and moisture-rich areas, to sustain spider populations. These insights are valuable for guiding forest management and biodiversity conservation strategies in the region.

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Analysis of Water Parameters of Textile Effluents in Western Rajasthan

Meena L. R.
Department of Zoology,
Dyal Singh College, University of Delhi, Lodhi Road, Pragati Vihar,
New Delhi - 110003.
And
Tandale M. R.
Department of Zoology,
Shri Vyankatesh Arts, Commerce and Science College, Deulgaon Raja,
Dist. Buldhana-443204
And
Meena A. S.
Department of Chemistry,
Swami Shraddhanand College, University of Delhi

ABSTRACT

The most crucial information on the pollution status of textile effluents and their impact on nearby water bodies and soil is found in their physico-chemical characteristics. Thus, Pali and Balotra textile industrial effluents are the two distinct locations that we have chosen for this study article. Based on the observations, it was determined that the effluent was alkaline and had high biological oxygen demand and salinity due to the presence of chloride, which may be used in various dyes used for coloration in the textile industry and the use of numerous chemicals in the dyeing and printing processes.

Key word: Effluent, Textile, Water, Analysis.

INTRODUCTION:

A key part of Rajasthan's economy is the textile industry. The cities of Pali and Balotra are in Rajasthan's western region. These are the major textile, printing, and dyeing industry clusters. The water quality in this semi-arid area of Rajasthan has been degraded due to the use of chemical dyes and a variety of mechanical processes. A significant amount of wastewater discharged from these textile factories comprises around 25% of the colors. In addition to being persistent in the environment and with the potential to physiologically change into carcinogenic substances; these synthetic dyes are intended to withstand bleaching by UV radiation and chemicals, which is why they are employed to enhance the quality of textiles. Total suspended solids levels in raw textile dyeing wastewater are low when compared to many other industries, according to Tufekci et al. (2007). This is because the majority of dyeing machines featured lint filters and other key control mechanisms to keep lint off of the cloth and out of heat exchangers. However, in cutting, fabric

production, and wet processing, biological oxygen demand and chemical oxygen demand are rather large, making them more significant targets for pollution avoidance.

Because of the rising demand for textile goods, the textile industries are significant industrial users of water resources and wastewater producers. Patel and Associates (2008). Worldwide, industrial wastewater is commonly discharged into rivers and streams. The decline in water quality has a negative impact, either directly or indirectly, on both aquatic ecosystems and people. Chinda et al. (2004); Emongor et al. (2005); Ugochukwo (2004). Any industrial facility now releases untreated effluent into the surrounding ecosystem. When untreated or partially treated wastewater enters a body of water, it either dissolves or floats on the riverbed, polluting the body of water. Nama and Meena (2017).

Site description

1. **Balotra:** The town of Balotra is situated in Rajasthan's Barmer district. It is located around 100 kilometers west of Jodhpur. The Balotra is well-known for its printing and dying processes. There are three main divisions in the industrial state that RIICO at Balotra is developing. In all, these sectors contain about 850 industry units. The majority of the pollutants coming from these enterprises are dyes, and they are flowing straight into the Luni River and the Nallah. Additionally impacted by these textile effluents are the nearby soil and water.
2. **Pali:** Pali is located along the Bandi River. The state and administrative center of Rajasthan is located in the district of Pali. The city is located between latitude 25O77' N and longitude 73O33' E. A significant tributary of the Luni River, the Bandi River runs south of Pali City and about east to west. The state of Rajasthan's industrial center for printing and dying is Pali. There are around 800 textile industries in operation.

MATERIAL AND METHODS

Monthly Water sample were collected from two different sampling sites (Pali and Balotra) in the periods of One Year. Water Temperature analyzed by simple thermometer, pH, Transparency by using Sacchi Disc, Total Hardness as Calcium and Magnesium, DO (Dissolved Oxygen), Free CO_2, Carbonates, Bicarbonates, Chloride, Salinity, Phosphate, Nitrates, Fluoride by using ELICO NEPHELOMETER CL 52D and SPECTROPHOTOMETER 106 SYSTRONIC by using photometric method, BOD, analyzed by Titrometric method with the help of standard method for water analysis **(APHA1998).**

Fig. 1. Photo shows Textile Effluents at Balotra and Pali.

	
Textile Effluents at Balotra	**Textile Effluents at Balotra**
	
Textile Effluents at Pali	**Textile Effluents at Pali**

RESULTS AND DISCUSSION:

During the research period, the most significant characteristic for aquatic life was temperature. The mean temperature of the Pali site ranged from 33.5 ± 0.2C^{o}, while the Balotra site had a mean temperature of 34.24167 ± 0.361814 C^{o}. May was the highest and December was the lowest recorded. The textile industry uses a variety of dyes for coloring since an alkaline pH value has always been observed. The pH values of the textile effluent water at Balotra (10.09 ± 0.252) and Pali (9.86 ± 0.306) over the research period indicate that the pH of the Balotra water was much more alkaline than that of Pali, with a summertime pH of up to 10.4. Islam et al. (2011) investigated the effects of wastewater from the textile industry and the primary risks associated with dye effluents, which comprise both organic and chemical contaminants. Munnaf et al. (2014). It is recommended to limit the overuse of chemical colors and switch to vegetable dyes, as

suggested by Pathak et al.
(2012). According to Tabassum et al. (2015), the massive volumes of sludge and waste that companies release into the environment may be the cause of the enrichment of all physico-chemical parameters that have been investigated at the discharge site.

The textile effluent transparency for Pali was around 15.51667 ± 0.581, whereas for Balotra it was 16.1625 ± 0.912. In Pali textile effluents, the dissolved oxygen content was 0.1975 ± 0.090194 mg/l, but at the Balotra sample site, it was 0.149167 ± 0.010607 mg/l. There were marginally more instances of dissolved oxygen during the Manson times because to the possibility that precipitation was aerated river water throughout the research periods. During the Manson, carbon dioxide was detected; however, during the summer, it may be transformed into bicarbonates and carbonates. The average free carbon dioxide levels on the Pali and Balotra sites were 105.45 ± 53.23 mg/l and 114.6818 ± 58.83 mg/l, respectively, as a result.

Tandale and Dabhade (2014) found that the pH of both textile effluent samples was alkaline because free carbon dioxide was converted to bicarbonate and very little to carbonate. As a result, the carbonate values ranged from 50.91667 ± 8.4459 mg/l at Pali to somewhat more on Balotra (91 ± 11.32843 mg/l), with the highest values occurring in the summer and the lowest in Manson. During the research period, high bicarbonate levels were obtained in Pali (883.75 ± 40.312 mg/l) and Balotra (878.167 ± 69.54549 mg/l). The total hardness of the effluent water at the Pali site was 915.125 ± 84.489 mg/l, whereas the Balotra site had 884.4167 ± 91.999 mg/l. This difference in hardness might be attributed to the presence of calcium. Because the water is unfit for human consumption, very high levels of chloride ions were found at both sites. The values of Pali ranged from 1598.667 ± 43.93 mg/l to 1602.125 ± 97.421 mg/l. We also estimated the salinity value from the chloride, and it ranged from 2888.865 ± 78.684 mg/l to 2894 ± 185.5033 mg/l. This waste water from the textile effluents was found to have a high salt level.

Regarding aquatic environments Since phosphate and nitrates serve as nutrients for live algae, we can determine the kind of aquatic body based on these nutritive substances. During the study period, Pali's nitrate levels were 116.748 ± 20.23 mg/l and 131.3358 ± 15.205 mg/l. Surface water has the largest concentration of cations and anions, according to a 2013 study by Hussain et al. Given that the phosphorus levels for Pali and Balotra ranged from 5.4479 ± 0.68257 mg/l to 5.7654 ± 0.61598 mg/l, we concluded that the effluent water was dangerous to consume. The permitted limit of 2.8458 ± 0.4079 mg/l for fluoride in water was discovered to be significantly exceeded in the Pali area, with a value of 3.153 ± 0.44065 mg/l in Balotra.Gautam et al. (2011) investigated the effects of fluoride on humans. The waste water has a high BOD value at both sample sites Pali: 265.333 ± 16.7137 mg/l and Balotra: 282.583 ± 37.78 mg/l due to the growing harmful load of dyes on effluent.

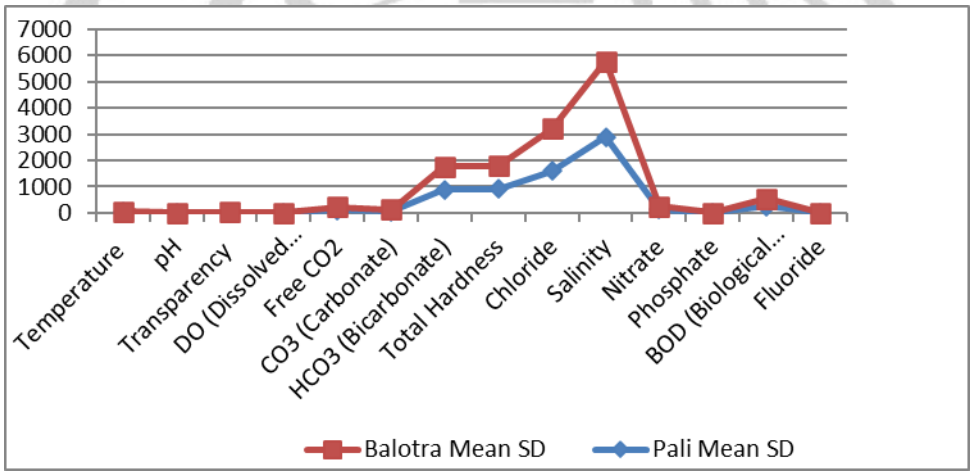
Dabhade and Tandale (2016) state that when the high load of these nutrients increases in water bodies, so does their biological oxygen demand. During the research periods the BOD values ranged from 140 mg/l to 411 mg/l. According to a 2012 study by Rathore, the Bandi River's water

quality was negatively impacted by industrial effluent. (2011) Varma and Sharma discussed the use of wastewater for irrigation purposes in agricultural lands, which is not advised. High TDS, BOD, COD, and salt content water is not suited for irrigation. The observed values of all physic-chemical parameters are discuses in Table no. and Graph plate no. 1.

Table No. 1. Shows mean values of Physico-Chemical parameters.

Parameters	Pali Mean SD	Balotra Mean SD
Temperature	33.5±0.2	34.24167 ±0.361814
pH	9.86±0.306	10.09±0.252
Transparency	15.51667±0.581	16.1625±0.912
DO (Dissolved Oxygen)	0.1975±0.090194	0.149167±0.010607
Free CO2	105.45±53.23	114.6818±58.83
CO3 (Carbonate)	50.91667±8.4459	91±11.32843
HCO3 (Bicarbonate)	883.75±40.312	878.167±69.54549
Total Hardness	915.125±84.489	884.4167±91.999
Chloride	1598.667±43.93	1602.125±97.421
Salinity	2888.865±78.684	2894±185.5033
Nitrate	131.3358±15.205	116.748±20.23
Phosphate	5.4479±0.68257	5.7654±0.61598
BOD	265.333±16.7137	282.583±37.78
Fluoride	2.8458±0.4079	3.153±0.44065

Graph Plate No. 1. Shows mean values of Physico-Chemical parameters.



CONCLUSION:

Since of the presence of chloride, which is used in many dyes used for colouring in the textile industry, and since dyeing and printing need a lot of chemicals, the effluent was alkaline and had high values for biological oxygen demand, total hardness, and salinity. Because of the effluents that drained into the river, the river's water quality is impacted and cannot be used for

irrigation or drinking.

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Diversity of moths in Sangrampur Tehsil: A Preliminary Study

Miss N. S. Dhore
Arts and Commerce College, Warwat Bakal, Tq- Sangrampur, Dist - Buldhana
And
Dr. M. R. Solanke
Arts and Commerce College, Warwat Bakal, Tq- Sangrampur, Dist- Buldhana
And
Dr. G.B. Kale
G.S. College, Khamgaon

ABSTRACT

Moths are the most taxonomically and ecologically diverse insect taxon for which there exists considerable time series abundance data. Moth constitute the large division of the order Lepidotera. The sample were collected from 4 different habitats as deserts area, vegetation, landscapes crops field and grassy lawns. Specimens were captured by direct hand pickling and with the help of hand nets. The taxonomic status was determined with the help of available identification keys and online websites. During October 2021 to March 2022 research resulted in order 7 families and 17 species of moths in Sangrampur Taluka, district- Buldhana.

Keyword- Moth, Insect., Diversity, Sangrampur, Buldhana

INTRODUCTION

Moths belongs from order Lepidoptera which include moths and butterflies there are about 1,60,000 species of moths many of them are not even study. Most of the moths are nocturnal. Moths are important pollinators. Moths pollinates on their nectar and their hairy bodies makes moths great pollinators they pick the pollen from any flower they land on; they are widespread found in different habitat and sensitive to change Habitats- Moths usually active at night and rest during the day in a preferred wooded habitatColour- Many moth species have stunning colour such as yellow, orange, pink, green and red patterns. Some fascinating moth species can look like leaves or barks white and dark brown wing pattern. Antennae- Moths have a pair of antennae, which vary in size and feathery Eyes of moth- Most moths are nocturnal, their eyes are covered in anti-reflective nanostructure that prevents light from reflectingoff them when they fly at night and giving away their location helping them to avoid predators

REVIEW OF LITERATURE

A) International Status

Today the most prominent names among macrolepidopterists are J. D. Holloway who is a specialist on macrolepidoptera with international Institute of Entomology. He is working fulltime on moth of Borneo and recently lead a team producing. The families of Malaysian moths and Butterflies common (1990) published the first comprehensive, illustrated book covering the

enormous diversity of Australian moth with information on their distribution, larval host plant and fascinating behaviour. Ian kitching of British Natural History Museum is an authority on biodiversity and biosystematics a phylogeny of macrolepidoptera with special emphasis on Bombycoidea and Sphingidea.E.C. Zimerman has worked on macrolepidoprera of Hawaii Island. Dr. Roger Kendrick has been documenting the moth fauna of Hong Kong, Apart from taxonomic study most prominent work on ecology of moths are done by Jan Beck and Chey Khen (2007). Gunnar Brehm and Konrad Fiedler (2004) who saw the pattern of body size change of some Geometrid moth along an elevational gradient in Andean rainforest.

B) National Status

The Indian scenario is little different with very few, if not a single one, study addressing ecological question behind the diversity and distribution pattern of moth's assemblages. Not a single study has so far addressed Indicator properties of moth assemblages in assessing habitat quality. All the work has been addressing the taxonomy of moth; still the inventory of these taxa for a single state is not complete. The earliest faunistic record of Leoidoptera from Indian are by Linnaeus (1758-68), Cramer (1775-82), Fabricus (1775-898), Kollar (1844-1848), Butler (1879-86). Bell and Scott (1937) published "Fauna of British" India to Family Sphingidae. Warren (1888, 1893, 1896, 1910, 19111, 1913 and 1914) andro the child (1914, 1915, 1920, 1933).

MATERIALS AND METHODS

Methods of sample collections:

In the experimental plots moth's specimen were collected by using light trap by using net during the study period October2021 to march 2022. The sample were recorded in morning 11pm to 4pm Saturday and Sunday. Moths arecollected using Specimen were identified with the help of fauna of British India hand book and some more identified with the help of the entomological scientist. Identify with the helpof guide and some references books.

Anytype of light will attract moths, moths need a surface to rest on, moths are also conducted by using smell fermented sugar and ripe fruit both food sources with the help of fermented fruit and sugar, the methos of attracting moth us simply called sugaring.

Observation and Results

As a part of the study the biodiversity of moth was carried out from October 2021 to march 2022. During the study period total 17 species of moths were recorded from study area. These 17 species belong to seven families of the suborder Heterocera of the order Lepidoptera. Maximum number of the moth were recorded from family Geometridae represented by six species (scopulaimmutata, Pleuropruchainsularia, Ennomosalniaria, Lomographavestaliata, Gnophosobsuccata and Eumelealudovicata)

Table: - Percentage of the species distribution in different sub families

Sr. no	Subfamily	Species richness	Percentage
1	Geometridae	6	35.29 %
2	Noctuidae	3	17.64%
3	Eribidae	3	17.64%
4	Sphingidae	2	11.76%
5	Totricidae	1	5.88%
6	Saturniidae	1	5.88%
7	Crambidae	1	5.88%
	Total	**17**	**100%**

Table: - Family wise distribution and list of moth Genera and identified species recorded from study area

Sr no.	Name of the species	Family	Genus
1	*Scopula immutata*	Geometridae	*Scopula*
2	*Pleuropruchainsularia*	Geometridae	*Pleuroprucha*
3	*Ennomosalniaria*	Geeometridae	*Ennomos*
4	*Lomographavestialiata*	Geometridae	*Lomographa*
5	*Gnophosobscuta*	Geometridae	*Gnophos*
6	*Eumelealudovicata*	Geometridae	*Eumelea*
7	*Helicoverpazea*	Noctuidae	*Helicoverpa*
8	*Agrotisipsilon*	Noctuidae	*Agrotis*
9	*Mythimaunipucta*	Noctuidae	*Mythima*
10	*Amata immutata*	Eribidae	*Amata*
11	*Utethesiapulchella*	Eribidae	*Utethesia*
12	*Chionarctia nivea*	Eribidae	*Chionarctia*
13	*Theretralatrilli*	Sphingidae	*Theretra*
14	*AcherontiaAtropos*	Sphingidae	*Acherontia*
15	*Eana osseana*	Sphingidae	*Eana*
16	*Antheraea yamamai*	Saturniidae	*Antheraea*
17	*European corn borer*	Crambidae	*European corn*

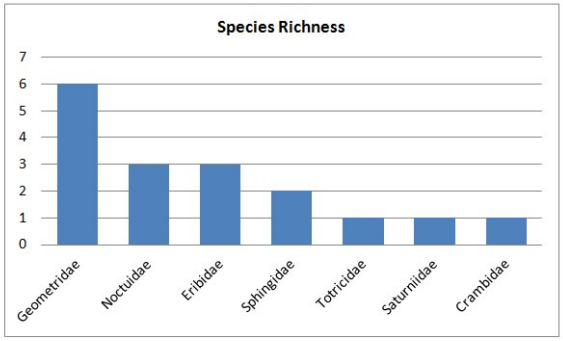


Fig. 1 : Species Richness in Subfamilies

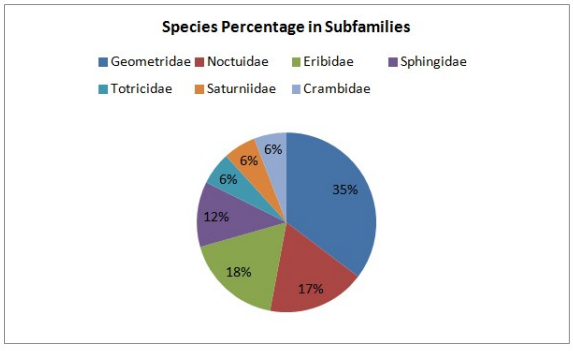
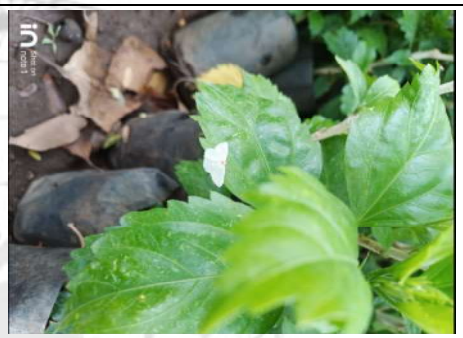


Fig. 2 : Percentage in Subfamilies

	
Scopula immutata	*Ennomos alniaria*
	
Pleroprucha insularia	*Lomographa vestaliata*
	
Gnophosob fuscata	*Helocoverpa zea*
	
Mythimna unipucta	*Utetheisa pulchella*

	
Amata immutata	*Chionarcyia nivea*
	
Theretra latreillii	*Eana osseana*
	
Acherontia atropos	*Antheraea yamamai*

DISCUSSION

To study the biodiversity of moth in Sangrampur Taluka was carried out during October 2021 to March 2022 from this study total species of moth collected in study area at Sangrampur Taluka variety of habitat available so the diversity of organism is reach. In this area well plantation and garden added some news species of plants in this areaDuring project work 17 species of moth were recorded and photograph all of the and species were identified with help of references and guidance, experts of Bombay Natural History Society Mumbai (SSI) sociological society of India or agriculture university experts.Total 7 families of moths of order Lepidoptera were ordered this 7 families Geometridae, noctuidae, Eribidae, Tartricidae, Crambidae, Sphingidae, and Saturniidae.

CONCLUSION AND SUMMARY

A total 17 species from 7 families were recorded, among them some species were common in their appearances. Biodiversity is generally a measure of the relative number of the relative number and types of organism presents. A comprehensive report of moth carried out that

result in 7 families and 17 species reported from different habitat of satpuda region from October 2021 to March 2022. The present study was designed to find the diversity and species composition of moths existing and at different tropical level in food chain for sustainable ecological process of forested. A total 17 species belonging to 7 families were collected from study area. The species were attracted to light at night, mostly moth species were present under light, all moth species were herbivorous, moth were present in different habitat and feeds on different plants. All the moths were attracted to the light at night.

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Preliminary Status of Jumping Spider (Family Salticidae) in Buldhana District

Miss. Sonali A. Tayade
Department of Zoology,
Arts and Commerce College, Warwat Bakal Dist. Buldhana
And
Dr. G. B. Kale
Department of Zoology,
G. S. Science, Arts & Commerce College, Khamgaon, Dist. Buldhana.

ABSTRACT

Spiders represent one of the most diverse animal groups globally. The presence of spiders in an ecosystem may influence the population dynamics of other arthropods. Spiders play an important role in insect pest control without any harm to agricultural crops. Salticidae is one of the major family of spiders containing about 685 genera and 6,702 species globally (WSC 2024). Jumping spider possess some of the best vision among arthropods which aids them in recognizing a potential mate or hunting prey. Jumping spiders are hunting spiders capable of jumping or leaping to a distance. They use their front legs to grasp or hold prey while feeding and use their hind legs for powering their jumps. Silk serves various purposes for jumping spiders: it acts as safety lines while they jump, a tether to reach otherwise inaccessible prey, and as "pup tents" for resting and sheltering during bad weather. Typically, jumping spiders don't build webs to catch their prey. During this study, total 5 species were recorded including Hasarius adansoni, Phintella vittata, Plexippus paykulli, Telamonia dimidiata and Thyene imperialis. Survey was carries out during September 2021 to September 2022 in some part of Buldhana district.

Keywords: Salticidae, Jumping spiders, Diversity, Arachnida, Spider

INTRODUCTION:

Spiders are one of the most abundant insectivorous predators of the terrestrial ecosystem. Spiders come under the phylum Arthropoda and class Arachnida. Arthropoda is more diverse and largest phylum than any other living or extinct animal taxon. We can differentiate spiders from any other arachnids by the presence of the pedicel. Pedicel is a narrow stalk that joins the cephalothorax and the abdomen. In other arachnids cephalothorax and abdomen are fused that that they appear as one. Spiders possess spinnerets which produces the silk. Spinnerets is silk spinning organ of spider which is situated near the hind end of the abdomen of spider. Spider have 8 legs and does not have chewing mouth part and wings and are found worldwide on every continent

except for Antarctica. They have become established in nearly every habitat with the exception of air and sea colonization.

Salticidae Blackwall, 1841 (Arachnida: Araneae) includes jumping spider which is the largest family of the order Araneae. Jumping spiders are very small to medium sized spider and size varies from 3-20 mm in length. They are active hunting spider which are capable of jumping to a distance. The most characteristic feature of jumping spider is the ocular quadrangle on the cephalothorax delimited by eight eyes arranged in three or four rows. Front row formed of forwardly directed four eyes among which the anterior median eyes are very large and easily noticeable. Their legs are two-clawed with claw tufts. Jumping spider are diurnal. Jumping spider are abundant in Tropic and found in various habitat includes grass, brushes, small and tall trees, tree bark, rocks, under stones, in litter and some species are also found in and around human dwellings. They hunt their prey by stalking, chasing and leaping over it. Their prey mainly includes insects but some may feed on other spider and or ants. Salticid show remarkable sexual dimorphism for colour and pattern and matured male are more brightly colored as compare to female (Oxford and Gillespie, 1998). Salticidae shows remarkable courting habits. Male of some species of jumping spider dance in front of female, they wave their palp or legs or both to attract the female (Tikader, 1987).

Till to the date 52,233 speciesof spider described under 4,393 genera and 134 families (WSC 2024). Indian spider fauna was updated to 1,953 species belonging to 503 genera and 62 families (https://indianspiders.in/) .Salticid fauna of world were recorded about 685 genera and 6,702 species (WSC 2024) while Salticid fauna of India were recorded in all state and union territories about 326 species under 110 genera except Daman and Diu and Dadra and Nagar Haveli (Singh et. al, 2021).

Wasankar, et al, (2016) recorded 37 speciesof spider in Dnyanganga Sanctury of District Buldhana, Vairale (2020) reported 137 of spider belonging to the 16 famillies in Agro-ecosystem of Buldhana district. There after Chaware et.al., (2021) reported 40 species of spider of 12 families. Upadhyay, et. al, (2024) studied the abundance and diversity of spiders in agroecosystem of Jabalpur and he found that Family Araneidae, Thomisidae and Salticidae were dominant in agroecosystem.

The present paper aims to discover spider diversity with special emphasize on Salticidae family (Jumping spider) in Buldhana district.

MATERIALS AND METHODS:

1) Study area:

The present study of Jumping spider was carried out from September 2021- September

2022 atBuldhana district. The Buldhana district of Maharashtra statecomes under the Amravati division. The latitudes of Buldhana are 19.51° to 21.17° N and longitudes are 75.57° to 76.59° E. It is bounded on the north by Madhya Pradesh state, to the East by Akola and Washim districts, to South by Parbhani and Jalna districts, and to the West by Jalna and Jalgaon districts. Its area is about 9640 sq. km.It is includes thirteen Tehsil namely Buldhana, Chikali, Mehkar, Lonar, Deulgaon Raja, Sindked Raja, Motala, Malkapur, Nandura, Khamgaon, Shegaon, Jalgaon Jamod, Sangrampur.The vegetation area of Buldhana is well developed.

2) Sampling Methods:

Spider inventory work was conducted from September 2021 to September 2022 in some parts of Buldhana district in Maharashtra. Survey was conducted in the morning hours between 6.30 amto 9.30 am. Spider were photographed by using mobile lense and other digital cameras.

The detailed descriptions of the observation techniques are as follows-

i) **Sweep netting**- Spider from the herbaceous- shrub and small tree vegetation were collected using standardized insect colleting net. Sweep netting method is used to collect the foliage spider.

ii) **Active searching and hand picking**-Spiders from all three layers were collected using this method. In this method spider specimens were actively searched under rocks, logs, ground debris and loose dead barks of tree etc.

iii) **Vegetation beating**- Spiders from trees and woody shrubs were dislodged and collected on a sheet by beating trees and shrubs with a standard stick. 10 beats per tree or shrubs were employed.

iv) **Litter sampling**-Litter is a deciduate from the ground which is collected by a hand and was put in big tray. Spider were collected from that litter.

All the spiders were observed from study area photographed in life with mobile microlense. Species were identified by using various taxonomic key.

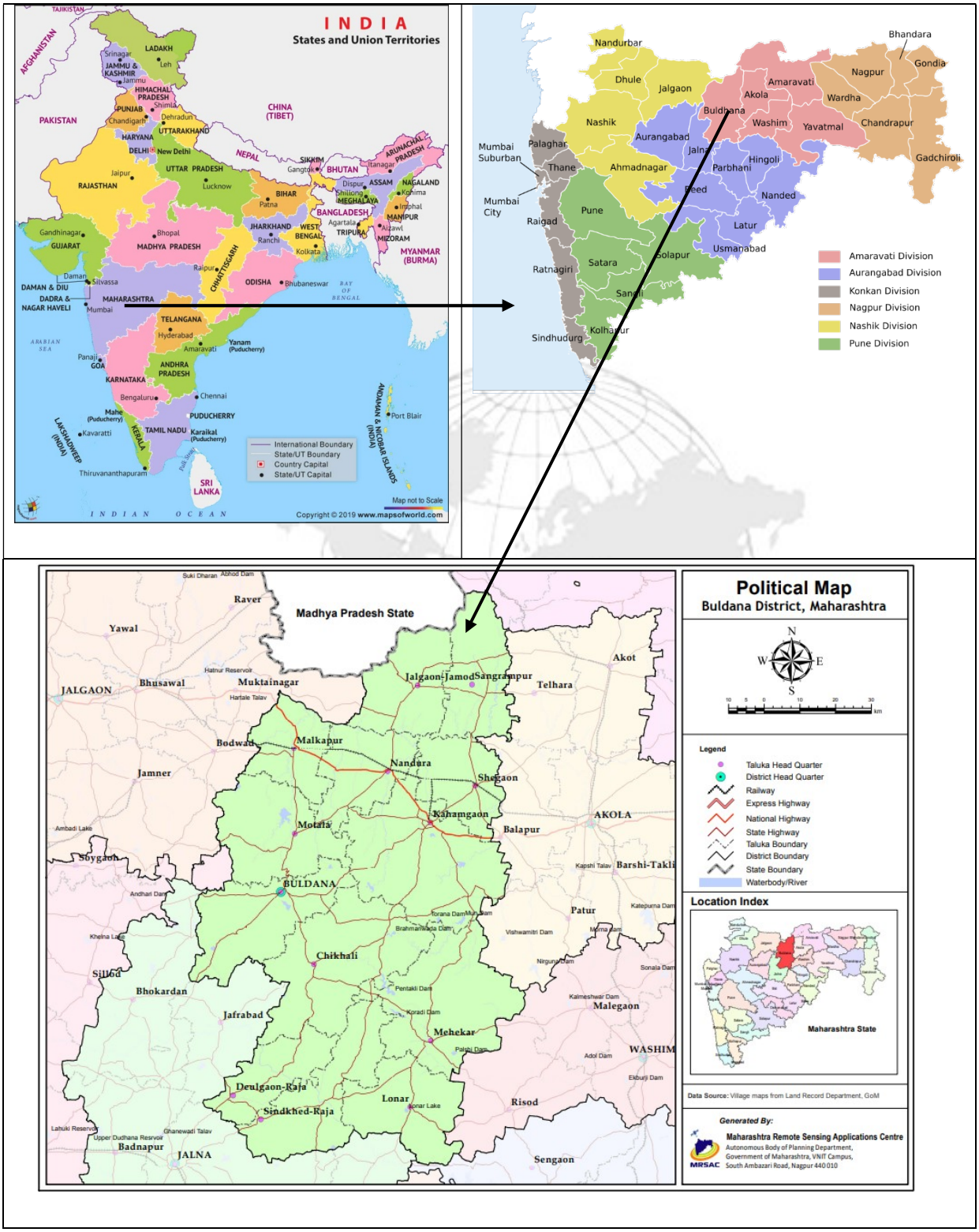


Fig. Geographical location of the research area

OBSERVATIONS:

Following species of Salticidae family were recorded during September 2021- September 2022

Sr. No.	Genus	Species
1.	*Hasarius*	*adansoni*
2.	*Phintella*	*vittata*
3.	*Plexippus*	*paykulli*
4.	*Telamonia*	*dimidiate*
5.	*Thyene*	*imperialis*

RESULT:

Present study was conducted to find out the diversity of Jumping spiders belonging to the Salticidae family in Buldhana district of Maharashtra. In this study total 5 speciesnamely *Hasariusadansoni, Plexippus paykulli, Phintella vittata, Telamonia dimidiate* and *Thyene imperialis* were reported which belong to 5 different genera.

General account of encountered species:

Phylum	**Arthropoda**
Class	Arachnida
Order	Araneae
Family	Salticidae

1) ***Hasariusadansoni* (Audouin, 1826)**

Common name- Adanson's house jumper

Habitat- House wall and gardens

Diagnostic Characters:

In male cephalothorax is black in colour. Moderately high cephalothorax having an ocular quadrangle with a white cross shaped band along the anterior region. White crescent mark is present behind the ocular quadrangle. Abdomen of male is small, oval and little yellowish brown in colour. At the anterior end of abdomen inverted broad crecent mark is present and in the middle a pair of dull white spots is present.

2) ***Phintella vittata* (CL Koch 1846)**

Habitat- Bushes and medium sized plants

Diagnostic Characters: Cephalothorax of of*Phintella vittata* is small, compact and quite high. There Cephalus region is flat while thorax sloping steeply to the posterior margin. Carapace of male is blackish, covered with iridescent scales. Just below the fovea, there is a large diamond-shaped patch is present which is connected with broad lateral bands with bluish-white iridescent setae. Outer margin of their carapace is lined by broad patch of white hairs. Anterior eyes surrounded by dull white scales. Legs of male are black withlighter yellowish metatarsi and tarsi. Abdomen is rounded with alternate transverse bands ofbrownishandiridescent setae. Female are similar but lighter in colour. Legs of female are yellowish.

a. Plexippus paykulli (Audoun 1826)

Common name- common zebra jumper

Habitat- walls of building and tree trunk

Diagnostic Characters: Carapace of male is blackish with a mid-dorsal longitudinal white band and abdomen is blackish with a mid-dorsal white band flanked by four white spots present in the posterior region, their lateral sides are white. Females are brownish in color and their abdomen has chevron shaped markings mid-dorsally, flanked with two pairs of conspicuous white spots.

3) Telamoniadimidiata (Simon,1899)

Common name- Two striped jumper

Habitat- Leaves of bushes and trees

Diagnostic Characters: Carapace of male is reddish-brown with broad white band along the lateral sides and they have white patch in the middle of the posterior ocular quadrangle. Abdomen of male is elongated, brownish with a broad, mid-dorsal white stripe. Females are lighter in color and their carapace is yellowish in color, ocular region is white. Abdomen of female is yellowish-white with a pair of reddish longitudinal stripes.

4) Thyene imperialis (Rossi, 1846)

Common name: Emperor jumper

Habitat: Foliage, tall grass

Diagnostic Characters: Female are lighter in color; carapace is yellowish which is covered with pale yellow scales. Abdomen of female is yellow-brown with rows of thin reticulations composed of white hairs, mid-dorsal region varies from dark brown to blackish in color on which a white spot and two rows of transverse white stripes are present.

Photographs of spiders:

	
Hasarius adansoni (Male)	*Thyene imperialis* (Female)

	
Phintella vittata (Male)	*Phintella vittata* (Female)

Plate 1

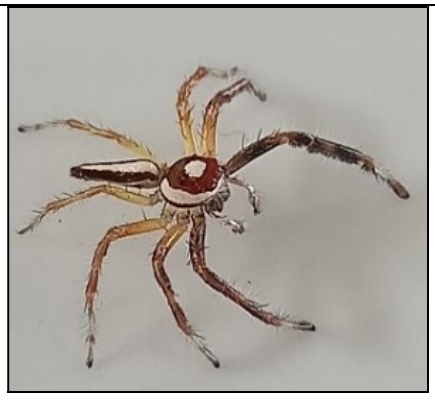
	
Plexippus paykulli (Male)	*Plexippus paykulli* (Female)
	
Telamonia dimidiate (Male)	*Telamonia dimidiate* (Female)

Plate 2

DISCUSSION:

Diversity of Salticidae fauna was conducted during Sept.2021 to Sept. 2022 in Buldhana district of Maharashtra, during this survey I have recorded the 5 Jumping spider species belonging to the 5 different genera. *Hasarius adansoni* and *Plexippus paykulli* these two species of Salticidae family are commonly found in human dwelling area such as wall of the buildings. *Phintella vittata* mostly observed bushes and medium size plant while *Telamonia dimidiate* found on bushes and tree. *Thyene imperialis* found on tall grass and foliage.

ACKNOWLEDGEMENT:

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Unraveling the Intricacies of Host-Parasite Interactions: From Mutualistic Alliances to Covert Exploitations

Mr. Sachin Dadarao Jadhav
Department of Zoology,
Shri Pundlik Maharaj Mahavidyalaya, Nandura,
Dist. Buldana (MS), India,
And
Dr. Ravikumar B. Shinde
Department of Zoology,
Shri Pundlik Maharaj Mahavidyalaya, Nandura,
Dist. Buldana (MS), India,
And
Mr. Shantaram B. Bhoye
Department of Zoology,
Shri Pundlik Maharaj Mahavidyalaya, Nandura,
Dist. Buldana (MS), India,

ABSTRACT

Host-parasite interactions represent a complex and dynamic aspect of ecological and evolutionary biology, encompassing relationships that range from mutualistic alliances to covert exploitations. This review delves into the intricacies of these interactions, examining the various forms of symbiosis—mutualism, commensalism, and parasitism—and their impact on the host and parasite populations. By exploring diverse examples from different ecosystems, the review highlights the adaptive strategies employed by parasites and the corresponding responses by hosts. The study further categorizes hosts into definitive, intermediate, reservoir, paratenic, and accidental types, each playing a critical role in the parasite's life cycle and transmission dynamics. Understanding these relationships not only provides insights i0nto the biological and ecological consequences of parasitism but also offers perspectives on the co-evolutionary arms race between hosts and parasites. This comprehensive analysis underscores the significance of host-parasite interactions in shaping biodiversity and ecosystem functions, contributing to our broader understanding of natural selection and survival strategies in the biological world.

❖ INTRODUCTION:

Host-parasite relationships encompass the interactions between two organisms, wherein a parasite resides either on or within a host organism and gains advantages while compromising the well-being of the host. This relationship is categorized as a form of symbiosis in which the parasite benefits while the host suffers adverse effects.

Host-parasite relationships can be observed in various ecosystems and involve a wide range of organisms, including animals, plants, and microorganisms. Parasites can be single-celled

organisms like protozoans or complex organisms like worms, insects, or fungi. They may cause harm to their hosts by feeding on their tissues, depriving them of nutrients, or transmitting diseases.

❖ **Varieties of Hosts and Relationships: Parasitism, Symbiosis, and Commensalism**

➢ **Parasitism**Parasitism is a type of symbiotic relationship where one organism, the parasite, benefits at the expense of another organism, the host. This relationship is characterized by the parasite deriving its nourishment or other benefits from the host, often causing harm, but typically not leading to the host's immediate death. Parasitism can occur in various forms and affect hosts in different ways, depending on the type of parasite and the relationship dynamics.

- **Varieties of Hosts**

1. **Definitive Host**: This is the host in which the parasite reaches its adult stage and reproduces. For example, in the life cycle of a tapeworm, humans can serve as the definitive host.
2. **Intermediate Host**: An intermediate host is one that harbors the parasite during its larval or asexual stages. In the case of the malaria parasite *Plasmodium*, mosquitoes serve as intermediate hosts, where the parasite undergoes development before being transmitted to humans.
3. **Reservoir Host**: This host is a species that harbors the parasite and serves as a source of infection for other species, including humans. For example, wild rodents can act as reservoir hosts for the parasite *Trypanosoma cruzi*, which causes Chagas disease in humans.
4. **Paratenic (Transport) Host**: In some cases, a parasite may enter a host where it does not undergo development but can be transmitted to another host. This host helps in the dispersal of the parasite without being directly involved in its life cycle. For instance, some nematodes use paratenic hosts to reach their definitive hosts.

- **Types of Parasitic Relationships**

1. **Ectoparasitism**: Ectoparasites live on the surface of the host. Common examples include lice, fleas, and ticks. They typically feed on blood or skin, and their presence can lead to irritation, disease transmission, and other health issues in the host.
2. **Endoparasitism**: Endoparasites live inside the host’s body, often within organs, tissues, or cells. Examples include tapeworms, which reside in the intestines, and **Plasmodium** species, which invade red blood cells. These parasites often cause more severe health problems compared to ectoparasites.
3. **Obligate Parasitism**: Obligatory parasites are entirely dependent on the host for their survival and reproduction. They cannot complete their life cycle without a host. For example, *Plasmodium* species must infect a host to reproduce.
4. **Facultative Parasitism**: Facultative parasites are capable of leading both a parasitic and

free-living existence. They do not rely solely on a host for survival but can exploit one if the opportunity arises. For example, some species of amoebas can live freely in the environment or parasitize hosts under certain conditions.

5. **Social Parasitism**: This occurs when one organism exploits the social behavior of another species. A well-known example is brood parasitism in birds, where species like the cuckoo lay their eggs in the nests of other birds, leading the host bird to raise the cuckoo's young.

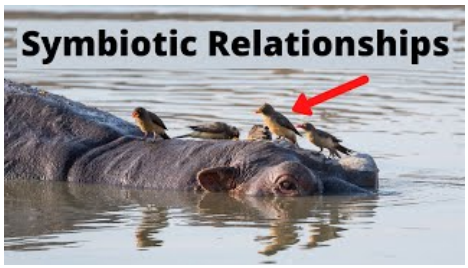
- **Effects of Parasitism on Hosts**

Parasitism can have a range of effects on the host, from mild discomfort to severe illness or even death. The degree of harm depends on the parasite's virulence, the host's immune response, and the duration of the parasitic relationship. In some cases, parasites can manipulate the host's behavior to enhance their transmission to other hosts, as seen in certain parasitic worms that cause their insect hosts to behave in ways that increase the likelihood of the parasite being transmitted to a definitive host.

In summary, parasitism is a complex and diverse form of symbiosis with significant implications for both the parasite and the host. Understanding the varieties of hosts and the types of parasitic relationships is crucial for studying the ecological and evolutionary dynamics of this interaction.

With a name like "Tongue-Eating Louse", you know this is going to be viscerally horrible, but bear with me… it's also pretty neat. Despite the name, these aren't actually lice, but parasitic crustaceans known as isopods. While there are dozens of species in the genus Cymothoa, most are parasites which live in the gills of fish and are, relatively speaking, unremarkable. But Cymothoaexigua is something special. While the male of the species (and this is a slippery term, as they can change sex when necessary) lives in fish gills, the female has developed an altogether original strategy. **Zimmerman, A. E. (2012, July 16). What's the matter, louse got your tongue? (Cymothoaexigua). Questionable Evolution. https://questionableevolution.com/2012/06/20/whats-the-matter-louse-got-your-tongue-cymothoa-exigua/**

- **Symbiosis:** refers to the close and long-term biological interaction between two different species, known as symbionts. These interactions can have varying effects on the associated populations, impacting their abundance and distribution. Symbiotic relationships encompass both positive (beneficial) and negative (unfavourable to harmful) associations, and they can be categorized into three main types: mutualism, commensalism, and parasitism.



- **Mutualism**, formerly referred to as symbiosis, mutualism denotes a partnership between two distinct species of organisms that yields benefits for both parties involved. These mutually advantageous arrangements commonly form between organisms with contrasting ecological requirements. Such relationships are typically characterized by close and enduring associations that are vital for the survival of each species. A notable instance of mutualism can be observed in the symbiotic bond between termites and protozoa within the termite's digestive system. The termite benefits from the protozoa's bacterial symbionts, which possess the ability to break down cellulose—a task the termite itself is incapable of performing. Without the protozoa, the termite would be unable to derive energy from the cellulose found in its primary food source, namely wood. Conversely, the protozoa and bacterial symbionts benefit from the protective environment and a steady supply of nourishment provided by the termite's wood-digesting activities. Another illustration of mutualistic symbiosis is evident in the relationship between lichens and fungi, where the photosynthetic algae or bacteria present within the lichen produce glucose that serves as sustenance for both organisms. Additionally, the physical structure of the lichen shields the algae from environmental elements while enhancing the availability of specific atmospheric nutrients for their growth.

An example of mutualism is observed in the relationship between clownfish and anemones, where the clownfish protect the anemones from predators while finding shelter within their tentacles. However, it is important to note that mutualistic relationships are not always rigidly fixed. Depending on the prevailing environmental conditions, formerly harmonious species can transition into competitors..Source:**A mutual breakdown. (2016, August 24). MIT News | Massachusetts Institute of Technology. https://news.mit.edu/2016/species-relationships-jointly-beneficial-competitive-**

- **Commensalism:** Commensalism is a form of relationship between two species wherein one species gains benefits from the other without causing any harm or providing any benefits in return. The species that benefits is known as the commensal, while the other species is referred to as the host. The commensal derives advantages such as food, shelter, support, or transportation from the host, while the host remains unaffected by the interaction. Unlike mutualism, where both species benefit, commensalism involves only one species receiving benefits.
- A notable instance of commensalism is observed in the association between remoras (fish) and sharks. Remoras possess a specialized suction disk on the top of their heads, enabling them to attach themselves to the bodies of sharks and other large fish. By hitching a ride on their hosts, remoras gain access to leftover food from the shark's meals. This relationship exemplifies commensalism as the remoras benefit from the available food source provided by the shark, without causing any harm or providing any advantage to the shark itself.

- Bird species like the great egret provide another example of commensalism. These birds feed on insects that are turned up by grazing mammals or on soil organisms stirred up by plowing. While the birds benefit from the availability of food, the grazing mammals or plowing activity of farmers is unaffected by the presence of the birds.
- Various biting lice, fleas, and louse flies also exhibit commensalism. These parasites feed harmlessly on the feathers of birds or on sloughed-off flakes of skin from mammals, without causing harm to the host organisms.
- Additional examples of commensalism can be found in nature. For instance, orchids growing on tree branches form a commensal relationship. Orchids rely on the host tree for support and access to sunlight, but they do not extract any nutrients from the tree or harm it.
- Golden jackals provide another example of commensalism in their relationship with apex predators like tigers. When expelled from their pack, golden jackals follow tigers and feed on the remains of their kills, benefiting from the leftover food without causing harm to the tiger.
- Sharks and remora fish (suckerfish) demonstrate a commensal relationship. Remora fish attach themselves to the bodies of sharks, waiting for the shark to feed. They then detach to consume the scraps left behind. Although the remora benefits from the shark's food, it does not harm the shark directly.
- Whales and barnacles also exhibit commensalism. Barnacles attach themselves to whales, using them as a substrate for growth and development. The barnacles obtain a habitat without harming the whale, as they feed on plankton and other small organisms in the surrounding water.
- These examples illustrate the concept of commensalism, where one species benefit while the other is unaffected by the interaction. Commensal relationships can be found across various ecosystems and play a role in shaping the dynamics of biological communities.
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Examples Of Commensalism **in** Nature
Douglas, A. (2022). Examples Of Commensalism in Nature.
Source: World Atlas.
https://www.worldatlas.com/animals/10-examples-of-commensalism-in-nature.html

❖ **Types of Hosts**

In the realm of infectious diseases, a host refers to an organism that serves as a habitat for a parasite, providing sustenance and protection. Depending on their involvement in the parasite's life cycle, hosts can be classified into various types. To illustrate this, we can examine the case of Plasmodium, the protozoan parasite responsible for malaria. By considering Plasmodium as an example, we can gain insight into the different categories of hosts.

Plasmodium, the protozoan parasite responsible for malaria, involves two hosts: humans and female Anopheles mosquitoes. Within the mosquito host, the parasite engages in sexual reproduction, resulting in the production of infective stages. When an infected mosquito bites a human, the infective stages of the parasite are transmitted to the human host. Inside the human host, the parasite undergoes asexual reproduction, generating a significant number of parasites. Some of these parasites develop into gamete-producing forms. When another infected mosquito bites the human host, gamete-producing parasites are transferred back to the mosquito, where sexual reproduction takes place, perpetuating the cycle.

❖ **Based on this example and the information from the sources, here are the different types of hosts:**

1. **Definitive or Primary Host:** The definitive host is the organism in which the parasite reaches its mature stage and carries out sexual reproduction. This host can be a mammal or another living organism. In the instance of Plasmodium, the female Anopheles mosquito serves as the definitive host for the parasite.
2. **Intermediate or Secondary Host:** The intermediate host is the host that accommodates the larval stages of the parasite or where asexual reproduction takes place. In the case of Plasmodium, humans serve as the intermediate host since they harbor the asexual stages of the parasite.
3. **Reservoir Host:** A reservoir host plays a crucial role by harboring parasites and acting as a significant source of infection for other susceptible hosts. These hosts may not exhibit symptoms or may remain asymptomatic despite carrying the parasite. Dogs, for instance, serve as reservoir hosts in the case of cystic echinococcosis.
4. **Paratenic or Storage Host:** A paratenic host acts as a transient sanctuary and means of transport for the parasite to reach its definitive host. Within the paratenic host, the parasite remains in an immature stage and can only progress to further development when the paratenic host or a part of it is consumed by a suitable definitive host. An example of this is lizards serving as paratenic hosts for Spiroceralupi in dogs.
5. **An incidental or accidental host** pertains to a host organism that provides refuge to a parasite but cannot facilitate the complete development of the parasite's life cycle. An example of this is humans acting as dead-end hosts for the Japanese encephalitis virus. These various host types play vital roles in the life cycle and transmission of parasites. The relationships between hosts and parasites can vary and encompass mutualism, parasitism,

commensalism, and amensalism, depending on the nature and extent of the association between the organisms.

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Seasonal Prevalence of Gastrointestinal Parasite *Haemonchus* species in Sheep and Goat of Amravati District, Maharashtra, India

Smita P. Augad
Department of Zoology
Government Vidarbha Institute of Science and Humanities, Amravati (M.S) India
And
Pradeep S. Deshmukh
Department of Zoology
Government Vidarbha Institute of Science and Humanities, Amravati (M.S) India

ABSTRACT

Haemonchus contortus commonly called the barber pole worm of sheep and goat, is found in the abomasum of sheep and gaots, cause the blood loss. A study on seasonal prevalence of gastrointestinal Haemonchus species in Sheep and Goat were carried out during the year 2022 to 2023. Total 720 sample were collected from various talukas of Amravati District, Maharashtra. The highest prevalence of Haemonchus controtus were recorded in the monsoon i.e. 75.67%, whereas the prevalence was lowest in the winter season i.e.41.79%. The median range of prevalence was noted in the summer i.e. 64.81%. In the above study it was observed that the prevalence of Haemonchus controtus was recorded highest in the monsoon season and lowest in the winter season. Age and sex wise Haemonchus contortus infection examined, female host were more prevalence 47.91% then Male host 37.5% likewise, month-wise age, there were no more differences in case of slaughter house goat; they were near about similar, i.e., > 9 months of age (47.45%), and < 9 months of age (47.28%) similarly in case of farm house goat , i.e > 9 months of age (45.85%), and < 9 months of age (45.20%) because of lack of cleanliness, poor management practices and less awareness about deworming. Host wise highest prevalence of Haemonchus contortus were recorded in sheep i.e 60.95% as compared to goat i.e 55.36%. There are number of factors are responsible for infection; like ground grazing habit of sheep, live in flocks and less cleanliness.

Keywords: Seasonal, *Haemonchus contortus*, Gastrointestinal, parasite, sheep, goat.

INTRODUCTION:

Goat acts as a multi-purpose animal that play an important role in the economy and nutrition of landless and marginal farmers. The estimate population of sheep and goats in India has been 47.26 million and 148.88 million, respectively, whereas the North –Western Himalayan state of Himachal Pradesh has 0.79 million sheep and 1.1 million goats as per 20th livestock census (20th livestock census, 2019). India's livestock sector is one of the highest in the world, accounting for 26.40% goats, which play an important in Indian economy (Anon, 2012). Tiny ruminants are extensively dispersed and have a significant role as a primary source of revenue for tiny and

landless farmers in rural areas. Goats and sheep with extensive genetic diversity about 0.5 to 5% of the cattle industry's overall output in India is accounted for by variety. (Singh, k.*et al.,*1995). Round worm of small ruminants results in low productivity because of stunted growth, low weight gain and low food intake capacity (Pedreria *et al.,*2006). The prevalence of gastrointestinal helminths is associated to the agro-climatic condition like quantity and qualityof pasture, temperature, humidity and grazing behaviour of host (Pal and Qayyum,1993).Goats are useful animals that may produce meat, milk, wool, hair, and skin. Parasitism is considered to be one of the main issues preventing goat production, among other issues (Dewan *et al.,* 1979; Nooruddin *et al.,* 1987; Shahiduzzaman *et al.,* 1999). The parasitic disease haemonchosis is brought on by nematodes of *Haemonchus (H.) species.* Significant blood loss is caused by the blood-sucking parasite *H. contortus*, which is presentin the abomasum of sheep and goats. Each worm sucks 0.05 ml of blood every day, meaning that sheep with 500 *H. contortus*may lose roughly 250 ml per day (Urquhart *et al.,* 1988). Sheep and goats are mostly affected by *H. contortus*, a highly pathogenic and economically significant disease (Maqsood *et al.,* 1996; Mortensen *et al.,* 2003). Both the wealthy and the poor can benefit from eating goats, which are also a delicacy that is highly valued during festivals and celebrations, particularly in the nation's southwest (Yusufu OA *et al.,*2017). Goat intestine has been used to make catgut, which is still used today as a string for musical instruments and as a material for internal human surgical sutures. (Olanike AO *et al.,* 2015). The most common nematode species known to impact small ruminants globally is *Haemonchuscontortus*. Gastrointestinal nematode infections (GIN) are the major prevalent parasite illnesses affecting small ruminant productivity worldwide, particularly in the tropics and sub-tropics. (Torrs- Acosta *et al.,* 2008).The geo-climatic conditions of Bangladesh and India are highly favourable for the growth and multiplication of parasites; the ideal condition for development from egg to L3 is 28 °C with humidity greater than 70% (Rossanigo& Gruner, 1995); little or no development of eggs to larvae will take place below 9 °C (Silverman & Campbell, 1959); consequently, the environmental conditions in which external larval stages of *H. contortus* can develop and complete their life cycle are limited in cold temperate climates. *H. contortus* is most common in tropical and subtropical, warm, moist regions of the world (Dorny *et al.,* 1996).

MATERIAL AND METHOD:

Study area: The study was conducted at different talukas in Amravati District, Maharashtra, India from Dec 2022 to Dec 2023. The study was done on various breeds of sheep and goats. The sheep breeds Deccani and Madgyal and the goat breeds Beetal, Osmanabadi, Sirohi, Non-descriptive (Deshi Breed), Barbari. The age of both hosts was considered 6 months to 6 years of both sexes

Collection of faecalsamples: During one years of a study total 720 fresh faecal samples were collected in morning directly from the rectum of each animal by using sterile disposable gloves and collect in plastic zip- lock bags. The sample were transferred directly at the same day of collection to the laboratory of zoology department of Government Vidarbha Institute of Science and Humanities, Amravati, Maharashtra and then stored at 4^0 Celsius for one month

Collection of Haemonchous from slaughterhouse: TheVisera of 615 goatswere collected from different talukas of Amravati district, Maharashtra, India from December 2022 to December 2023. Post mortem examinations of slaughtered animal were carried out and abomasam were thoroughly examined and collected nematodes parasites were first washed with physiological saline solution. Nematode parasites were fixed in 70% alcohol and preserved in 70% alcohol and glycerine. The nematodes were then cleared in lactophenol and identified with reference to the literature (Soulsby, 1982) for permanent mount in DPX and identified.

Parasitological techniques: Haemonchus recovered from each of the infected abomasum during the survey in slaughter houses were counted and morphologically identified (Zajac *et al.,*2006). Faecal samples were examined by direct smear, sedimentation techniques for the presences of haemonchus eggs (Martin *et al.,*1990). *Haemonchus contortus* generally has reddish appearance. The white ovaries wind around the blood-filled intestine, give the nickname "barber pole" when referring to the females while females have length ranging from 18-30 mm, the males are shorter, ranging from 10-20 mm. The male distinct feature is its well-developed copulatory bursa containing asymmetrical dorsal lobe and Y shaped dorsal ray (Barnes et.,1987)

Faecal sample examination:

Direct smear method: (wet mount method)

Normal saline solution: Two grams of faces were combined into a saline drop to create a solution for the saline wet mount on a slide. Smear analysis was conducted using a light microscope in accordance with Urquhart *et al.,* (1987). And Identification of eggs, larva on the basis of morphological characteristics as per Urquhart et al. (1996) that is observed under the compound microscope 10X and 40X magnification and photographs were taken.

Age- wise category:>9 months of ageand <9months ofage.

Seasonal variation was studied in the three seasons: Monsoon (June to September), Winter (October to January) and summer (February to May).

RESULT AND DISCUSSION:

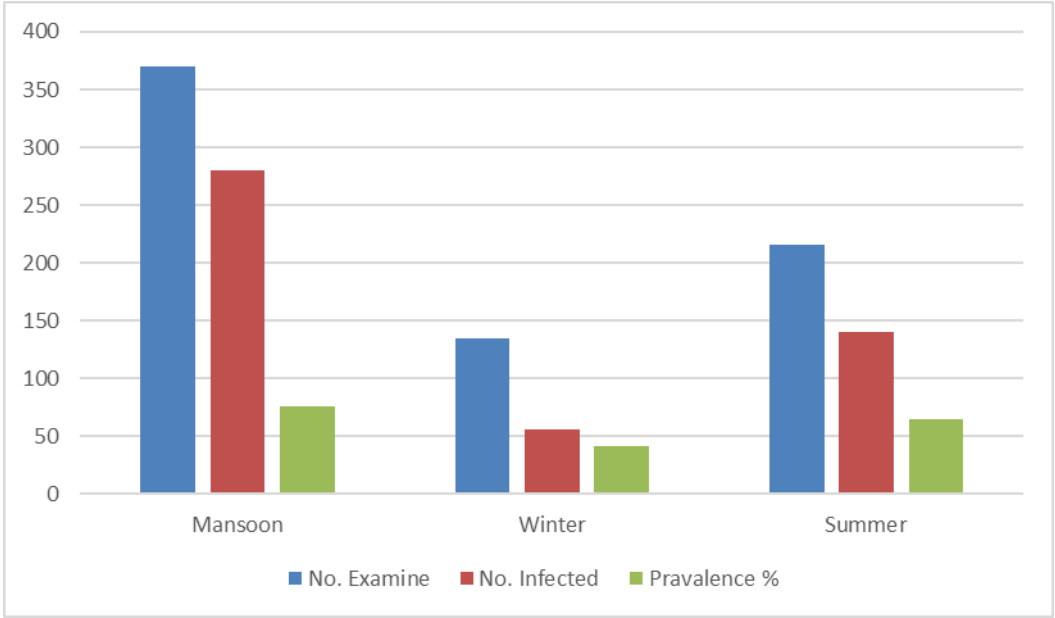
Season wise Prevalence's of *Haemonchus* species:

The highest prevalence of *Haemonchus controtus*were recorded in the monsoon i.e. 75.67%, whereas the prevalence was lowest in the winter season i.e.41.79%. The median range of prevalence was noted in the summer i.e. 64.81% because of suitable climatic condition and environment factor. However, the monthly prevalence and parasitic abundance are shown in the current finding are in closeassociation with the report of (Pathak and pal, 2008), reported that unlike most of the state of India, where three seasons like summer, rainy and winter have been observed. In that respect, over all the highest prevalence was recorded during rainy season (65.45%) followed by cool season (37.66%), summer season (36.48%) and cold season (25.80%).Similarly (Dorny et., 1995) observed that highest prevalence of gastrointestinal parasite during rainy season as observed in present study although supported by other workers, but this agroclimatic region has more time period for rainy season and thus need special care to monitor

and control gastrointestinal parasitism in goats, in comparison to other parts of the country. Similar to the present finding, maximum eggs count in wettest period of the year have been observed. (Sharma etal.,2009) who reported that seasonal prevalence of gastrointestinal parasitic infection in goats as highest in monsoon (94.60%), moderate in summer (87.50%) and lowest in winter(63.15%) with overall prevalence of 85.22%.Earlier workersShahiduzzaman et al. (2003) who reported highest prevalence in the month of July (84.42%) followed by June (72.58%) and October (72.41%). Whereas, the lowest prevalence of haemonchosis was found 46.15% in the month of January. The prevalence of infection relates to the humidity during the study period, which also followed an increasing pattern from April to August (72% to 88%) and then gradually decreased from September to March (87% to 65%). The findings of the study are also in coherent with the findings of Enyenihi et al. (1975) who reported that optimal conditions (hot and humid climate) are really helpful in the development of parasites. These variations in the findings with the earlier report might be due to the differences in sample size, species variation and also in the difference in the climatic condition of the study area. Our finding is not correlate with (Tariq *et al.,*2010) who observed that in temperate agroclimatic zone of India, maximum gastrointestinal infection has been observed during summer season and *H. contortus* has been recorded as highest prevalent species

Table no. 1: Seasonal prevalence Of *Haemonchus species* in sheep and goats.

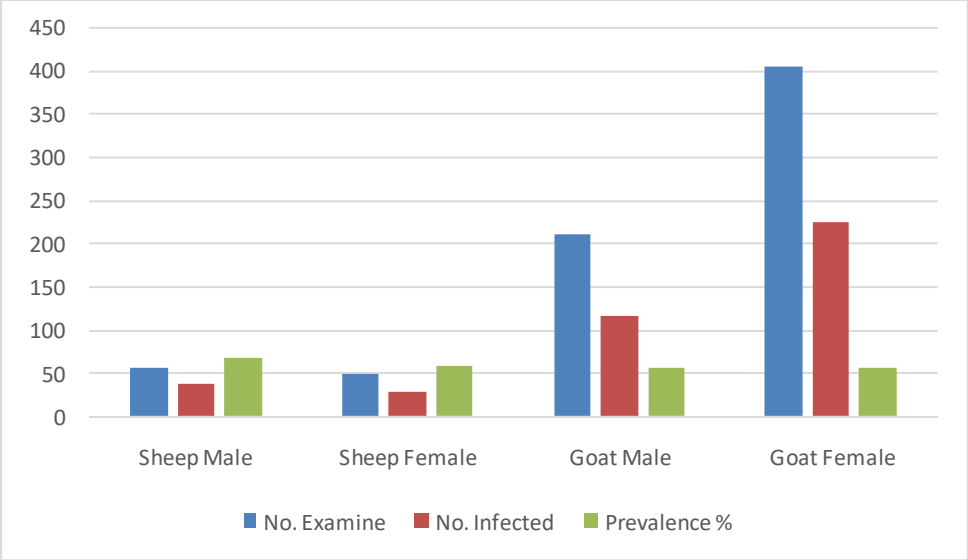
Season	No. Examined	No. Infected	Prevalence %
Monsoon	370	280	75.67
Winter	134	56	41.79
Summer	216	140	64.81



Sex- wise seasonal Prevalence of *Haemonchus species* in sheep and goat: According to our analysis male shows high prevalence (67.85%) as compared to female sheep (57.14%); whereas there are no moredifferencesinprevalence between male and female goats i.e in male (55.23%) and in female (55.80%) inTable no.2 .Our findings were closely related to those of previous researchers have observed higher rate of haemonchus infection in male hosts compared with female sheep by different researchers. The result of present study is supported by Iqbal *et al.,* (1993) Maqsood *et al.,* (1996), Hussain *et al.,* (1996) Mandonnet *et al.,* (2003) and Vanimisetti (2003), similarly Courtney *et al.,* (1984) observed that male sheep appear to be more susceptible to parasitic infections when compared to female sheep. Similarly, Barger (1993) and Bilbo and Nelson (2001) reportedthat such differential prevalence of gastrointestinal nematodes in sheep may be due to stimulatory effects of oestrogen and inhibitory effect of androgens on immune responses. The same factor could be responsible for the higher prevalence of *H. controtus*in male then female sheep during the present study. Our finding is not corelate with Asanji and Williams, (1987); Pal and Qayyum, (1992); Maqsood *et al.,* (1996); komoin *et al.,* (1999) velcarcel and Romero, (1999) gaulyet *al.,* (2006) reported that the rate of infection was higher (74.6%) in female then male (59.1%) sheep.

Table no. 2: Sex -wise seasonal Prevalence of *Haemonchus species* in Goat and Sheep

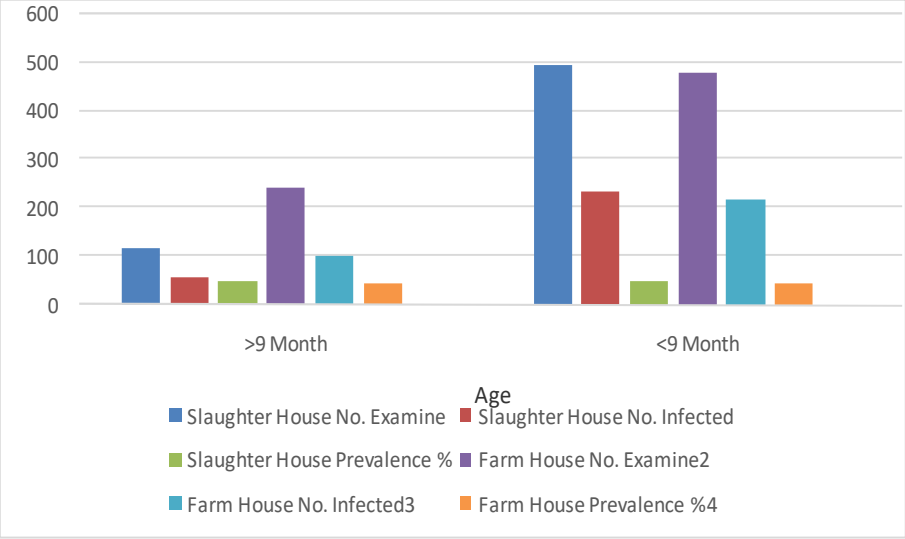
Host	Sex	No. Examined	No. Infected	Prevalence %
Sheep	Male	56	38	67.85
	Female	49	28	57.14
Goat	Male	210	116	55.23
	Female	405	226	55.80



Age wise seasonal prevalence of *Haemonchus species*: -According toour analysis age –wise seasonal prevalence there were no more difference between in slaughter goats> 9 month of age i.e (45.85%) and < 9 month of age i.e (45.20%) and in case of farm house goat >9 month of age i.e (47.45%) and < 9 month of age i.e (47.28%) because of lack of cleanliness, poor management practices and less awareness about deworming.These results are not closely related to the findings of Assoku, (1981); Gibbs, (1986); Asanji & Williams, (1987); Pal & Qayyum, (1992); Maqsood *et al.,* (1996); Vlasoff *et al.,* (2001); Magona and Musisi, (2002); Vanimisetti *et al.,* (2004); Lateef *et al.,* (2005). similarly, Maqsood *et al.,* (1996) reported that the prevalence of haemonchosis was higher in both sheep and goats less than two years of age (67.1%; 47.8%) compared with those of above two years (40.4%; 33.3%). Worm burden was higher in sheep as compared with goats. It was recognized that sheep below 9 months of age are more susceptible to parasite infection than above 9 months of age, similarly Gamble and Zajac, (1992); Watson *et al.,* (1994); Colditz *et al.,* (1996). Observed thatthis may be due to the fact that with the advancement of age, vigour of the animal become better and they develop resistance against the parasitic diseases (Silverman & Patterson, 1960). Observe the results of the present study are in line with the above-mentioned workers.

Table no. 3: age wise seasonal prevalence of *Haemonchus species*

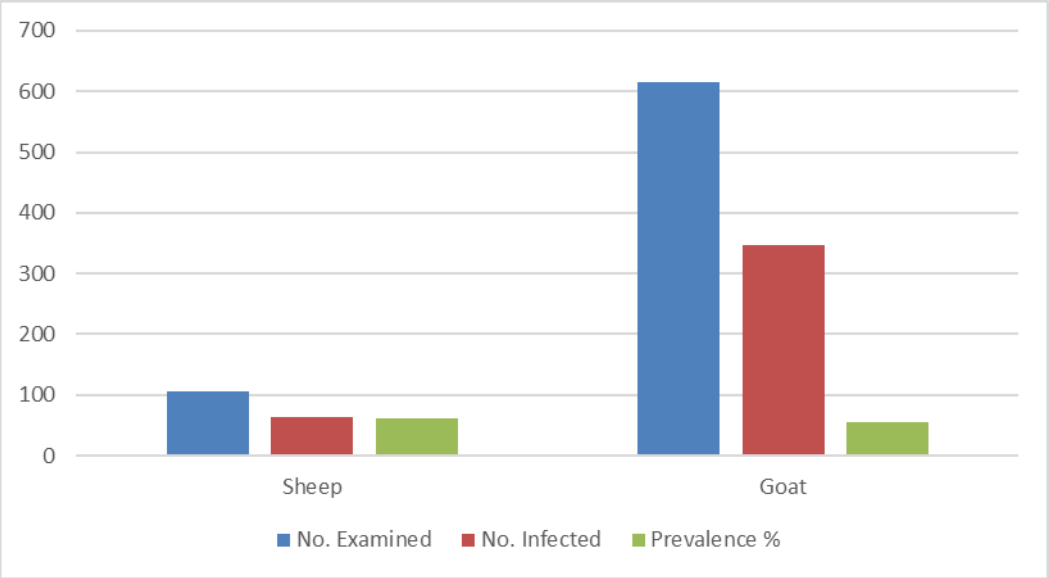
Age	Slaughter House Goats			Farm House Goats		
	No. Examine	No. Infected	Prevalence %	No. Examine	No. Infected	Prevalence %
>9 Month	118	56	47.45	240	101	45.85
<9 Month	497	235	47.28	480	217	45.20

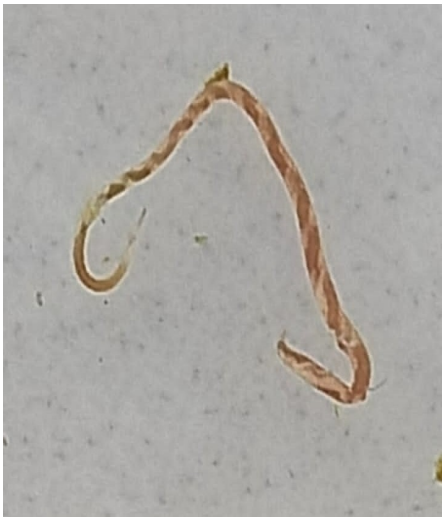


Host-wise Prevalence of *Haemonchusspecies*: According to our analysis host wise prevalence of Haemonchus species in sheep shows high prevalence (60.95%) as compared to goat (55.36%) for this no of factor is responsible like ground grazing habit of sheep, live in flocks and less cleanliness. Similarly, our result is corelate with previous workers (Riche et at.,1973; Suh *et al.,* 1980; Javed *et al.,*1992). Observed that the highest Haemonchosis in sheep then goat may be attributed to variety of factor like ground grazing habit of sheep, relatively less cleanliness and extensive pasture grazing compared with goats.

Table no. 4: Hostwise prevalence of *Haemonchus species*

Host	No. Examine	No. Infected	Prevalence %
Sheep	105	64	60.95
Goat	615	346	55.36





CONCLUSION:

The highest prevalence of *Haemonchuscontortus* were recorded in the monsoon i.e. 75.67%, whereas the prevalence was lowest in the winter season i.e.41.79%. The median range of prevalence was noted in the summer i.e. 64.81%. In the above study it was observed that the prevalence of *Haemonchuscontorts*was recorded highest in the monsoon season and lowest in the winter season. because of suitable climatic condition and environment factor. Age and sex wise *Haemonchuscontortus* infection examined, female host were more prevalence 47.91% then Male host 37.5% that such highest prevalence of gastrointestinal nematodes in sheep may be due to stimulatory effects of estrogen and inhibitory effect of androgens on immune responses. age- wise, there were no more differences in case of slaughter house goats they were near about similar, i.e., > 9 months of age (47.55%), and< 9 months of age (47.28%) similarly in case of farm house goat., > 9 months of age (45.85%), and< 9 months of age (45.20%) because of lack of cleanliness, poor management practices and less awareness about deworming. Host wise highest prevalence of *Haemonchuscontrotus* were recorded in sheep i.e 60.95% ascompared to goat i.e 55.36% due to variety of factor is responsible like ground grazing habit of sheep, live in flocks and less cleanliness.

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Beyond the Diagnosis: Exploring the Social and Psychological Impacts of PCOS on Individuals.

Vanita Chavhan
Research Scholar, Department of Zoology
Amolakchand Mahavidyalaya,Yavatmal - 445001 [M.S.] India.
And
Sunita Gupta
Professor, Department of Zoology
Amolakchand Mahavidyalaya, Yavatmal - 445001(M.S.), India.

Abstract:

Polycystic ovarian syndrome (PCOS) heightens the risk of significant problems in females. Approximately 10-15 % of females have significant issues related to infertility and irregularities in their menstrual periods. Polycystic ovarian syndrome- a multifactorial reproductive, metabolic and hormonal affecting an increasing number of Adolescent girls and women between puberty and menopause. It is Called 'Syndrome' because it refers to multiple symptoms experienced simultaneously. It's first observed by 'stein-Leventhal' so known as 'stein-Leventhal syndrome'. Commonly caused by multiple factors like irregular periods which further may leads to infertility and complications during pregnancy. Excess male hormone Androgen, in severe cases leads to hirsutism. Along with some metabolic complications like insulin resistance 12% leads to diabetes type 2, Obesity and infertility. all above issues impacts the quality of life like Social and mental Wellbeing, which may increase the risk of anxiety and

depression with low self-esteem and social glitch. this study Indicates into the intricate landscape of PCOS and its prevalence among adolescent girls and women of reproductive age post reproductive age. Through a comprehensive review of existing literature, community surveys, this study aims to elucidate the burgeoning rates, phenotypic variations, and socio-demographic factors influencing and its adverse Social and Psychological Impacts among Individuals with PCOS.

Keywords: PCOS, hirsutism, Obesity, acne vulgaris, Anxiety.

1. Introduction:

Polycystic ovarian syndrome is a complex endocrine syndrome which is characterized by hormonal imbalance, Excess Androgens, ovarian dysfunction and metabolic issues that impacts multiple factors like cardiovascular issues, reproductive and mental wellbeing. Particularly during their reproductive age, Yavatmal city of Maharashtra serves the geographical area focused for this purpose to address the limited knowledge on PCOS prevalence in this region. There is no exact known cause of PCOS. Although it is believed to be linked to lifestyle and genetics. The majority of individuals lead to Various symptoms such as, Excess Androgens, Irregular menstrual cycles,

polycystic ovary - where the ovaries develop numerous small cysts. PCOS can manifest differently from person to person, but common symptoms include:

1. **Hormonal imbalance:**

The principle clinical symptoms include irregularity in menses, absence of menses leads to infertility other Common Symptom is acne due to increased Androgens, which leads to symptoms like hirsutism an excessive hair growth on the face, chest and neck. which also leads to androgenic alopecia a severe hair loss from scalp in some individuals. also causes acne due to excess oil production.

2. Irregular Menstrual cycle:

lack of regular menses shows cysts in the ovaries on ultrasound imaging and can be cause of infertility OR gives difficulty in conceiving, in severe cases leads to endometrial cancer. Acanthosis nigricans a condition show Patches of darkened skin on the back of the neck, understand arms and into the groin area.

3. **Metabolic risk** - This complex endocrine syndrome includes compensated insulin resistance, disrupted carbohydrate metabolism that leads to diabetes type 2 and obesity. This weight gain tendency causes cardiovascular issues which shows increased cholesterol levels in blood. Imbalanced body mass index (BMI) causes all above long term effects with elevated potential risk of cardiovascular diseases.

4. Mental health:

PCOS is associated with an increased potential risk of diagnosis of anxiety, mood swings, bipolar disorder and obsessive-compulsive disorder along with poor body image, dissatisfaction of one's body, sadness all because of increased levels of cortisol and DHEA due to hormonal and metabolic complications.

2. Definition of PCOS for prevalence:

Polycystic ovarian syndrome (PCOS) is a snagging multifactorial hormonal syndrome among people assigned female at birth, characterized by irregularity in menses, excess male hormone Androgen level, typically manifesting during puberty and the presence of small cysts in the ovaries. The prevalence of PCOS among adolescent girls is challenging to determine precisely but it is estimated to affect approximately 10-15% of this population during their reproductive phase.

3. Objective:

To Explore the Social and Psychological Impacts of PCOS on Individuals, Adolescents in Yavatmal city, Maharashtra and its Complications with respect to the clinical findings and its diverse range.

4. Methodology:

This Mismatched survey study conducted in Various educational institutions like Coaching classes, Engineering college and girl's hostel and fitness center in Yavatmal city focused at

Appraise Clinical and physical features dataset which contains 500 adolescent girls.

Inclusion criteria include 14-23 years old; this study used a confidential polycystic ovarian syndrome questionnaire (PCOSQ) which includes a general health-related question like history with Socio-demographic information and clinical implications like lifestyle, hormonal imbalance and menstruation data. Metabolic risk factors like glucose intolerance, increased insulin, diabetes, acne and hirsutism with androgenic alopecia, obesity and endometrial complications. PCOS is the main cause of effective infertility at reproductive age and associated with obesity in most of the cases.the affected individual encounters insulin resistance compensated by hyperinsulinemia in 6%.the prevalence of PCOS among
Adolescents girls in Yavatmal city is about 7%.hyperandrogenism,acne and are considered Due to increased androgen level in blood.the clinical symptoms of hirsutism which is lethal implication in PCOS shows increased growth of terminal hairs in the androgen dependent parts of the body.surv Survey shows that some individuals have Acanthosis nigricans a darkened skin patches on the neck,groin area and underarms. Most of the individuals may have only one OR two clinical symptoms and in severe cases have multiple. The most
common clinical finding is menstrual disorder usually started from menarche and may appear in the form of amenorrhea (Absence of menses), oligomenorrhea (Frequent menses), and polymenorrhea (Abnormally Frequent menses) and might even being normal ovulation
combines with other complications hence it is called as a multifactorial complicated
condition, there is no single criteria for the diagnosis of this syndrome.acne was observed called acne vulgaris. Prevalence of Polycystic Ovarian Syndrome also impacts individuals
mental health with all the above complications the adolescents face social Gauche with own body dissatisfaction result in low self esteem and aggressiveness irritability, temper,sadness and ego-resiliency with anxiety and depression all causes because of polycystic ovarian
syndrome. All above data is a foremost Consideration for preventive healthcare measures associated with PCOS.

5. **Discussion** - principle findings.

The findings of this study suggest that Adolescent girls with PCOS have a higher chances of prevalence of metabolic complications with a cardiovascular risk and infertility due to irregularities of menses due to imbalanced hormones and disturbed lifestyle as compared to general Adolescent girls. Due to hormonal imbalance the interrupted carbohydrate metabolism leads to excess blood sugar and damaged glucose intolerance with insulin resistance compensated by hyperinsulinemia,which is mainly responsible for obesity.In recent years the prevalence of PCOS in young Adolescent females is mainly due to transforming lifestyle changes. This survey suggests that adolescents with PCOS may be at an increased risk for anxiety symptoms that give them moodiness,anger issues and disbalanced behaviour. It leaves adolescents With low confidence and worry for future health related challenges.

There is a limited source of data in the literature Unveiling prevalence of

PCOS.Understanding the wide range of polycystic ovarian syndrome manifestations and complications in this women population will help in measuring effective preventive and therapeutic interventions. The discussion will encompass the socio-demographic and socio-economic Determinants, potential risk factors and implications for public health policies.

6. Result:

The study reveals a burgeoning rate of prevalence of PCOS among adolescent girls with a higher possibility of metabolic complications, abnormalities in menstruation which leads to infertility and serious issues like diabetes Type 2 and cardiovascular problems. The adolescent girls had inadequate information and less awareness about PCOS. To overcome such lethal effects of PCOS and to improve the quality of life, individuals need knowledge and understanding of it which can be highly possible by setting specific and essential health-related strategies like structured teaching programmes by conducting Awareness Seminars and workshops can be useful. Enhancing awareness information by using social networks,and Creating awareness programmes in every educational institution can help to understand and deal with PCOS.

7. Table: Total individuals surveyed 500.

PCOS	35 (7%)
Obesity	50 (10%)
Hyperandrogenism	27 (5%)
Hyperinsulinemia	30 (6%)
Insulin resistance	25 (5%)
Acanthosis nigricans	25 (5%)

8. **Conclusion** :

This Research contributes to the growing body of knowledge and awareness of polycystic ovarian syndrome by shedding light on its prevalence among adolescent girls in Yavatmal city of Maharashtra. The outcomes will Inform healthcare professionals and educators to develop targeted strategies significantly for early detection and diagnosis and prevention.

This will help in managing hormonal fluctuations effectively with polycystic ovarian syndrome in this specific demographic,ultimately fostering better reproductive and metabolic health outcomes for individuals with PCOS.

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Water Quality Analysis of Koradi Dam, Mehkar, Dist. Buldhana (M.S.), India

Tanpure O. G.
Department of Zoology,
Smt. Sindhutai Jadhav Arts and Science College, Mehkar
And
Rathod S. D.
P. G. and Research Department of Zoology, R. A. College, Washim

ABSTRACT

It is very crucial in understanding the quality and characteristics of water bodies and environmental samples. This study aimed to analyze the physicochemical parameters of Koradi Dam to assess its suitability for various uses. Koradi dam is one of the fresh water resources present in Buldhana district. Resources for fresh water like lakes, dam, stream, reservoir, rivers etc. are majorly used for the purpose of drinking, irrigation, to many villages, and also to good source of fishery. This study is an initial attempt to assess the Koradi Dam water quality. Several physical and chemical characteristics were examined for five months (August to December 2023) in order to assess the health of the water. The current study's findings demonstrate that every metric fell within the WHO-recommended standard range. It is recommended that the water be kept in the reservoir for its sustainability.

Keywords: Koradi, Dam, reservoirs, Mehkar, limnology.

INTRODUCTION:

In the recent years environmental monitoring through regular assessment of water quality has become a factor in the exploitation or conservation of aquatic resources. Water is the most vital abiotic component and is unique in many respects. In precipitation it becomes a mixture and acts as abiotic component of aquatic ecosystems. Water quality thus at a given time and space acts as a limiting factor that, in turn, regulate biotic diversity and biomass, energy, material cycle, tropic levels and rate of succession. A water quality assessment generally involves analysis of physicochemical, biological and morphological parameter and reflects on abiotic and biotic status of the ecosystem. This, in turn, helps in planning exploitation, antipollution or conservation strategies. Further, due to their open nature a constant exchange of matter and energy goes on between ecosystems and its surroundings thus making water quality a dynamic entity. That is why water quality assessment is a continuous process undertaken on a regular basis. **Manjare *et al.*, (2010)** studied the physico – chemical parameters of Tamadalge water tank in Kolhapur District of Maharashtra.Assessmentinfluences the pollution and overall conservation of ecosystem. It shows anomalous behavior due to the presence maximum organic and inorganic compounds in it **Dohare *et al.* (2014).**

Various researchers studied the physicochemical properties of water and the seasonal

variation in physicochemical parameters was checked by **Muniyan *et al.* (2011)**. The physico-chemical parameters of water were also analyzed by **Patil *et al.* (*2012)***. The Physico-chemical analysis of surface and ground water was investigated by **Mahananda *et al.* (2010),** at Baragrahdistrict Orissa, India Kalra.The parameters studied by **Meitei *et al.* (2004)** that shows pollution trend increases due to discharge of sewage and anthropogenic activities. The analysis of physico-chemical parameters of the Nkam river for establishing the diagnosis of its water was done by **Togue *et al.* (2017)**.

MATERIALS AND METHODS

Current investigation is done on four different sampling sites viz. S1, S2, S3, and S4, water sample were collected from respective sampling sites of Koradi Dam. In which selected Physico-chemical parameters were analyzedthat includes, Color, Temperature, pH, TDS, EC, DO, CO2, CO3, HCO3, Salinity, Chloride, Total Hardness and Calcium Hardness. The standard method of Clecset *et al.,* (1998, 2006, and 2008) in APHA was used for analysis.

Site Description: KoradiDam

Koradi Dam was created as a result of construction of Koradi Dam of Koradi Irrigation Project. Official Designation of the The Project is " Koradi D - 01436". Locally this is also known as " Koradi Talav" or " Koradi Lake". Koradi Project was constructed as part of irrigation projects by the Government of Maharashtra the year 1979. Nearest city to dam is Mehkar and the Dam is situated in Mehkar Taluka of Buldana District of Maharashtra. Koradi Project is built on and impounds Koradi River. The Dam is an Earth-fill Gravity Dam. Purpose of the Project is for irrigation and also farmer and fisherman depends on respective waterbody. Length of the Dam is 900 m (2952.76 Feet). while the height of the dam above lowest foundation is 19.31 m (63.35 Feet). Detailed information about project spillway is not available. Spillway length is not known. However measured length of the spillway is 137 m (451 Feet). Spillway appears to be of other type and ungated. Catchment area of KoradiReservoir is not known. Maximum / Gross storage capacity of Koradi Reservoir is 22.5 MCM. Live storage capacity is 15.12 MCM. Now a days almost all the water bodies make for good picnic spots, Koradi lake is also a popular Tourist attraction for its scenic beauty.

Satellite View of Koradi Dam

Showing Sampling Site

RESULT AND DISCUSSION:

The physico-chemical characteristics of the Koradi Dam in Buldhana District of Maharashtra state were examined. Table I displays the mean and standard deviation values for every physico-chemical parameter of the water sample that was taken from sampling locations S1, S2, S3, and S4.

Table No I: Physico-Chemical Parameters Mean and Standard Deviation.

Physicochemical parameters	Mean and Standard Deviation
pH	7.5±0
Temperature	25.75±0.37
Electrical Conductivity	190.37±0.24
TDS	172.37±0.92
Dissolved Oxygen (DO)	4.38±0.61
Free Carbon Dioxide (CO_2)	Absent
Carbonate (CO_3)	203±19.55
Bicarbonate (HCO_3)	156.3±10.74
Total Hardness	263.6±73.24
Calcium Hardness	111.51±0.43
Magnesium Hardness	189.81±12.95
Chloride	91.344±10.19
Salinity	167.03±17.72

1) **Colour:** One distinctive feature of lake water is coloration, which allows us to estimate the number of phytoplankton and zooplankton in the lake as well as assess its quality. Over the course of the research, the color of the KoradiDam water did not show any change.
2) **pH**: Since most biological processes and biochemical reactions depend on pH, It is an essential physical parameter. The most important factor in figuring out how corrosive water is its pH value; the higher the pH, the more corrosive the water. The pH was measured and found to be 8.25±6.92, the highest value in five months due to seasonal swings. Table I displays the seasonal variations in the pH of Koradi Dam.
3) **Temperature:** The water's temperature has a significant impact on the chemistry and metabolic reactions that occur within the organisms. Since it controls the succession of dominating algae, bacteria, and other aquatic species, it is a crucial component of aerobic habitats in aquatic systems. The highest temperature recorded in the current study was 26.816±25.184 at Koradi Dam. **Verma *et al.*, (2015)** reported values that were comparable.
4) **Electrical Conductivity:** The amount of electric current that a solution can transport is measured by its electrical conductivity (EC). The concentration of ionic or soluble salts in soils, water sources, fertilizer solutions, and chemical solutions can be rapidly estimated using electrical conductivity. The current study found that Koradi Dam had the highest conductivity at 191.20±189.29.
5) **TDS:** The many types of minerals that are present in the water are mostly indicated by total

dissolved solids. The presence of dissolved solids is a crucial component of drinking water. The investigation found that Koradi Damhas the highest TDS at 173.95±170.54.

6) **Dissolved oxygen:** Dissolved oxygen had a maximum value of 5.095±4.905. August and December were found to have the highest and lowest values of dissolved oxygen, respectively. The current study's findings were discovered to be comparable to those of **H. R. Abhilash and M. Mahadevaswamy (2022)**

7) **CO3 (Carbonate phenolphthalein alkalinity):** The maximum value of Carbonate was found in month of October (243.14±195.85) and the minimum value of Carbonate was found in December (194.14±144.08).

8) **Bicarbonate:** During the present study the bicarbonate was observed lowest at Koradi Dam (150.91±144.08) in December while the highest average value was observed (178.82±171.17) in October.

9) **Chloride:** Chloride anions are abundantly present in waste water. The maximum (120.29±88.85) and minimum (20.495±15.645) value of chloride was observed in the month of November and October respectively.

10) **Salinity**: The maximum value of salinity was found in the month of November 217.22±160.34 and the minimum value was found to be in the month of December151.20±130.34.

11) **Total hardness:** During the present analysis the maximum value of total hardness of Koradi Damwas found to be 316.32±283.67 mg/l. The maximum value of hardness was found to be in month of August and the minimum value 138.29±127.70 of hardness was found in the month of august. The current study was supported by **Mahor (2011)** studied limnology of fresh water reservoir Tighra, Gwalior.

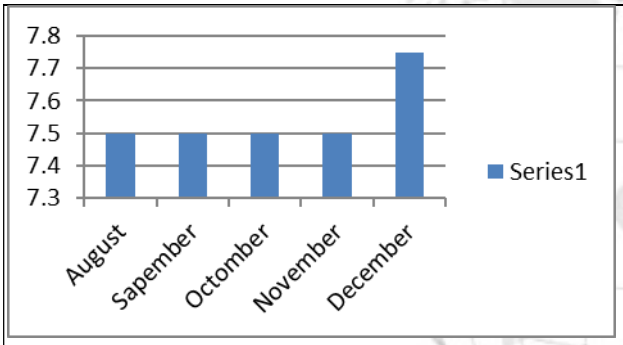
12) **Calcium hardness**: The same value of calcium hardness of Koradi Damwas found to be in the month of October and November 112.29±111.64 while the lowest value was found to be in the month of December111.70±109.79.

13) **Magnesium:** The magnesium is also an important parameter of water which shows the water quality. The minimum and maximum value of magnesium was found to be 206.42±172.11 and 26.54±15.49 respectively.

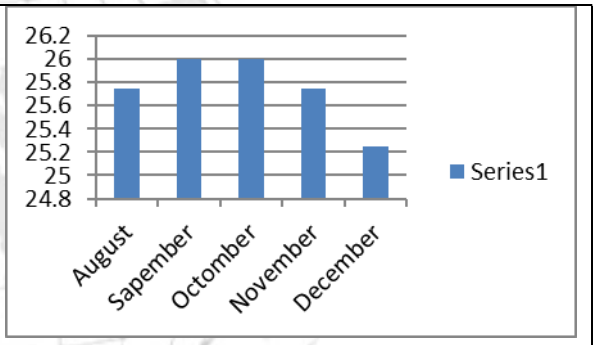
Month:	August	September	October	November	December
Colure	Olive Green	Olive Green	Olive Green	Olive Green	Olive Green
pH	7.5	7.5	7.5	7.5	7.75
Temperature	25.75	26	26	25.75	25.25
Electrical Conductivity	190.5	190.5	190.6	190.25	190
TDS	171.75	171.25	173.3	173.35	172.25
DO	5	4.9	4.5	3.9	3.6

CO2	Absent	Absent	Absent	Absent	Absent
Carbonate	190	220	215	215	175
Bicarbonate	153	154	175	152	147.5
Total Hardness	300	304	133	291	290
Calcium Hardness	110.75	111.5	111.97	111.97	111.4
Magnesium Hardness	189	192.5	21.02	178.01	179.38
Chloride	92.17	97.48	85.	104	77.99
Salinity	166.39	175.99	163.20	188.78	140.79

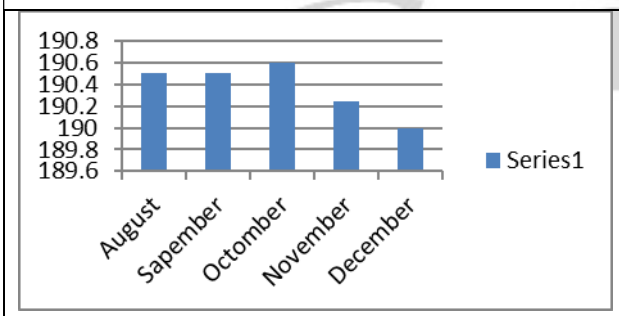
Graph Plate I: Monthly Variations of Physico-Chemical Parameters of Kodari Dam



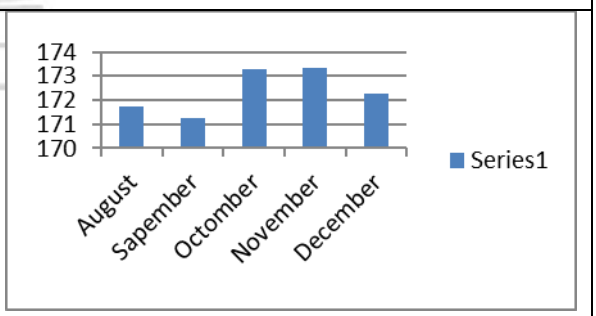
Monthly changes in pH from four sampling sites.



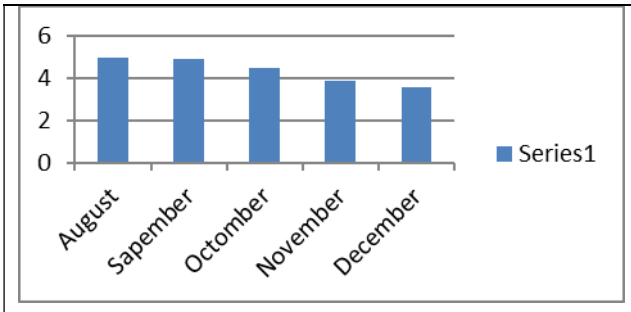
Monthly changes in Temperature from four sampling sites.



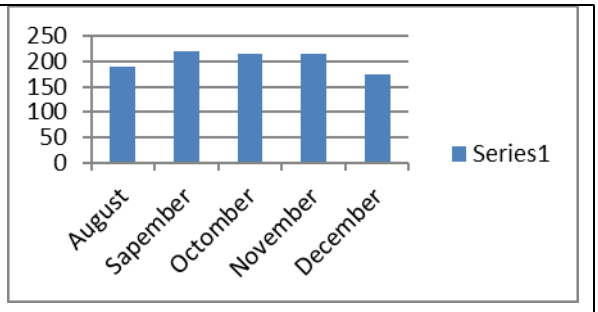
Monthly changes in Electrical conductivity from four sampling sites.



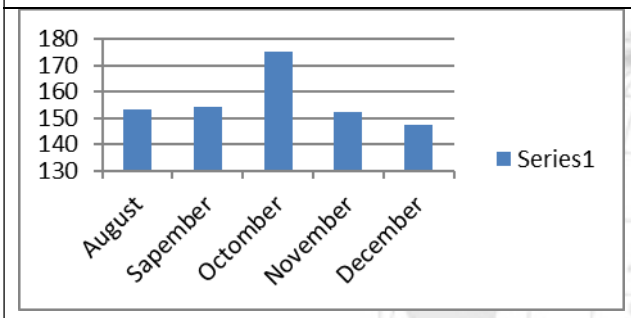
Monthlychanges in TDS from four sampling sites.



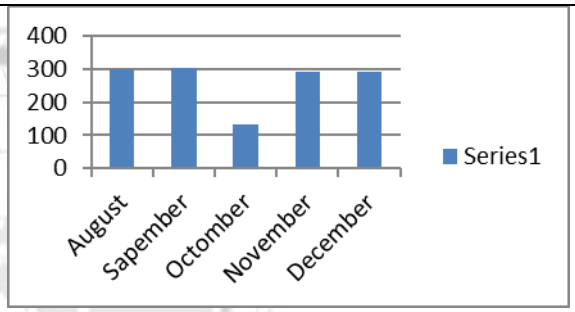
Monthly changes in DO from four sampling sites.



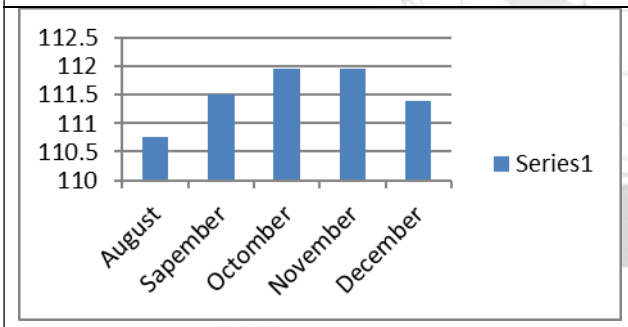
Monthly changes in Carbonate from four sampling sites.



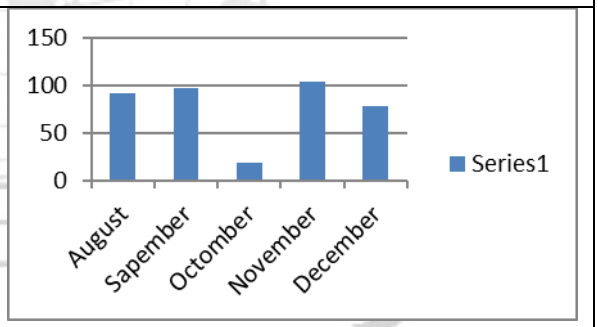
Monthlychanges in Bicarbonate from four sampling sites.



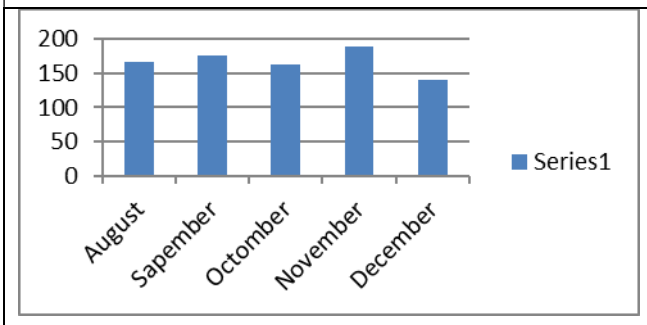
Monthlychanges in Total Hardness from four sampling sites.



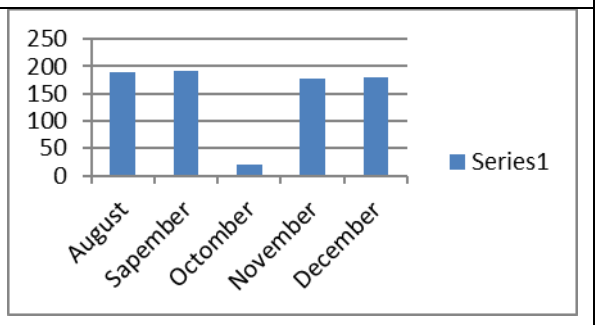
Monthlychanges in Calcium Hardness from four sampling sites.



Monthlychanges in Chloride from four sampling sites.



Monthlychanges in Salinity from four sampling sites.



Monthly changes in Magnesium from four sampling sites.

CONCLUSION

The present study was carried out on Koradi Dam, Dist. Buldhana for the period of five months (August to December). The water of Koradi Dam is used for drinking, irrigation and for other domestic purposes and that's why it is important to monitor the water health of the dam water. The various parameters like Colour, pH, Temperature, TDS, Electrical conductivity, Dissolved oxygen, carbon dioxide, Carbonate, Bicarbonate, Total hardness, Calcium, Magnesium, Chloride, Salinity were analyzed. According to WHO standard values the water was found to be potable. On the basis of results of present study, it could be concluded that most of the parameters were within the permissible limit so the water of Koradi reservoir was in good state but for the better understanding of Koradi Dam we recommend a long-term study covering all aspects of water ecosystem.

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A Novel Study of *Cissusquadrangularis* Stem and Leaves on Mounting Behavior in Male Albino Rats

Shital. R. Pare
Department of Zoology,
Shri R.R. Lahoti Science College, Morshi, 444905.

ABSTRACT

In this study, we observed the aphrodisiac activity of aqueous, chloroform and alcohol extractofCissus quadrangularisstem and leaves in male albino rats. The mounting behavior were studied in male albino rat of control and experimental groups and compared with those administered with the standard reference drug Sildenafil citrate. Clinical toxicity symptoms such as respiratory distress, salivation, weight loss and change in appearance of hair as well as maternal mortality were not observed at any period of the experiment. The aqueous extract at the dose of 500 mg/ kg body weight had a pronounced effect on themounting behavior.

Keywords: Aphrodisiac, mounting behavior, Cissus quadrangularis, Male albino rat, stem and leaves.

INTRODUCTION

Sexual relationships are among the most important social and biological relationships in human life. Sexual health is an important component of an individual's quality of life and well-being [1]. For life to continue, an organism must reproduce itself before it dies, one of the main aims of marriage is procreation (reproduction) and more importantly for sexual fulfilment of both partners. Enhanced sexual behavior may provide increased relationship satisfaction and self esteem in humans. Aphrodisiac have been of great interest to humans since the beginning of time. An aphrodisiac is defined as an agent (food or drug) that arouses or increases sexual desire.

Male impotence or erectile dysfunction (ED) is a significant problem that may contribute to infertility [2]. There has been a worldwide increase in the incidence of ED, probably due to aging populations and other risk factors such as the presence of chronic illnesses (e.g. heart disease, hypertension, and diabetes mellitus), smoking, stress, alcohol, drug abuse and sedentary lifestyles. ED is defined as the consistent inability to achieve an erection sufficient for the purpose of satisfactory sexual intercourse, or the inability to ejaculate, or both [3]. Management therapies include the use of psychotherapy, vacuum devices, surgery, penile implants and drugs [4]. Some of these are too expensive and not easily affordable.

Plants have played a significant role in maintaining human health and improving the quality of human life for thousands of years and have served humans as valuable components of medicines, seasonings, beverages, cosmetics and dyes. [5,6]. For centuries, Arabs have made use of herbal drugs to improve sexual performance and increase libido[7]. In African traditional medicine, especially in Cameroon, *Zingiber officinale* and *Pentadiplan-drabrazzeana* are used as

aphrodisiac and male sexual stimulation [8]. Substances often used as aphrodisiac cross the blood brain barrier and mimic or stimulate some area of sexual arousal in the central nervous system. Some nutritional foods improve the well being of the individual and consequently improve sexual performance and libido. [9].

Cissus quadrangularis belongs to the genus *Cissus* of the family Vitaceae.*Cissus quadrangularis* is a rambling shrub of approximately 1.5 cm in height. Alcoholic extract of the plant is reported to be locally as well as intramuscularly facilitating rapid healing of fracture in albino rats [10]. Methanol extract (90%) and dichloromethane extract of *C. quadrangularis* stem possess antibacterial activity against *S. aureus, E. coli,* and *P. aeruginosa* and mutagenicity against *Salmonella microsome* [11-13]. The alcoholic extract of aerial part was found to possess antiprotozoal activity against *Entamoeba histolytica* [13]. Alcoholic extract of the stem showed activity against *E. coli* [14]. However the validity of the tribal claimed aphrodisiac activity of *Cissus quadrangularis* has not been proven scientifically. Hence this study was carried out to provide scientific support for its purported folkloric usage.

MATERIAL AND METHOD

Collection of plant material

The plant *Cissus quadrangularis* wascollected from Melghat region, identified and authenticated by experts from Botanical Survey of India, Pune, where a voucher specimen with herbarium accession number (SHPACIQ7) was deposited.

Animal Stock

Healthy wistar male and female albino rats of approximately 8 weeks of age and weighing 100-160 gm were purchased from Sudhakarrao Naik Institute of Pharmacy, Pusad. They were housed in a polypropylene cages, maintained at a temperature of approximately 25 ± 2 $^{\circ}$C. and a photoperiod of 12 h light and 12 h dark cycle. The animals were provided with standard pelleted diet (Trimurti Lab Feeds, Nagpur) and water *ad libitum*. They were allowed a 15 days acclimatization period before the experimental session. All the experimental protocols were met with the approval of institutional Animal Ethics Committee with registration number (1060/ac/07/CPCSEA (IAEC/01/2009).

Preparation of plant extract

The stem and leaves of *Cissus quadrangularis* were collected, shade dried, cut into pieces, pulverized using an electric blender and subjected to soxhlet extraction for 24 h with distilled water (60 $^{\circ}$C), chloroform (20 $^{\circ}$C) and alcohol (20 $^{\circ}$C). The extract was evaporated to near dryness on a water bath, weighed and stored at 4°c in refrigerator until the experimental testing.

Preparation of test samples

Aqueous, chloroform and alcohol extract was suspended in 5 ml/kg of distilled water or olive oil (Figaro- refined olive oil, Spain)and administered orally. Sildenafil citrate suspension was prepared by crushing a tablet of Sildenafil citrate and administered orally at a dose of 5ml/kg in distilled water. (Caverta -Sildenafil citrate IP-50mg Ranbaxy, Sirmour, India).

Treatment

The male rats were randomized into five groups comprising of 6 animals each. The reconstituted aqueous, chloroform and alcohol extract was administered orally using intragastric (ig) soft rubber catheter to all animals in different groups for 1 day at the doses given below.

Group I- administered with distilled water (5 ml/kg) served as control.

Group II- administered with aqueousextract at the dose of 500 mg/kg body weight (b. w.) in distilled water (5 ml/kg).

Group III-IV- administered with chloroform and alcohol extract at the dose of 500 mg/kg body weight (b. w.) in olive oil (5 ml/kg).Group V- given 5 mg/Kg b. w. of Sildenafil citrate suspension

Phytochemical analysis

Phytochemical screening of the aqueous, chlololform and alcohol extract of *Cissus quadrangularis* stemand leaves showed the presence of alkaloids and saponins, while anthraquinone glycosides, tannins, phenolic compound and steroids were found to be absent [15].

Acute toxicity study

The healthy 60 male albino rats, starved for 3- 4 h, group I was administered with the distilled water (1 ml/rat), group II-X were administered with 1000, 2500 and 5000 mg/kg dose of aqueous, chloroform and alcohol extract and subjected to acute toxicity studies. The rats were observed continuously for 2 h for behavioural, neurological and autonomic profiles and for 24 and 72 h for any lethality or death. No death was observed at highest dose (5000 mg/kg body weight) so its one tenth (500mg/kg) used for studies as per Organization of Economic Co-operation and Development (OECD) 423 guideline [16].

Mounting behaviour test

Mount is operationally defined as the male assuming the copulatory position but failing to achieve intromission. To quantify mounting behaviour, non-oestrous female mice were paired with males treated with the most active dose (500 mg/kg) of the *Cissus quadrangularis* (aqueous, chloroform and alcohol extract). Animals were observed for 3 hrs and their behaviours were scored according to [17]. Males were placed individually in a glass cage, after 15 minutes of acclimatization a non-oestrous female was introduced into the arena. The number of mounts was recorded during a 15 minutes observation period at the start of 1st hr. Then the female was separated for 105 minutes. Again the female was introduced and the number of mounts was observed for 15 minutes as before at 3rd hr. All the experiments were performed between 16.00 to 18.00 pm.

Statistical analysis

The data are expressed as mean±SE. Statistical analysis was done by using paired and unpaired Student's t-test and one way analysis of variance (ANOVA) [18].

RESULT

Phytochemical screening of the aqueous, chlololform and alcohol extract of *Cissus*

quadrangularis stem and leaves showed the presence of alkaloids, steroid and saponins, while anthraquinone glycosides, tannins, and phenolic compound were found to be absent.

Cissus quadrangularis stem and leaves extract produced no toxic symptoms (salivation, weight loss and change in appearance of hair and mortality), similarly no changes in the behavioral, neurological and autonomic profiles were observed up to a oral dose level of 5000 mg/kg body weight in male rats, and hence the drug was considered safe for further aphrodisiac screening. Hence one tenth of this dose i.e. upto 500 mg/kg body weight was used as the maximum dose for aphrodisiac testing.

Mounting behavior

The *Cissus quadrangularis* stem and leaves extract (aqueous, chloroform, alcohol) of treated male rats displayed excessive mounting behavior as compared to control (F=33.06 at P<0.01). (Table- 1).

Table 1: Mounting behavior test of aqueous, chloroform and alcoholic extracts of *Cissus quadrangularis*

Treatment groups	Doses (mg/kg body wt.)	Mounting behavior
Control (Group I)	Vehicle	1.16±0.91
Aqueous extract (Group II)	500	8.16±0.42***
Chloroform extract (Group III)	500	7.83±0.44***
Alcohol extract (Group IV)	500	7.16±0.16***
Sildenafil Citrate (GroupV)	5	5.33±0.20***

P values: ***<0.1, **<0.01, ***<0.001, when compared with control, ns=non significant. Values are mean±S.E. n=6.**

DISSCUSSION

Cissus quadrangularis stem and leaves have been used by the tribals of Melghat region as a sexual stimulator even without any scientific validity. Hence this study was carried to validate scientifically the tribals claim. The study on *Cissus quadrangularis* stem and leaves aqueous, chlololform and alcohol extract (500 mg/kg b.w.) was found to significantly increase the mounting behavior of male rat as compared to control. The root as well as flower of *Argyreia nervosa* treated males displayed excessive mounting behavior as compared to control [19]. The study on the flower of *Vanda teslata*which was found to be stimulating the mounting behavior of male mice[20] , The

tuber of *Gloriosa superba* treated male rats showed extreme mounting behavior as compared to control[21] hence, the present study further supports the folklore use of *Cissus quadrangularis* as an aphrodisiac.

CONCLUSION

In conclusion, the study validates the effectiveness of herb in improving mounting behaviour. The 500 mg/kg dose of aqueous extract shows pronounced effect on mounting frequency ensures the pure libido of the extract.

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Ground Water Resource Management and recommendations of Ralegon Taluka in Yavatmal District

Dr. S. D. Dawada
Department of Zoology, Indira Gandhi Kala Mahavidyalay Ralegaon,
District Yavatmal, 445402 Maharashtra, India

ABSTRACT

Year by year the water is becoming the scare source all over the world. Water resources available on earth are in the two forms namely surface water and ground water. According to the study of scientist the total volume of the ground water is very less as compared to the total water available in the globe. There are many areas in our country that are facing scarcity of water, and this is due to the no proper planning of the ground water development, results in the fall of water levels, drying of wells, etc. Ralegaon is a small village located at distance of 42 Kms from Yavatmal city. It lies between North latitude 20°25'0"and East longitude 78°31'00". Some management and recommendations have been adopted to recharge the ground water resources. Hence it is planned to take such techniques and measures which will direct this extra runoff to ground water storage. The most significant feature of the work is that if such technologies are developed and adopted at larger scale in rural areas, it will prevent thousands of villages of the country from water supply by tankers.

Geographic information system (GIS) an essential tool for watershed planning and management tasks. For the GIS mapping drainage network, topography, flow path of water are to be easily locate. In the Ralegaon some measures and recomndations have been adopted to recharge the ground water resources, but it has been found that these measures don't work with full capacity in some cases. In the Ralegaon watershed area, demand of water for agriculture and drinking purpose is increasing rapidly depleting water resources coupled with overpopulation. Efforts are made to divert large amount of rainwater to recharge ground water resources.

Keywords: Watershed management techniques, ground water storage, Geographic information system

INTRODUCTION:

Various developmental activities over the years have adversely affected the groundwater regime in the Ralegaon. There is a need for scientific planning in development of groundwater under different hydrogeological situation and to evolve effective management practices with involvement of community for better ground water governance. The vagaries of rainfall, inherent heterogeneity & unsustainable nature of basalt aquifers, over exploitation of once copious alluvial aquifers, lack of regulation mechanism has a detrimental effect on ground water scenario of the Country in last decade or so. Thus, prompting the paradigm shift from “traditional groundwater

development concept" to "modern groundwater management concept". Aquifer mapping can be understood as a scientific process wherein a combination of geological, geophysical, hydrological & chemical fields and laboratory analyses are applied to characterize the quantity, quality, and sustainability of ground water in aquifers. Aquifer mapping is expected to improve our understanding of the geological framework of aquifer, their hydrologic characteristics, and water level in aquifer and how they change over time and space and the occurrence of natural and anthropogenic contaminants that affect the portability of groundwater. Varied and diverse hydrogeological settings demand precise and comprehensive mapping of aquifers down to the optimum possible depth at appropriate scale to arrive at the robust and implementable ground water management plans. The proposed management plans will provide the "Road Map" for ensuring sustainable management and equitable distribution of ground water resources, thereby primarily improving drinking water security and irrigation coverage. Thus, the crux of NAQUIM is not merely mapping, but reaching the goal-that of ground water management through community participation. Results of these studies will contribute significantly to resource management tools such as long-term aquifer monitoring network and conceptual and quantitative regional groundwater flow models to be used by planners, policy makers and other stake holders.

APPROACH & METHODOLOGY

Aquifer mapping is an attempt to integrate the geological, geophysical, hydrological & chemical field and laboratory analyses and are applied to characterize the quality, quantity and sustainability of ground water in a quifer. Under the National Aquifer Program, it is proposed to generate Aquifer Mapson1: 50000 scale, which basically aim satcharacterizingtheaquifergeometry, behaviour of ground water levels and status of ground water developmenti nvariousaquifersystemt of acilitateplanningo ftheirsuitable management. The major activities in volved in this process encompass compilation of existingdata, identification of data gaps, generation of data for feeling data gaps and preparation of different aquifer layers. Aquifer mapping is a process wherein a combination of geologic, geophysical, hydrologic and chemical analyses is applied to characterize the quantity, quality and sustainability of ground water in aquifers.

Flow chart: -

Compilation of existing data (Central & State Govt.) → Generation of Different Thematic Layers → Identification of Primary Aquifer → Identification of Data → Gap Data generation (water level, exploration, geophysical, hydro-chemical, hydrogeological etc.) → Aquifer Maps with 3D disposition → Preparation of Aquifer Management Plan.

Study Area:

The Yavatmal district is one of the eleven districts of Vidarbha Region of Maharashtra. It is bounded on east by Yavatmal district, on south by Andhra Pradesh State and Nanded district on

west by Washim and Hingoli districts and on north by Amravati and Wardha districts. Wardha River forms the north eastern boundary of the district. The district lies between 19°26' and 20°42' north latitudes and 77°18' and 79°9' east longitudes. It falls in parts of the Survey of India Toposheet No. 55L, 55I, 56E, 56I, 56M, covering an area of 13582sq. km.

Ralegon is one of Taluka of Yavatmal District, it is located **northwest from Yavatmal.** It is located 42 km away from Yavatmal and 21 km away from the Kalamb which is on Nagpur-Yavatmal Road. And just 41 km from city Wardha. This is a border taluka between Yavatmal district and Wardha Districthavin coordinates 20°25′0″N 78°31′00″E

MATERIAL AND METHOD:

Minor Irrigation Schemes in Ralegon Taluka: -

ZP level	local level	Percolation tank	KT	Storage Bhandara
14	2	28	31	31

Alluvium occurs in patches along the banks of Wardha and Penganga rivers and their major tributaries and consists of clay and silt with lenticular bodies of sand and gravel. In Ralegaon area, it is observed that sand zones are found in the depth range of 20-25 mbgl, while the top 15-16 m is full of clay and silt. Ground water in Alluvium occurs both under unconfined and semi-confined conditions.

GROUND WATER QUALITY

The concentrations of various gases and ions dissolved in water from the atmosphere, soil strata and minerals and rocks with which it comes are the characteristics of water. This ultimately decides the quality of ground water. The concentration of CO32-, CO3-, OH- and H+ ions and dissolved CO2 gases in water decide the acidic or basic nature ofwater while the salts of ions like Ca2+ and Mg2+ in water makes itsoft or hard. Waterwith high Na+ and Cl- concentration can make the water saline. Nitrate ions percolatedfrom anthropogenic sources can become predominant major anion in ground water. The excess fluoride concentration in ground water from fluoride bearing minerals maybe related to the concentration of Ca2+, Na2+ and HCO3- ions present in ground water. Water sampling of Yavatmal district is being done every year from GWM wells during pre-monsoon period (May). A total of 38ground water monitoring wells of CGWB and GSDA have been utilised to decipher the quality scenario for shallow aquifer and 91 exploration wells of CGWB and GSDA have been utilised to decipher the quality scenario for deeper aquifer. Samples were analysed involving use of different instruments such as pH meter, EC meter, Flame Photometer, UV/ Visible Spectrophotometer and Titrimetric methods, for generating the map and to study the spatial variation of ground water quality.

GROUND WATER RELATED ISSUES

Declining Water Levels During pre-monsoon, fall in water level trend has been recorded at

Ralegaon. The major part of the Ralegon region is occupied by basaltic rock formation that inherently consist of limited extent of porous and pervious zone; absence of primary porosity; predominance of secondary porosity that has evolved from prevailing erratic joint pattern, absence of primary porosity and also, low rainfall results in poor sustainability of the aquifers. However, the erratic nature of existing joints/fractures pattern results in highly varying yield capacities of the aquifers in the area. In the area depth of potential aquifers is generally restricted up to 35 m. The potential of the fracture zones reduces substantially below 100 m depth. About 50% of area of the district is having low yield potential.

GROUND WATER MANAGEMENT PLAN:

The management plan has been proposed to manage the ground water resources and to arrest further decline in water levels. The management plan comprises two components namely supply-side management and demand side management. The supply side management is proposed based on surplus surface water availability and the unsaturated thickness of aquifer whereas the demand side management is proposed by use of micro irrigation techniques and change in cropping pattern.

Area feasible and volume available for Artificial Recharge:

The supply side management of ground water resources can be done through the artificial recharge of surplus runoff available within river sub basins and micro watersheds.

Sr.No.	Geographical Area (sq. km.)	Area feasible for recharge (sq. km.)	Unsaturated Volume (MCM
1	760.55	472.94	495.82

Demand Side Management

The Demand Side Management is proposed in areas where the Stage of Ground Water Development is relatively high and adopting micro-irrigation techniques for water intensive crops Sugarcane and cotton or change in cropping pattern or both are required to save water.

Expected Benefits

The impact of groundwater management plans on the groundwater system in the Ralegaon taluka of Yavatmal district after its implementation is evaluated and the outcome shows significant improvement in groundwaters.

CONCLUSION:

The highly diversified occurrence and considerable variations in the availability and utilization of groundwater makes its management a challenging task. Scientific development and management strategy for groundwater has become imperative to avert the looming water crisis. In this context, various issues such as, prioritization of areas for development of groundwater

resources vis-a-vis its availability, augmentation of groundwater through rainwater harvesting and artificial recharge, pricing and sectoral allocation of resources and participation of the stakeholders must be considered. In view of the above, the present study area a systematic, economically sound and politically feasible framework for groundwater management is required. A thorough study was carried out based on data gap analysis, data generated in-house; data acquired from State Govt. departments and GIS maps prepared for various themes. All the available data was brought on GIS platform and an integrated approach was adopted for preparation of block wise aquifer maps and aquifer management plans of Ralegaon taluka in Yavatmal district.

RECOMMENDATIONS

- The interventions discussed above needs to be implemented to bring down the Stage of Ground Water extraction down and put a halt to further decline of ground water levels and improve the sustainability of groundwater resources.
- Land based interventions like construction of lined farm ponds, rehabilitation of existing farm ponds along with horticulture plantation as may be feasible to take on to increase the availability of irrigation water during both kharif (July to October) as well as rabi (October to March) season.
- Sustainable management of the area is required to be taken off to improve the quality and quantity of the groundwater and regular monitoring is therefore recommended.
- The interventions above need to be supported by regulation on extraction from deeper aquifer. So, the deeper ground water resources are protected for future generation and also serve as ground water sanctuary in times of distress/drought.
- In terms of the critical issues for the drinking water such as source sustainability, water quality management and better operation and maintenance, it is important that strong grassroots awareness is generated. Thus, IEC activities and capacity building activities needs to be aggressively propagated to establish the institutional framework for participatory ground water management. Awareness among stakeholders & their participation for ground water recharge and conjunctive use of available resource. Farmers should be trained for adopting more efficient irrigation techniques and water conservation practices and boosting recharge.
- As it is peek time to move to multi-disciplinary approach to save more water viz. Diversification in agriculture (horticulture, vegetables, green houses, agro-forestry, and fodder crops, Diversification of Livelihoods (Agriculture, Animal Husbandry, and Self-Employment).

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Study Of Glycogen Content in Host *Capra Hircus* and Their *Anoplocephalidean* cestode Parasites from Jalna District (M.S.) India.

Arun Gaware
Shri Shivaji Art's, Commerce and Science College Motala, Dist. Buldhana
And
Chitra Morey
Shri Vyankatesh Arts & commerce College Deulgaon Raja
And
Rahul Khavaland
Shri Vyankatesh Arts & commerce College Deulgaon Raja
And
Sunita Borde
Department of Zoology, Dr. B. A. M. U. Chatrapati Sambhajinagar

ABSTRACT

The present study deals with the comparative study of Glycogen content in the cestode parasites Moniezia, Avetillina, Stilesia and their host intestine i.e. infected and non- infected intestinal tissue of Capra hircus. The results obtained in the present study indicates that the amount of Glycogen content obtained in cestodes Monieziasp. is higher than the Avitellinasp. and Stilesia sp. whereas in infected intestine amount of glycogen content is lower than the non-infected intestine of the host Capra hircus.

Keywords: Anoplocephalidea, Capra hircus, Glycogen.

INTRODUCTION

'Glycogen' is the main carbohydrate reserve in the adult parasitic helminth which is a typical energy reserve of helminths in habiting the environment with low oxygen tension (Barret J., 1943). The level of carbohydrate reserve in helminth depends, of course, on the nutritional state of the parasite and may changes during the life-cycle. Helminth parasitism especially, gastrointestinal parasitism, is one of the major health problems severely limiting the animal production in dairy animals. In spite of significant production losses, this may run into millions of rupees (Shah and Chodhary, 1995). The problem is neglected due to its chronic and insidious nature (Sanyal, 1998). The diverse agro-climatic conditions animal husbandry practices and pasture management largely determines the incidence in region. Sheep and goats rearing contribute significantly to the agrarian economy especially in areas where crop and dairy farming are not economical and it plays an important role in the livelihood of a large production of small and marginal farmers and landless laborers (Acharya, 1982).

The tapeworms (cestodes) when live in the intestine of hosts, they utilize food from the gastrointestinal tract. The metabolism of these cestodes depends on the feeding habits and the rich nourishment available in the gut of the host. These worms use this nourishment for their normal development and growth.

Nutritional deficiencies as a result of intestinal helminth infection have been the subject of several investigations (Hadju, *et al.,* 1996; Lunn and Nothrop-Clewer, 1996). Intestinal helminth may affect the nutritional status by causing increased nutrient loss, in addition to decreased food intake and nutrient absorption (Edirishinghe and Tomkins, 1995).

MATERIAL AND METHOD (KEMP METHOD)

The collected worms and host intestine were kept on blotting paper to removed excess water from the body of cestodes. This material was transferred on a watch glass. This weighed material was ground in to homogeneous paste in mortar pestle. To this paste 1ml of 30% KOH is added and taken in centrifuge tube and digested in hot water bath for 20 min. cooled and to the same 1.5ml of 95% ethanol was added by stirring with glass rod. Brought gently to boil in hot water bath, cooled and centrifuged for 15 min at 2000 R.P.M. Supernatant was drained on filter and 5ml distilled water was added and reacted with 5ml of test sol^{n}, 5ml of glucose standard sol^{n}5ml of D.W. separately in three test tube in each 10ml of anthron reagent was added and mixed then heated for 10 min and immediately cooled and reading were taken with the help of colorimeter at 620mμ setting a blank 100.

RESULT AND DISCUSSION

Table No. 1. Glycogen content in cestode parasite *Moniezia* sp., *Stilesia* Sp. and *Avitellina* Sp. and their infected and non-infected intestinal tissue of *Capra hircus* (L.).

Sr. No.	*Moniezia* Sp.	*Stilesia* Sp.	*Avitellina* Sp.	Infected intestinal tissue	Non-infected intestinal tissue
Glycogen content	0.145±0.003mg /100 mg dry wt. of tissue per ml sol^{n}	0.090±0.002mg /100 mg dry wt. of tissue per ml sol^{n}	0.11±0.004 mg/100 mg dry wt. of tissue per ml sol^{n}	0.149±0.002mg /100 mg dry wt. of tissue per ml sol^{n}	0.160±0.004mg/ 100 mg dry wt. of tissue per ml sol^{n}

Graph no. 1: Glycogen content in cestode parasite *Moniezia* sp., *Stilesia* Sp. and *Avitellina* Sp. and their infected andnon-infected intestinal tissue of *Capra hircus* (L.).

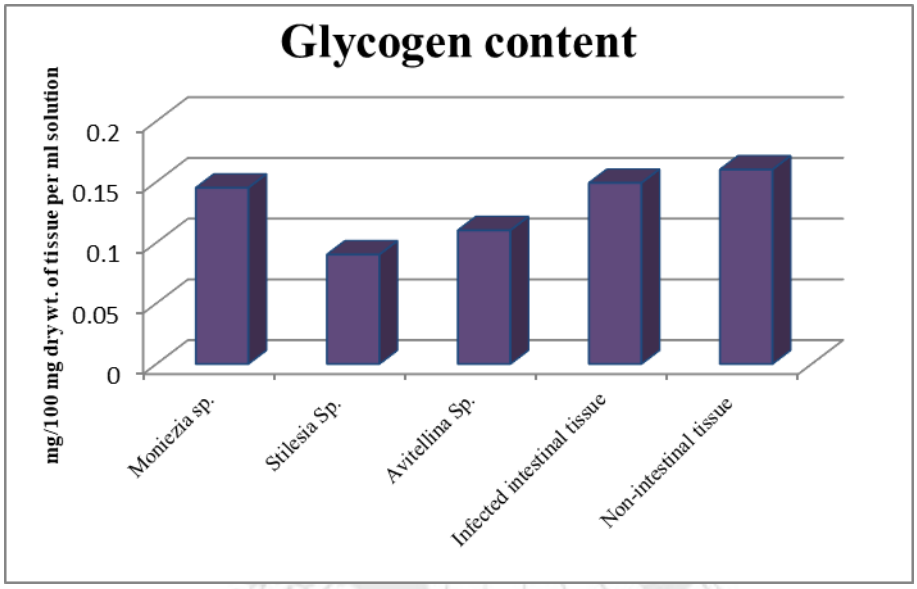

Table 1. and Graph 1. Shows the Glycogen content in the cestode parasites *Moniezia* sp.0.145±0.003 mg/100 mg dry wt. of tissue per ml solution was observed whereas in *Stilesia* Sp. 0.090±0.002mg/100 mg dry wt. of tissue per ml solution and in *Avitellina* Sp. 0.11±0.004 mg/100 mg dry wt. of tissue per ml solution was observed. The glycogen content in host infected and non-infected intestine was observed 0.149±0.002 mg/100 mg dry wt. of tissue per ml solution and 0.160±0.004 mg/100 mg dry wt. of tissue per ml solution respectively.

In the investigation of present study indicates that the amount of glycogen present in cestode parasites is significantly lower as compared to glycogen present in infected intestine as well as in host normal intestinal tissue. Similar result obtained Amol Thosar *el. al.* (2014) the glycogen content of *Moneizia* sp. obtained 0.18 mg/100mg dry weight of tissue and *Stilesia* sp. obtained 0.06 mg/100mg dry weight of tissue. Such as infected as well as non-infectedintestine of sheep obtained 0.16 mg/100 mg dry weight oftissue and 0.17 mg/100 mg dry weight of tissue respectively. Similar finding observed particularly in *Stilesia* sp. by M. B. Sonune (2012) glycogen content is lower in *Stilesia* sp. ascompare to infected and non-infected intestine of host. The glycogen distribution shown in present study is an agreement with the result of Jadhav *et al.,* 2008, M. B. Sonune (2014), Premavati and Tayal (1978) and Read and Phifer (1956).

The results obtained in the present study indicates that the amount of glycogen content obtained in cestodes *Moniezia* sp. is higher than the *Avitellina* sp. and *Stilesia* sp. whereas in infected intestine amount of glycogen content is lower than the non-infected intestine of the host *Capra hircus (*L).

Hence it can be concluded that *Moniezia* Sp., *Stilesia* Sp. and *Avitellina* Sp. would maintain a good balance in glycogen content with their host *Capra hircs* (L).

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Evaluation of Water Quality and Physico-chemical Characteristics of Pentakli Dam, Buldhana (M.S) India

Dabhade S. S
P. G. and Research Department of Zoology,
R. A. Arts, Shri M. K. Commerce and Shri S. R. Rathi Science College,
Washim-444505
And
Rathod S. D.
P. G. and Research Department of Zoology,
R. A. Arts, Shri M. K. Commerce and Shri S. R. Rathi Science College,
Washim-444505

ABSTRACT

The present investigation was conducted over twelve months, from June 2022 to May 2023, to evaluate the physico-chemical parameters of water at different sites in Pentakli Dam, Buldhana district, Maharashtra, India. Water samples were collected monthly from four different sites of the dam, representing diverse environmental conditions. The study evaluates various physico-chemical parameters such as water temperature, transparency, pH, conductivity, turbidity, dissolved oxygen (DO), biochemical oxygen demand (BOD), total dissolved solids (TDS), alkalinity, hardness, chloride, nitrate, and phosphate. The findings show how seasonal changes affect these parameters, highlighting clear variations in water quality throughout the year. Turbidity was highest during the monsoon, while temperature, total dissolved solids (TDS), and hardness peaked in the summer. Dissolved oxygen (DO) levels were highest in winter, and transparency was lowest in the monsoon and highest in winter. The pH was slightly more alkaline in summer. Electrical conductivity reached its peak in summer and was lower during the monsoon. Biochemical oxygen demand (BOD) levels were highest in summer and lowest in winter. Chloride and alkalinity were elevated in summer and reduced during the monsoon, while nitrate and phosphate concentrations were highest during the monsoon. The results indicated that all physico-chemical parameters were within the permissible limits set by water quality standards, suggesting that the dam water is suitable for irrigation, pisciculture and domestic purpose.

Keywords- Water quality, Physico-chemical parameter, Pentakli Dam, Seasonal variations.

1) INTRODUCTION

Water is an essential resource for all forms of life, playing a crucial role in various ecological and human processes. It is vital for drinking, sanitation, agriculture, industry, and energy production. The unique properties of water, including its high specific heat, solvent capabilities, and surface tension, make it indispensable for sustaining life and maintaining

ecological balance (Gleick, 1996). However, the increasing demand for water, coupled with pollution from industrial, agricultural, and urban sources, poses significant threats to water quality and availability (Karn & Harada, 2001). Pollution of water bodies can lead to the degradation of aquatic ecosystems, loss of biodiversity, and adverse health effects on human populations. Contaminants such as heavy metals, nutrients, and pathogens can enter water systems through various pathways, including runoff, wastewater discharge, and atmospheric deposition (Mason, 2002).

Pollution adversely affects zooplankton and fish, which are crucial components of aquatic ecosystems. Zooplankton, as primary food sources for fish and indicators of water quality, are sensitive to changes in physicochemical parameters such as temperature, pH, and nutrient levels. Alterations in these parameters can disrupt zooplankton populations, impacting the food web and overall ecosystem health (Patra *et al.,* 2011). Similarly, fish populations are directly impacted by pollutants, including heavy metals and organic contaminants, which can alter growth, reproduction, and survival rates (Kaur *et al.,* 2018). Eutrophication, often driven by excess nutrients like nitrogen and phosphorus, can result in harmful algal blooms, depleting oxygen levels and harming aquatic life (Smith *et al.,* 1999). These environmental challenges underscore the need for comprehensive water quality assessments to manage and safeguard aquatic ecosystems, particularly in reservoirs that serve multiple purposes such as irrigation, drinking water, and aquaculture.

Pentakli Dam, located in the Buldhana District of Maharashtra, India, is a critical resource providing essential water for drinking, irrigation, and fisheries. Understanding the physicochemical characteristics of water in such reservoirs is essential for evaluating their health and usability (Keesari *et al.,* 2020). Physicochemical parameters, including temperature, pH, turbidity, transparency, conductivity, dissolved oxygen (DO), biochemical oxygen demand (BOD), total dissolved solids (TDS), alkalinity, hardness, chloride, nitrate, and phosphate, are integral to water quality assessments. These parameters significantly influence the water's suitability for various applications and the well-being of aquatic life (Patel & Singh, 2020; Verma *et al.,* 2022).

Seasonal variations can have a profound impact on these parameters. Changes in temperature, rainfall, and evaporation can alter water quality, thereby affecting its usability and the health of aquatic ecosystems (Sharma *et al.,* 2019). Recent studies have highlighted how seasonal dynamics, such as increased turbidity during monsoons or elevated temperatures in summer, can influence water quality (Reddy *et al.,* 2023).

Analyzing physicochemical parameters is crucial for monitoring the water quality of aquatic ecosystems, supporting effective management and habitat conservation. This study evaluates the water quality of Pentakli Dam, Buldhana, Maharashtra, over a twelve-month period (June 2022 to May 2023), assessing water samples from four distinct sites to understand the impact of seasonal variations. The findings will provide valuable insights into the sustainable management of the dam and offer a framework for managing similar aquatic systems.

2) MATERIAL AND METHODS-

Pentakli Dam is a medium irrigation project situated on the Painganga River in the Godavari Basin, near Pentakli village, Taluka Mehkar, in Buldhana District, Maharashtra, India. It is positioned at latitude 20.2775° N and longitude 76.4666° E. This dam is a crucial resource for drinking, irrigation, and fisheries.

Water samples were collected monthly from four sites in Pentakli Dam from June 2022 to May 2023. Sampling occurred in the early morning using acid washed plastic cans. Physical parameters such as water temperature and pH were recorded on-site using appropriate meters. Samples for chemical analysis were transported to the P.G. and Research Department of Zoology, R.A. College, Washim.

Physicochemical parameters were analyzed using standard methods. Total Dissolved Solids (TDS) were measured with a TDS meter, and electrical conductivity was recorded with a digital meter. Other parameters were analyzed following the procedures outlined in APHA (1998), Trivedy, R.K. and Goel P.K. (1986)

3) RESULTS AND DISCUSSION

Water samples were collected monthly from four sites in Pentakli Dam, Buldhana District, Maharashtra, from June 2022 to May 2023. The physico-chemical parameters of the water were analyzed across three distinct seasons: monsoon, winter, and summer. The results are summarized in Table 1.

Water Temperature

Water temperature in Pentakli Dam showed distinct seasonal variation, with the highest mean value recorded during summer (28.50 ± 1.20°C), followed by monsoon (25.10 ± 1.05°C), and the lowest during winter (21.50 ± 0.90°C). The increase in temperature during summer can be attributed to higher atmospheric temperatures, increased solar radiation, and reduced water levels due to evaporation. Similar findings were reported in water bodies across Western Maharashtra, where elevated solar radiation and lower water levels significantly raised summer temperatures (Sangma *et al.,* 2021). The observed temperature range aligns with patterns noted in other water bodies across Maharashtra (Bobdey *et al.,* 2007).

Transparency:

The transparency values at Pentakli Dam show distinct seasonal variations, with mean measurements of 14.38 ± 4.00 cm in the monsoon, 19.10 ± 4.22 cm in winter, and 21.23 ± 1.10 cm in summer. The summer season records the highest mean transparency at 21.23 ± 1.10 cm, reflecting stable conditions with minimal sediment disturbance. This trend supports findings by Ghaware and Jadhao (2015) that summer conditions improve water clarity. Reduced transparency during the monsoon and summer is attributed to increased turbidity from suspended solids and runoff, respectively, paralleling observations in Govindgarh Lake, Madhya Pradesh (Chaurasia & Nighojkar, 2017)

pH:

The pH of Pentakli Dam ranged from 7.20 ± 0.45 in winter to 7.95 ± 0.50 in summer, indicating a shift from slightly acidic to more alkaline conditions. The increase in pH during summer is likely influenced by enhanced photosynthetic activity, which removes CO_2 and increases pH

levels. Seasonal pH variations influenced by biological activities such as photosynthesis and organic matter decomposition were also reported in the Kolhapur region of Maharashtra (Kulkarni & Adsule, 2018).

Conductivity:

Conductivity values peaked in summer (360 ± 10 µmho/cm) and were lowest during monsoon (250 ±7.50 µmho/cm). The elevated conductivity in summer is primarily due to the concentration of dissolved ions as a result of evaporation. This pattern is consistent with studies from the Subarnarekha River, where conductivity was higher in dry seasons due to evaporation concentrating dissolved salts (Giri & Singh, 2014).

Turbidity:

Turbidity was highest in the monsoon season (7.50 ± 1.30 NTU), influenced by surface runoff carrying suspended particles. A similar increase in turbidity during the rainy season was observed in the Godavari River in Maharashtra, highlighting the impact of rainfall on water clarity (Aher *et al.,* 2018). The lowest turbidity values were observed during winter (4.80 ± 0.60 NTU), when runoff was minimal.

Dissolved Oxygen (DO):

DO levels were highest during winter (9.80 ± 0.70 mg/L) and lowest in summer (6.90 ± 0.50 mg/L). The elevated DO levels in winter can be attributed to lower temperatures, which enhance oxygen solubility, and reduced microbial consumption of oxygen. Research in Tamil Nadu, India, similarly noted increased DO during colder months due to higher solubility and decreased microbial consumption of oxygen (Kulinkina *et al.,* 2016).

Biochemical Oxygen Demand (BOD):

Biological Oxygen Demand (BOD) shows notable seasonal variations, reflecting changes in organic pollution and microbial activity. During the monsoon, BOD is highest (4.00 ± 0.30 mg/L) due to increased organic matter from surface runoff, agricultural activities, and urban effluents, which enhances microbial activity. In winter, BOD is lowest (2.60 ± 0.35 mg/L) due to lower temperatures that reduce microbial metabolic rates and decrease organic matter influx from reduced runoff (Durge *et al.,* 2018). In summer, BOD levels are moderately high (3.40 ± 0.45 mg/L), driven by higher temperatures that boost microbial activity and organic decomposition rates, along with concentrated pollutants due to evaporation. This seasonal pattern aligns with observations from other regions, where BOD levels are elevated during the rainy season and reduced during cooler months (Kshirsagar & Gunale, 2011).

Total Dissolved Solids (TDS):

The analysis of Total Dissolved Solids (TDS) revealed significant seasonal variations, with mean ± SD values of 155 ± 12.00 mg/L in the monsoon, 175 ± 10.00 mg/L in winter, and 190 ± 15.00 mg/L in summer. The observed increase in TDS from monsoon to summer aligns with previous studies, indicating that environmental and climatic factors significantly influence solute concentrations in water bodies. During the monsoon, increased rainfall dilutes dissolved solids, resulting in lower TDS values (Saha *et al.,* 2020). As the season transitions to summer, higher evaporation rates and reduced water levels lead to increased concentrations of dissolved solids (Sharma & Gupta, 2019). Similar seasonal TDS variations were noted in Chandigarh, with higher levels during dry periods due to evaporation effects (Goel *et al.,* 2015).

Alkalinity:

Alkalinity exhibits significant seasonal variation, with the highest levels recorded in summer (130.00 ± 2.50 mg/L) and the lowest in winter (85.00 ± 1.50 mg/L). These patterns align with observations from the Western Ghats of Maharashtra, where higher alkalinity during the monsoon was attributed to increased runoff and mineral dissolution (Saraswat & Patil, 2018). Elevated summer alkalinity can be linked to increased decomposition of organic matter, which enhances the concentration of bicarbonates and carbonates (Deshmukh & Ghosh, 2020).

Hardness:

Water hardness exhibits distinct seasonal variations influenced by natural and anthropogenic factors. During the monsoon, hardness is lowest (100.00 ± 2.50 mg/L) due to the dilution effect of rainfall, which reduces the concentration of dissolved minerals like calcium and magnesium. In winter, hardness increases moderately to 120.00 ± 2.80 mg/L, attributed to reduced water flow and gradual mineral accumulation due to decreased rainfall and lower temperatures (Budhlani *et al.,* 2011). The highest hardness level (150.00 ± 3.10 mg/L) is observed in summer, driven by high evaporation rates that concentrate dissolved minerals, coupled with increased agricultural runoff (Kadam *et al.,* 2021).

Chlorides:

Chloride levels varied seasonally, reflecting the influence of natural factors such as evaporation and anthropogenic inputs. During the monsoon, chloride levels were lowest (40.00 ± 1.50 mg/L) due to the dilution effect of rainfall. In winter, levels rose to 55.00 ± 1.90 mg/L, attributed to reduced water flow and ongoing mineral accumulation. The highest chloride concentration was recorded in the summer (60.00 ± 2.00 mg/L), likely driven by high evaporation rates that concentrate dissolved salts. Similar seasonal chloride fluctuations have been observed in reservoirs in Western Maharashtra, where reduced dilution during the dry season led to increased chloride concentrations (Kulkarni & Adsule, 2018).

Nitrate:

Nitrate levels at Pentakli Dam showed significant seasonal variations, influenced primarily by agricultural runoff and organic matter decomposition. The lowest nitrate levels were observed in winter (3.80 ± 0.30 mg/L) due to reduced agricultural activity and slower decomposition rates.

In contrast, nitrate levels peaked during the monsoon (5.20 ± 0.45 mg/L), driven by increased agricultural runoff and enhanced organic decomposition under higher temperatures. These seasonal variations in nitrate levels are consistent with studies of drinking water quality in Maharashtra, which highlight the impact of agricultural practices on nitrate concentrations (Tambe *et al.,* 2008).

Phosphate:

Phosphate levels were found to be highest during monsoon (0.85 ± 0.12 mg/L), moderate during the summer (0.65 ± 0.10 mg/L), and lowest in winter (0.45 ± 0.08 mg/L). Phosphate concentrations were highest in monsoon (0.85 ± 0.12 mg/L), likely driven by agricultural runoff and nutrient loading. This trend aligns with findings in Chandrabhaga River, Maharashtra, where seasonal phosphate levels increased during the monsoon due to nutrient runoff and agricultural activities (Watkar & Barbate, 2015). The lowest values in winter result from decreased agricultural activities and reduced soil erosion. These findings are consistent with observations from other studies on seasonal nutrient variations in water bodies (Gupta *et al.,* 2021)

Table 1: Seasonal Variations in Physico-chemical Parameters at Pentakli Dam

Parameter	Monsoon (Mean± SD)	Winter (Mean± SD)	Summer (Mean±SD)
Water Temperature (°C)	25.10 ± 1.05	21.50 ± 0.90	28.50 ± 1.20
Transparency (cm)	14.38 ± 4.00	19.10 ± 4.22	21.23 ± 1.10
pH	7.65 ± 0.40	7.20 ± 0.45	7.95 ± 0.50
Conductivity (µmho/cm)	250 ± 7.50	270 ± 10.00	360 ± 10
Turbidity (NTU)	7.50 ± 1.30	4.80 ± 0.60	6.00 ± 0.90
Dissolved Oxygen (mg/L)	7.50 ± 0.55	9.80 ± 0.70	6.90 ± 0.50
BOD (mg/L)	4.00 ± 0.30	2.60 ± 0.35	3.40 ± 0.45
TDS (mg/L)	155 ± 12.00	175 ± 10.00	190 ± 15
Alkalinity (mg/L)	90.00 ± 1.70	85.00 ± 1.50	130.00 ± 2.50
Hardness (mg/L)	100.00 ± 2.50	120.00 ± 2.80	150.00 ± 3.10
Chlorides (mg/L)	40.00 ± 1.50	55.00 ± 1.90	60.00 ± 2.00
Nitrate (mg/L)	5.20 ± 0.45	3.80 ± 0.30	4.60 ± 0.35
Phosphate (mg/L)	0.85 ± 0.12	0.45 ± 0.08	0.65 ± 0.10

4) CONCLUSION

The evaluation of Pentakli Dam's water quality exhibited significant seasonal changes, influenced by factors such as temperature, rainfall, runoff, and biological activity. Despite these variations, the water remains within acceptable limits, indicating its suitability for agricultural use,

industrial applications, and aqua-cultural activities. It is also safe for drinking when properly treated. (BIS 2012, WHO 2022). Overall, the dam's water is clean, well-balanced, and poses minimal risk to human health and the environment, confirming its reliability as a valuable resource.

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Groundwater Quality Assessment: Spatial Distribution of Total Dissolved Solids (TDS) in Yavatmal City (M.S.) India during Period of September 2023 to august 2024

Vaishnavi Vyavahare
Research Scholar, Department of Zoology
Amolakchand Mahavidyalaya, Yavatmal – 445001 [M.S.] India.
And
Sunita Gupta
Professor, Department of Zoology,
Amolakchand Mahavidyalaya, Yavatmal – 445001 [M. S.] India.

ABSTRACT

Water is life. Out f all the water resources groundwater is considered as purest and majorly available source of water. Groundwater is the lifeblood of our ecosystem, supporting human consumption, agriculture and industry as a vital source of freshwater. Groundwater plays a crucial role in sustaining life and livelihoods. Groundwater is the primary source of water for millions of people worldwide making its quality and management a top priority. The health of our groundwater resource is essential for ensuring food security, economic growth and environmental sustainability. TDS stands for Total Dissolved Soilds and represents the total concentration of dissolved substances in water. TDS is made up of inorganic minerals, salts as well as a small amount of organic matter that can be a general indicator of water quality.

Yavatmal is a district of Indian state of Maharashtra it is located in the region of vidarbha. As groundwater is prominently used to fulfil domestic demands hence quality of groundwater must be checked time to time in order to supply safe drinking water. In this paper one attempt has made to study of variation in Total Dissolved Solids of water in some regions of Yavatmal city (M.S.) India over a period of one year from September 2023 to August 2024

Keywords – TDS, Dissolved solids, Groundwater

INTRODUCTION

Water is life. Water is a colourless, odourless, and transparent substance, essential for human life and the sustenance of our planet. It covers approximately three-fourths of the earth's surface and comprises 60-65% of the human body, making it a vital component of our physiology. Water is a precious resource, and its importance cannot be overstated. A person can survive for several weeks without food, but only a few days without water. Despite its abundance, only a tiny fraction of the Earth's water is readily available for human consumption. About 97% of the Earth's water is seawater, and another 2% is tied up in ice caps, glaciers and atmospheric moisture. This leaves only about 1% of the Earth's water as freshwater, and most of this is underground.

Water is an excellent solvent and can contain lots of dissolved chemicals. Since groundwater moves through rocks and surface soil, it has a lot of opportunity to dissolve substances during interaction as it moves. For that reason, groundwater will often have more dissolved substances than surface water.

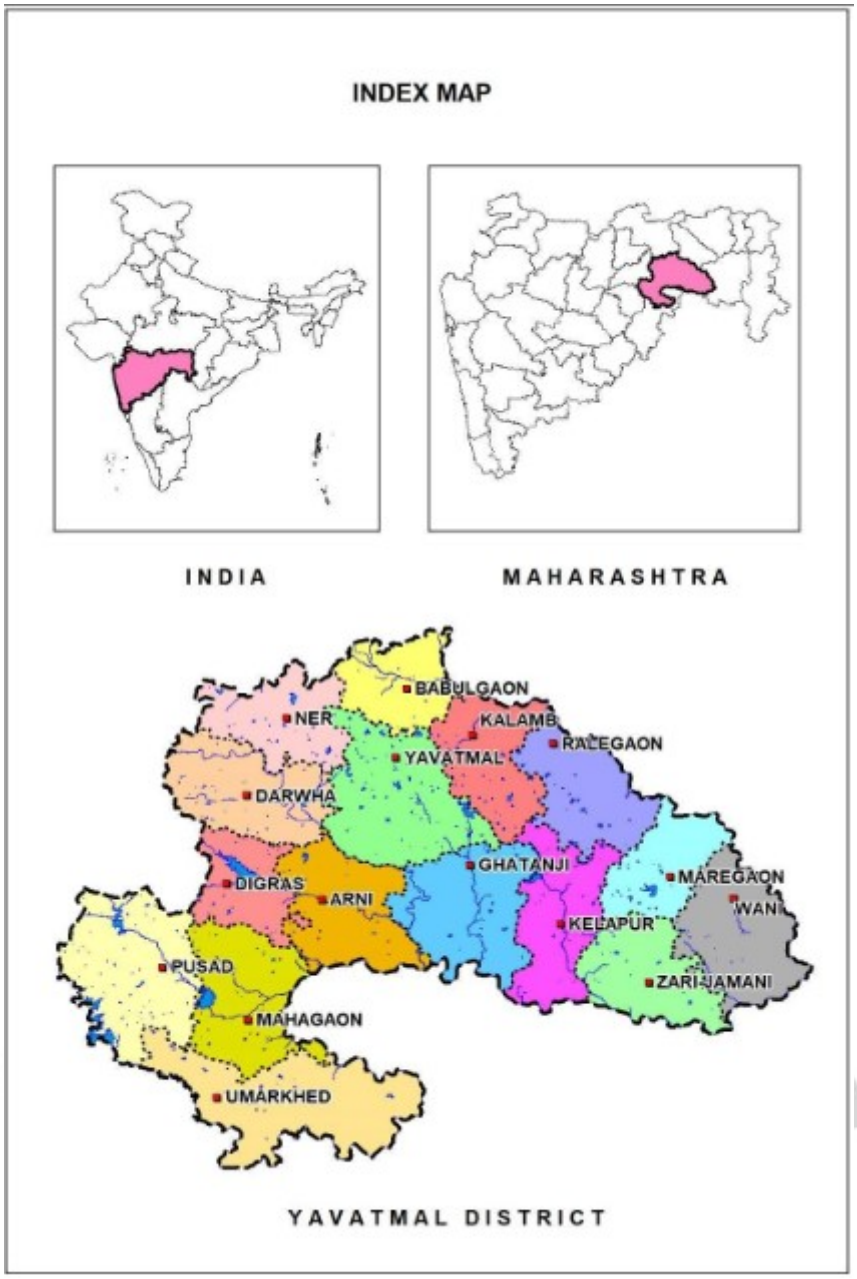
Groundwater is a vital source of freshwater, according for approximately 0.003% of the Earth's water. It is a renewable resource, replenished by precipitation and surface water infiltration. Groundwater has several advantages, including excellent natural quality, free from pathogens, colour and turbidity. It can consume directly without treatment and also does not require large storage, treatment and distribution systems. It can develop incrementally, near the point of demand. It is chemically and microbiologically non-polluted and safe for drinking, cooking, agriculture and industrial use. That's why groundwater is h9ighly valued because of certain properties not possessed by surface water.

In India, groundwater plays a crucial role in meeting the country's water demands. It is used to irrigate around 40% of the country's agricultural land and fulfils: 50% of urban water demand and 80% of rural water demand in India.

1 TDS stands for total dissolved solids. TDS refers to the concentration of dissolved substances in water including minerals, salts, metals, and other inorganic and organic compounds. Excluding the organic matters that are sometimes naturally present in water and the environment some of these compounds or substances can be essential in life. But if can be harmful if taken more than desired amount needed by the body. TDS is crucial water quality parameter influencing waters taste odor and aesthetic appeal. When left unfiltered, total dissolved solids can be the cause of various diseases. Total dissolved solids (TDS) are a measure of the combined total of organic and inorganic substances contained in a liquid. This includes anything present in water other than the pure H_20 molecules.

2. The Yavatmal district is one of the eleven districts of Vidarbha Region of Maharashtra. It is bounded on east by Yavatmal district, on south by Andhra Pradesh State and Nanded district on west by Washim and Hingoli districts and on north by Amravati and Wardha districts. Wardha River forms the north eastern boundary of the district. The district lies between 19°26' and 20°42' north latitudes and 77°18' and 79°9' east longitudes. It falls in parts of the Survey of India Toposheet No. 55L, 55I, 56E, 56I, 56M, covering an area of 13582sq. km. As groundwater is prominently used to fulfill domestic demands hence quality of groundwater must be checked time to time in order to supply safe drinking water.

Map of Yavatmal District



3. In this paper one attempt has been made to study of variation in total dissolved solids of water yavatmal city over a period of one year.

METHODOLOGY

Water samples were collected from various locations in the city over a period of one year (September 2023 to August 2024) and immediately after collection physical-chemical parameters such as pH, temperature and TDS (total dissolved solids) were measured. For the water samples a digital TDS meter was used to measured total dissolved solids (TDS) The specifications of the digital TDS meter are as follows:

- Brand : Hi-Tech sweet water technologies Pvt. Ltd.
- Model Number : tdsmeter

Type	• : Digital
Range	• : 0-9,990ppm
Temperature Range	• : -5+50 degree C degree C
Accuracy	• : +-2%
Battery	• : 2x1.5 V(button cell)

Dimensions

Width	• : 3 cm
Height	• : 15 cm
Weight	• : 90 gram

Manufacturer: Hi-Tech sweet water technologies Pvt. Ltd, 1800 121 1232

Source-www.Amazon.com

For the purpose of this study, we selected five areas in the city and collected water samples from each area on the weekly bases, resulting in the total of four samples per month. We used a digital TDS meter to measure the Total Dissolved Solids (TDS) levels in each samples. Following table shows details of the water sample source:

Sr. No.	Sample	Area of sample	Groundwater source	Depth
1.	Sample 1	Gandhi nagar	Borewell	175 ft
2.	Sample 2	Satyanarayan lay-out	Borewell	100 ft
3.	Sample 3	Samarth wadi	Borewell	125 ft
4.	Sample 4	Bangar nagar	Borewell	120 ft
5.	Sample 5	Indira nagar	Borewell	200 ft

Following table shows TDS (Total Dissolved Solids) of different samples under study-

Sr. No.	Month	Week	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
			TDS (in ppm)	TDS (in ppm)	TDS (in ppm)	TDS (in ppm)	TDS (in ppm)
1	September 2023	I	362	302	445	403	603
2		II	361	323	475	400	660
3		III	362	345	545	401	654
4		IV	365	300	488	421	503

5	October 2023	I	365	351	526	435	523
6		II	366	388	560	423	621
7		III	360	300	503	431	684
8		IV	361	295	533	431	
9	November 2023	I	353	303	523	433	699
10		II	353	356	545	435	707
11		III	359	389	549	440	775
12		IV	355	358	581	442	658
13	December 2023	I	356	358	589	444	674
14		II	351	394	601	445	684
15		III	350	393	590	451	687
16		IV	351	401	656	447	607
17	January 2024	I	352	423	649	440	593
18		II	349	390	648	441	571
19		III	348	345	604	450	581
20		IV	349	307	631	447	593
21	February 2024	I	353	341	601	431	496
22		II	356	393	550	451	495
23		III	356	403	558	458	536
24		IV	357	366	556	460	503
25	March 2024	I	360	348	552	468	503
26		II	361	381	448	470	569
27		III	362	332	400	473	568
28		IV	362	321	408	488	452
29	April 2024	I	360	323	423	487	569
30		II	358	325	451	490	584
31		III	350	303	432	501	539
32		IV	347	301	493	503	607
33	May 2024	I	339	288	500	507	694
34		II	343	296	507	521	628
35		III	345	333	556	523	703
36		IV	349	365	503	531	754

37	June 2024	I	349	345	490	535	684
38		II	353	357	499	534	674
39		III	356	403	514	531	681
40		IV	357	454	523	558	623
41	July 2024	I	361	400	526	549	564
42		II	358	403	543	548	541
43		III	357	438	558	548	628
44		IV	365	398	575	453	632
45	August 2024	I	356	561	389	558	569
46		II	356	560	385	590	623
47		III	359	563	345	603	660
48		IV	360	563	354	623	601

According to World Health Organization (WHO) and Bureau of Indian Standard some parameter are as follows:

Sr. No.	Water quality parameter	Bureau of Indian Standard (IS-10500:1994)	WHO International Standard (1983)
1.	pH	6.5-8.5	7.0-8.5
2.	Total Dissolved solids (ppm)	500-2000	500
3.	Total hardness (ppm)	300-600	100

TDS (Total Dissolved Solids) – The mineral constituents dissolved in water make up the Total Dissolved Solids (TDS) in natural water, the concentration of dissolved solids is typically less than 500 parts per million (ppm). However, water with TDS levels exceeding 500 ppm is generally considered undesirable for drinking and industrial purposes. According to reports, the desirable limit for Total Dissolved Solids (TDS) is 500 ppm, while the maximum permissible limit is 2000 ppm. Water containing more than 500 ppm of TDS can cause gastrointestinal irritation and prolonged consumption may lead to various health issues. High values of Total Dissolved Solids (TDS) can significantly impact the taste, Hardness of water other properties of water. In general, high TDS levels can affect the aesthetic and functional qualities of water, making it less desirable for drinking, industrial and agricultural uses. Drinking water should strike a delicate balance between containing sufficient minerals to support health and avoiding excess minerals that can lead to overload in the body. In this paper we delve into the acceptable minimum and maximum Total Dissolved Solids (TDS) limits for water. Minimum TDS limits ensuring adequate mineral intake for health and maximum TDS limits preventing excessive mineral buildup and potential

health risks. Understanding these limits is crucial for maintaining optimal water quality.

TDS Level (ppm)	Palatability of Water
Less than 300	Excellent
300-500	Good
600-900	Fair
900-1200	Poor
Above 1200-2000	Unacceptable / Unpalatable

CONCLUSION

From the variation of hardness table it is observed that the minimum TDS of groundwater Yavatmal city is 295 ppm and maximum is 775 ppm. Out of five samples, four samples have TDS more than 500 ppm and below 1000. These samples have acceptable value according to Bureau of Indian Standard (IS-10500:1994) which has range 500-2000 ppm. One sample has value below 500 ppm which has acceptable value according to WHO International Standard. TDS range of groundwater in Yavatmal city is found to be acceptable and fair.

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Assesment Of Visiting Avian Fauna in Jijamata Mahavidyalaya Buldhana, Maharashtra, India

R. M. Yewale
Assistant Professor of Zoology and Botany, Jijamata Mahavidyalaya, Buldhana, 443001
And
P.R. Thakare
Assistant Professor of Zoology and Botany, Jijamata Mahavidyalaya, Buldhana, 443001
And
A.T. More
Assistant Professor of Zoology and Botany, Jijamata Mahavidyalaya, Buldhana, 443001
And
R. W. Ukey
Assistant Professor of Zoology and Botany, Jijamata Mahavidyalaya, Buldhana, 443001
And
P. P. Ware
Assistant Professor of Zoology and Botany, Jijamata Mahavidyalaya, Buldhana, 443001

ABSTRACT

Jijamata Mahavidyalaya is situated in Buldhana city, which is located in Satpuda mountain range. Also have Dnyanganga Wildlife Sanctuary and Yelgaon dam located nearby.

The visiting Avifaunal diversity of Jijamata College in Buldhana, Maharashtra state was recorded from June 2022 to May 2023. The external appearance of birds was noted down for the identification of avian species. This observation was done by walking through the campus area. Total 49 species from 37 families were recorded in time span of the year. This works briefly concludes about the presence of bird's species in Buldhana district and its surrounding. This study is also a stepping stone towards the conservation of threatened birds species and biodiversity around the area.

Keywords: Buldhana, Avifauna, Satpuda, Visiting Birds

INTRODUCTION:

India, the land which consists of variety philosophy, knowledge, culture, flora and fauna. But here we are about to represent the diversity among the avesin Buldhana and its surrounding. The study of birds or ornithology has many objectives such as understanding evolution, behaviour and ecology. Along with the development in fields like definition of species, speciation and ecological niches conservation.

The growth of human population and co-ordinatively leads to the disturbance in natural habitat of whole living organism. These sudden changes may lead to depletion or extinction of some species. Therefore, it is important with the increasing awareness about conservation of

biodiversity to maintain the records. This prompted us for the survey of Avain fauna in the campus of prestigious Jijamata Mahavidyalaya of Buldhana with the scientific insight and methodology.

Jijamata Mahavidyalaya is situated in Buldhana city, which is located in Satpuda mountain range. Also have Dnyanganga Wildlife Sanctuary and Yelgaon dam located nearby. This study will briefly reveal about the avifauna found in Jijamata Mahavidyalaya campus in Buldhana and its surrounding.

OBJECTIVES:

The primary focus behind this work is to study about the presence of variety of avian species in and around the campus area along with the study of there habitat. Which will later open the door to detail research about there direct or indirect association and changes in environment, along with flora and fauna ofthe surrounding.

METHODOLOGY:

Study site: The campus of Jijamata Mahavidyalaya comprises around 23 acres of land (Image 1) which is situated in urban area that is in Buldhana city, which is also a district place in Maharashtra state of India. The land of Buldhana city is situated on hilly top area of elevation about 639 meter which is part of Satpuda mountain range. The location coordinates of study site or the campus of this righteous institute is 20.5266360 Latitude and 76.1845097 Longitude. This site is located to 3.8 km north to Yelgaon dam and 20.7 km south-west of Dnyanganga Wildlife Sanctuary and also have two ponds as source of water.

The floral diversity in the campus consists of *Terminalia belllirica*, *Kigeliaafricana*, *Terminalia chebula*, *Acacia leucophloea*, *Santalum album*, *Sterculia urens*, *Delonix regia*, *Cycas revolute*, *Tectona grandis*, *Dolchandrone falcate*, *Casurinaequisetifolia*, *Azadirachta indica*, *Erythrina variegata*, *Ficus benghalensis*, *Ficus amplissima*, *Butea monosperma*, etc.

Image 1: Satellite image of Jijamata Mahavidyalaya Campus.

Methods: Documentation of avifaunal diversity is done by walking through the campus area and encountered species were noted down. These birds species were recorded from two ponds in campus, botanical garden and trees located around. Observation of birds were made around 120 minutes (06:00-07:00 hr and 18:30-19:30 hr) from June 2022 to May 2023.

OBSERVATION AND RESULT:

The study in the campus area of Jijamata Mahavidyalaya reveals the occurrence or presence of 47 species of aves belonging to 36 different families. Table 1 consists of the list of the birds observed in the campus with there common name, scientific name and family to which they belong.

Sr. No.	Common name	Scientific name	Family
1	Baya weaver	*Ploceusphilippinus*	Ploceidae
2	Jungle babbler	*Turdoides striata*	Leiothrichidae
3	Chestnut-breasted mannikin	*Lonchuracastaneothorax*	Estrildidae
4	Barn owl	*Tyto alba*	Tytonidae
5	Common myna	*Acridotheres tristis*	Sturnidae
6	Common hawk cuckoo	*Hierococcyxvarius*	Cuculidae
7	Scaly breasted munia	*Lonchurapunctulata*	Estrildidae
8	Greater coucal	*Centropus sinensis*	Cuculidae
9	Blossom headed parakeet	*Psittacularoseata*	Psittaculidae
10	Green bee-eater	*Meropsorientalis*	Meropidae
11	House sparrow	*Passer domesticus*	Passeridae
12	Golden back woodpecker	*Chrysocolaptesguttacristatus*	Picidae
13	Sarus crane	*Grus antigone*	Gruidae
14	Great horned owl	*Bubo virginianus*	Strigidae
15	Indian jungle Crow	*Corvus culminatus*	Corvidae
16	Golden oriole	*Oriolusoriolus*	Oriolidae
17	Yellow browed sparrow	*Ammodramusaurifrons*	Passerellidae
18	Rock pigeon	*Columba livia*	Columbidae
19	White throated kingfisher	*Halcyon smyrnensis*	Alcedinidae
20	Asian green bee-eater	*Meropsorientalis*	Meropidae
21	Yellow-throated sparrow	*Gymnorisxanthocollis*	Passeridae
22	Laughing dove	*Spilopelia senegalensis*	Columbidae
23	Spotted dove	*Spilopelia chinensis*	Columbidae
24	Indian roller	*Coracias benghalensis*	Coraciidae
25	White bellied drongo	*Dicruruscaerulescens*	Dicruridae
26	Black drongo	*Dicrurusmacrocercus*	Dicruridae
27	Black kite	*Milvus migrans*	Accipitridae
28	Alexandrine parakeet	*Psittaculaeupatria*	Psittaculidae
29	Long tailed shrike	*Lanius schach*	Laniidae
30	American robin bird	*Turdus migratorius*	Turdidae
31	Malabar pied hornbill	*Anthracoceros coronatus*	Bucerotidae
32	Rose-ringed parakeet	*Psittaculakrameri*	Psittaculidae
33	Spotted Owlet	*Athene brama*	Strigidae
34	Yellow-footed green pigeon	*Treron phoenicopterus*	Columbidae
35	Red wattled lapwing	*Vanellus indicus*	Charadriidae
36	India gray Hornbill	*Ocycerosbirostris*	Bucerotidae
37	Asian koel	*Eudynamysscolopaceus*	Cuculidae
38	White throated fantail	*Rhipidura albicollis*	Rhipiduridae

39	Oriental magpie robin	*Copsychussaularis*	Muscicapidae
40	Indian bush lark	*Mirafraerythroptera*	Alaudidae
41	Grey heron	*Ardea cinereas*	Ardeidae
42	Indian swiftlet	*Aerodramus unicolor*	Apodidae
43	Black-crowned night heron	*Nycticoraxnycticorax*	Ardeidae
44	Grey francolin	*Ortygornispondicerianus*	Phasianidae
45	Grey quail	*Synoicusypsilophorus*	Phasianidae
46	Crested serpent eagle	*Spilornischeela*	Accipitridae
47	Great barbet	*Psilopogon virens*	Megalaimidae

Table 1: Common name, scientific name and families of recorded species.

CONCLUSION:

This brief survey introduces us with the availability of avian species in part of western Vidarbha, which will further help us to study the about the extinction of these birds species. Total 47 species from 36 different families were recorded.

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Optical Phenomena in Zoology: From Bioluminescence to Polarization Vision

R. R. Kajalkar

Department of Zoology,

M.S.P. Arts, Science & K.P.T. Commerce College Manora,

Dist.-Washim, Maharashtra, India

ABSTRACT:

Optical phenomena play a vital position in zoological studies, imparting insight into the behaviours, variations, and interactions of animals with their surroundings. This assessment explores two key optical phenomena: bioluminescence and polarization imaginative and prescient, both of which might be critical to survival, communique, and navigation in diverse species. Bioluminescence, customary in each marine and terrestrial organisms, serves functions including predation, defence, and mating via the emission of mild generated by way of a chemical response. In comparison, polarization imaginative and prescient, observed in species which include bugs and cephalopods, allows animals to locate polarized light styles, helping in navigation, searching, and conversation. Additionally, the evaluate examines structural shade, which arises from light interference and diffraction in organisms like butterflies and birds, contributing to camouflage and mate choice. Advances in optical imaging technologies, inclusive of spectroscopy and optical coherence tomography (OCT), have enabled deeper exploration of those phenomena, revealing their ecological and evolutionary significance. Understanding these optical skills enriches our understanding of animal biology and enhances the capacity for destiny discoveries in zoology.

Keywords: Predator-prey interaction, Spectroscopy, Optical imaging, Evolutionary biology

1. INTRODUCTION

Optical phenomena in zoology encompass a wide range of light-associated approaches that animals use to engage with their environment. From imaginative and prescient to communique, the way animals make use of mild regularly involves tricky biological systems that reflect, emit, or manage light [1]. This overview explores most important optical phenomena in the animal country, that specialize in bioluminescence and polarization vision, both vital to survival, conversation, and behavior [2].

2. Bioluminescence in Zoology

Bioluminescence, the emission of mild via dwelling organisms, is found in many marine and terrestrial species. It is a manufactured from a chemical reaction that entails the enzyme luciferase acting on a substrate known as luciferin in the presence of oxygen [3]. This phenomenon performs essential roles in predation, defence, mating, and communication.

2.1 Mechanism of Bioluminescence

Bioluminescence generally takes place via a chemical reaction:

$$\text{Luciferin} + O_2 \longrightarrow \text{Oxyluciferin} + \text{Light}$$

The mild produced tiers in shade, frequently relying at the organism's habitat. For example, deep-sea organisms have a tendency to provide blue and inexperienced light, which travels farther through water.

2.2 Role of Bioluminescence in Marine Life

In the ocean, bioluminescence is commonplace in species like jellyfish, deep-sea fish, and squid [4]. It serves several purposes:

1. Predation and Défense: Deep-sea anglerfish use bioluminescent lures to attract prey.
2. Counter-illumination: Some species emit light to combination with downwelling daylight, hiding from predators under.

2.3 Three Terrestrial Bioluminescence

On land, fireflies are the maximum recognizable bioluminescent organisms. They use flashing styles to communicate during mating. The mild produced is extraordinarily efficient, with almost no warmth generated a system often known as "bloodless light."

3. Polarization Vision in Animals

Polarization imaginative and prescient refers back to the ability of animals to come across the orientation of light waves [5]. This potential is full-size among invertebrates such as insects, cephalopods, and crustaceans, and performs critical roles in navigation, foraging, and verbal exchange.

3.1 Mechanism of Polarization Vision

Polarized light includes light waves oscillating in unique guidelines, and a few animals have specialized photoreceptor cells capable of distinguishing this pattern. Polarization sensitivity is generally found in photoreceptor cells organized in particular orientations, permitting animals to locate the attitude of light waves.

3.2 Polarization Vision in Navigation

Polarization vision is specifically useful for animals that rely on celestial cues for navigation. For example, wasteland ants use the polarization pattern of the sky to orient themselves at the same time as foraging. These ants are capable of detecting polarized mild even if the solar is obscured, letting them navigate correctly in difficult environments [6].

3.3 Polarization Vision in Communication

Cephalopods, which includes squid and cuttlefish, are able to hit upon polarized light and use it in complicated verbal exchange. Their skin can reflect polarized mild in patterns invisible to predators however detectable with the aid of different cephalopods, imparting a non-public verbal exchange channel for signalling intentions or warnings.

3.4 Polarization Vision in Hunting and Predation

Many marine predators, together with mantis shrimp, own incredibly touchy polarization

vision, which they use to come across prey that might be camouflaged in different approaches. The capacity to detect polarized mild complements assessment, making prey easier to identify [7]. Mantis shrimp, particularly, have a number of the maximum complex eyes regarded inside the animal state, with polarization detectors that allow them to see a wide range of visual cues.

4. Structural Coloration: Interference and Diffraction

Structural coloration, resulting from interference and diffraction of mild, produces a number of the most shiny and dynamic hues seen within the animal country. Unlike pigmentation, structural colour effects from the physical interplay of mild with microscopic structures on the surface of an organism.

4.1 Thin-Film Interference in Insects

Butterfly wings and beetle shells are well-known for their iridescent hues, which end result from thin-movie interference. These systems manage light, developing tremendous colorations that may change relying on the perspective of viewing [8]. This shape of color regularly serves to draw friends or keep off predators.

4.2 Structural Coloration in Birds

Birds, in particular species like peacocks and hummingbirds, also show off structural colors because of the interplay of mild with feather microstructures. In those instances, nanostructures in the feathers reflect and scatter mild to supply colourful presentations, which might be regularly worried in sexual choice.

5. Ecological and Evolutionary Implications

The diverse optical abilties found in animals replicate the evolutionary variations that optimize survival in specific environments. The ecological roles of bioluminescence, polarization vision, and structural coloration have some distance-accomplishing implications for predator-prey dynamics, mating techniques, and communique [9].

5.1 Camouflage and Concealment

Certain animals, consisting of cuttlefish, can control polarization and structural colour to combination into their environment. This camouflage allows them avoid predators or ambush prey.

5.2 Sexual Selection

In species like birds of paradise and butterflies, shiny colour created by using optical phenomena is often a key factor in mate desire. Bright hues signal true fitness and sturdy genetics, using sexual selection and influencing evolutionary consequences.

6. Recent Advances in Optical Zoological Studies

With the development of optical imaging technologies, researchers can now look into these phenomena at remarkable levels of element [10]. Techniques such as spectroscopy, laser scanning microscopy, and optical coherence tomography (OCT) have more advantageous our know-how of ways animals engage with light.

- Spectroscopy has been used to take a look at pigmentation and structural colours in detail, revealing how animals mirror and take in precise wavelengths of light.

- Optical Coherence Tomography (OCT) gives non-invasive imaging of tissue systems in animals, losing mild on how those structures have an effect on mild reflection and absorption.

7. CONCLUSION

Optical phenomena inclusive of bioluminescence, polarization imaginative and prescient, and structural shade are crucial to information the complicated interactions between animals and their environments. These capabilities provide insights into survival techniques, verbal exchange, and evolutionary procedures. As technology advances, the observe of these optical phenomena will keep to reveal captivating elements of zoology, enriching our information of the natural international.

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Effect of Sodium Fluoride toxicity on the male reproductive organ of Albino rats (*Rattus norvegicus*)

Diksha N. Athawale
Research scholar,
Department of Zoology,
Govt. Vidarbha Institute of Science and Humanities, Amravati.
And
Milind D. Kale
Assistant professor
Department of Zoology,
Govt. Vidarbha Institute of Science and Humanities, Amravati.

ABSTRACT:

The impact of sodium fluoride (NaF) toxicity on the male reproductive organs of Rattus norvegicus. Experimental male rats were exposed to 1/20thchronic concentration of NaF through drinking water over a period of 90 days. Histological analysis was performed to evaluate reproductive alteration in the tissue of testis. The significant alteration was observed in the testicular histological structure after exposed in NaF as compared to controls. In the seminiferous tubule developing process of spermatogonia was arrested in some stages and immature development of sperms are noticed.

Keywords: Sodium fluoride, Testis, seminiferous tubule, sperm development

INTRODUCTION:

Sodium fluoride (NaF) is a colourless to white solid that is moderately soluble in water. Inorganic Fluorides are introduced into the environment as a result of natural emission and anthropogenic sources. Depending on metrological condition and season, gaseous and particulate inorganic fluorides are transported in air and ultimately are deposited on land or open water bodies. In water mobility and transport of inorganic fluoride are dependent on pH, water hardness, and the prescience of ion exchange mineral. Inorganic fluorine compounds are used in industry for a wide range of purposes. They are used in aluminium production and as a flux in the steel and glass fibre industries.They can also be released to the environment during the production of phosphatefertilizers which contain an average of 3.8% fluorine, bricks, tiles and ceramics. Fluorosilicic acid, sodium hexa-fluorosilicate and sodium fluoride are used inmunicipal water fluoridation schemes (IARC, 1982; IPCS, 2002).Traces of fluorides are present in many waters; higher concentrations are oftenassociated with underground sources. In seawater, a total fluoride concentration of 1.3mg/litre has been reported (Slooff *et al.,* 1988). In areas rich in fluoride-containingminerals, well water may contain up to about 10 mg of fluoride per litre. The

highestnatural level reported is 2800 mg/litre.

Fluorides may also enter a river as a result ofindustrial discharges (Slooff *et al.,* 1988). In groundwater, fluoride concentrationsvary with the type of rock the water flows through but do not usually exceed 10mg/litre (US EPA, 1985a).

Fluoride concentrations in the groundwater of some villages in India were greaterthan the normal range of WHO (1.5 mg/litre). Virtually all foodstuffs contain at least traces of fluorine. All vegetation containssome fluoride, which is absorbed from soil and water. The highest levels in fieldgrownvegetables are found in curly kale (up to 40 mg/kg fresh weight) and endive (0.3–2.8 mg/kg fresh weight) (Slooff *et al.,* 1988). Other foods containing high levelsinclude fish (0.1–30 mg/kg) and tea (US EPA, 1985a; Slooff *et al.,* 1988). Highconcentrations in tea can be caused by high natural concentrations in tea plants or bythe use of additives during growth or fermentation. Levels in dry tea can be 3–300mg/kg (average 100 mg/kg), so 2–3 cups of tea contain approximately 0.4–0.8 mg (IPCS, 1984; Slooff *et al.,* 1988). In areas where water with a high fluoride content isused to prepare tea, the intake via tea can be several times greater.

Sodium fluoride (NaF) is a widely used chemical compound known for its application in dental care products and water fluoridation. While its benefits in preventing dental caries are well-documented, concerns regarding its potential toxic effects, particularly at elevated exposure levels, have garnered increasing attention. Several epidemiological studies are available on the possible association betweenfluoride in drinking-water and cancer rates among the population. IARC evaluatedthese studies in 1982 and 1987 and considered that they provided inadequate evidenceof carcinogenicity in humans.Few reports available in this line stated that fluoride toxicity results in impairment of fertility (Messer et al. 1973), low birth rate (Messer et al.1973; Freni 1994), and deflagellation of sperm both in human ad experimental animal (Chinoy and Sequeria 1989).Elevated fluoride intakes can also have more serious effects on reproductive organmay be observed whendrinking-water contains 230 mg of fluoride per litre.Recent studies suggest that $1/20^{th\ (11.5ppm)}$ Sodium fluoride concentration may impact reproductive organ.

METHODOLOGY:

Subjects: Male albino rats were divided into three groups: a control group (0 mg/L NaF), an acute group (0.23mg/L NaF) for 72-96 hrs, and a chronic group (0.0115mg/L NaF) for 90 days.

Exposure: NaF was administered through drinking water.

Assessments: At the end of the exposure period, rats were euthanized, and the testes were collected for histological examination.

Histological Analysis: Testicular tissues were processed and stained with hematoxylin and eosin (H&E) for microscopic evaluation.

RESULT AND DISCUSSION:

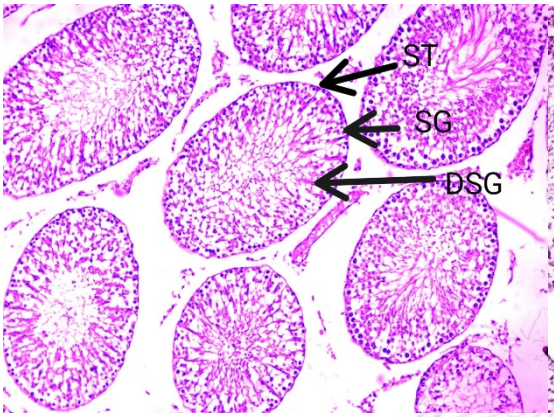

Figure 1: Control group

Figure 2: Control group

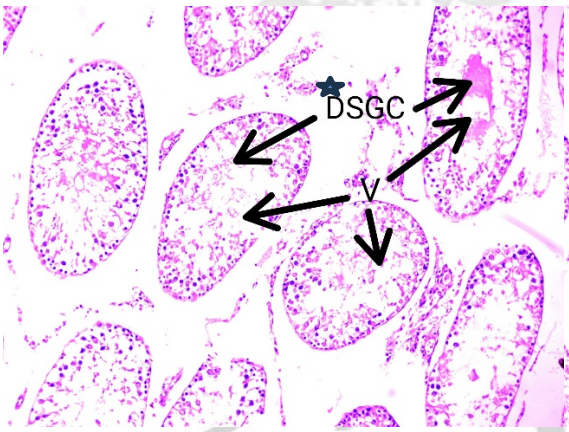

Figure 3: 1/20th of chronic T. S. of testis

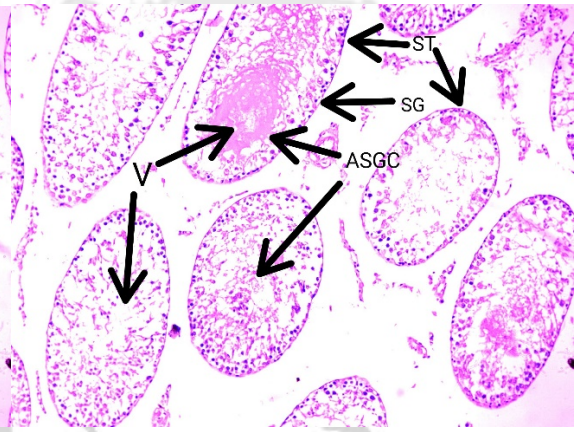

Figure 4: 1/20th of chronic T. S. of testis

{ST: Seminiferous Tubules, SG: Spermatogonia, DSG: Developing Spermatogonia, DSGC : Degenerated Spermatogonial Cells, ASGC: Arrested Spermatogonial Cells, V: Vacuole}

In control group normal histology of male testis was(fig.1) clearly observed such as seminiferous tubule was complete with natural size and shape, In the seminiferous tubule normal histological was present in the manner of spermatogonia mother cell, different stages of developing spermatogonia, and spermatid.

Testicular tissue of figure 2 in the current study showed atrophy of seminiferous tubules with Interstitial calcification, whereas testicular tissue of figure 3 showed focal testicular degeneration with single or multiple layers of vacuolated spermatocytes with a little evidence of spermatogenesis. In experimental condition(figure 3 and 4) in Chronic group (long term exposure to 1/20thNaF for 90 days) exhibited significant degeneration of seminiferous tubules, reduced the number of spermatogenic cells, arrested the future development of spermatogonial cells increased interstitial space as compared to controls. Recent studies revealed that the testes undergo severe diffused testicular degeneration with numerous spermatocytes and spermatid giant cell formation

(the cells might be fused together to form such giant cells) without spermatogenesis after exposure in sodium fluoride (NaF) in 1/20th concentration for 90 days. The spermatocytes were mostly necrotic in condition was observed.

CONCLUSION:

The current study proved that Sodium fluoride has chronic (90 days) toxic effects on the structure and function of testicular tissues of male albino rats. Therefore, it is suggested that continuous consumption of sodium fluoride through drinking water or any other sources as compared to normal range its show adverse impact on the reproductive organ of experimental animal. Its toxic effects was alter the histological architecture of testis.

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A Review on Fresh Water Fish Diseases: Types, Causes and Their Treatment

Swati L. Nalinde
Dept .of Zoology,
Shri. Shivaji Science and Arts College, Chikhali
And
Dr. M.T. Nikam
Dept.of Zoology,
Shri. Shivaji Science and Arts College, Chikhali, Dist. Buldana

ABSTRACT

Freshwater fish are susceptible to a range of diseases that can adversely impact their health and aquaculture productivity. These diseases are primarily caused by various pathogens including viruses, bacteria, parasites, & fungi. Generally freshwater fish is the principal source of protein for people in many parts of the world. In fish outbreak of diseases caused by stress such as natural drought or pollution or predators. The most common fish disease particularly in fresh water aquarium, include columnaris, gill disease, dropsy, ick, tail and fin rot infections, white spot disease, vitamin C deficiency, cloudy eye, furunculosis etc. Due to water pollution a huge amount of bacteria affect fish body. In the review article topic "A Review on Fresh Water Fish Diseases: Types, Causes and Their Treatment" several studies have been published providing further evidence how the different types of diseases harm fish diversity in aquaculture habitat, their cause and their preventive measures.

Keywords: Fish diseases, aquaculture, pathology, treatment, diagnostics

INTRODUCTION:

Freshwater fish diseases are broadly categorized into infectious and non-infectious types. Infectious diseases include bacterial, viral, parasitic &fungal infections. Bacterial infections are commonly caused by species such as *Aeromonas* and *Pseudomonas*, presenting symptoms like ulcers and fin rot. Viral diseases involve pathogens like Carp Edema Virus and Largemouth Bass Virus, which cause lesions and systemic issues. Parasitic infections are caused by protozoa (e.g., *Ichthyophthirius*), worms, or crustaceans (e.g., *Argulus*), leading to skin, gill, and internal organ problems. Fungal infections often occur secondary to other issues, manifesting as cotton-like growths. Non-infectious diseases arise from environmental stress, nutritional deficiencies (e.g. vitamin C deficiency), or physical injuries, which weaken fish and make them more susceptible to infections. Freshwater fish are susceptible to a range of diseases that can impact their health, growth, and survival. Understanding these diseases is crucial for effective treatmentmanagement and in aquaculture and natural habitats. This review aims to provide a comprehensive overview of freshwater fish diseases, focusing on their causes, symptoms, and treatment options.

Common symptoms of freshwater fish diseases include behavioral changes e.g. reduced

activity, physical signs for examplelesions, ulcers, abnormal growths, and physiological distress for example labored breathing. Symptoms vary depending on the type and severity of the disease.

TREATMENT STRATEGIES:

Treatment approaches differ based on the disease type. Bacterial infections are typically managed withand improved water quality targeted antibiotics. Viral infections require supportive care and management of environmental conditions. Parasitic diseases are treated with anti-parasitic medications and regular cleaning of tanks or ponds. Fungal infections are addressed with antifungal treatments and maintaining optimal water conditions. For non-infectious diseases, addressing environmental factors, ensuring proper nutrition, and minimizing physical damage are crucial.

MATERIAL AND METHOD:

The comprehensive articles search using keywords like (fresh water fish) and (fresh water fish disease) and (aquaculture) and (aquatic disease) and (fish pathology) and (diagnostics) articles published in research paper. A selective filtration strategy was applied for articles published only in the English language and studied that were conducted in the different countries were included for the review. Data extraction was done by using the search keywords. Discussions were made on the basis of included articles key findings such as data for author, year, study period and summary were extracted.

RESULT AND DISCUSSION:

In the review article topic," **A Review on Fresh Water Fish Diseases: Types, Causes and Their Treatment**" several studies have been published are discussed below.

In research article Contemporary threats of bacterial infections in fresh water fish **Agnieszka Pekala- Safinska (2018)** discussed about how fresh water ecosystem develop treats of diseases. In research article salmonscan: A novel image dataset for machine learning and deep learning analysis in fish disease detection in a aquaculture **Ahmed M.S.and Jeba S.M.(2024);** discussed about deep learning and machine learning analysis in fish diseases. **B. Sai Kumar et.al. (2024**) in research article researched about A study on fish diseases in freshwater aquaculture at Siddipet (D) Telangana state, India. In review article fresh water and marine water fish diseases: A review, **Dr. Swarnima Kumari (2020)** discuss about how pathogenic microorganisms infect fishes and other causes too. In research article Bacterial Pathogenesis in various fish diseases: Recent Advances and specific challenges in vaccine development **Irshath A.A; ett.al. (2023)** discuss about how fast rowing aquaculture sector is plagued by a plethora of bacterial pathogens that infect fish. In review article "Diseases of freshwater fishes in India and its treatment: A review'' **Kalaria KK, et.al. (2024)** discussed about fresh water fish diseases and their treatment. **Praveenraj J. (2024)** in reseach article "First report of two bacterial diseases from the freshwater fishes of the Andaman Islands, India'' discussed about bacterial disease from the Andaman and Nicobar Islands during 1996-1999. **Sen K. And Mandal (2018)** in research article "Fresh-water fish diseases in West Bengal, India'' they discuss about fish diseases, causes and their treatment**.** In a case study**, "**fish

disease detection system: A case study of freshwater fishes of Bangladesh'' **Sikder J. Et.al. (2021**) discuss about fish disease detection based on the K-means and C-means fuzzy logic clustering method to segment the filtering image.

CONCLUSION:

Effective management of freshwater fish diseases involves accurate diagnosis, preventive measuresand appropriate treatment. Regular monitoring of water quality, nutritional balance, and fish health can mitigate the risk of disease outbreaks and promote overall fish well-being.

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Clarifying the Dominance and Recessiveness of Morphogenetic Traits in the Jalgaon District Population

Chude Meghraj V.
Department of Zoology,
B.P. Arts, S.M.A. Science & K.K.C. Commerce College, Chalisgaon
Dist. Jalgaon, 424101 (MS) India
And
Pawar Santosh S.
Department of Zoology,
Government Vidarbha Institute of Science and Humanities (Autonomous),
Amravati, 444604 (MS) India.

ABSTRACT

This study investigates the prevalence of ten morphogenetic traits in a sample population from the Jalgaon district, aiming to clarify the distribution of dominant and recessive characteristics. The traits analysed include earlobe attachment, dimples, index finger length, tongue rolling, chin shape, hitchhiker's thumb, handedness, widow's peak, arm crossing, and hair nature. Data were collected from 1,000 individuals through physical examination and recorded via Google Forms for efficient analysis. The results were compared with existing literature and data from other regions to assess the dominance and recessiveness of these traits. The findings provide insight into the genetic makeup of the Jalgaon population and contribute to broader understanding of morphogenetic trait distribution in different regions.

Keywords: Morphogenetic Traits, Dominant traits, Recessive traits, genetic makeup.

INTRODUCTION:

Morphological traits pertain to the external physical features or observable characteristics of individuals. A trait refers to a specific variation in an organism, serving as a noticeable characteristic in an individual (Munir *et al.,* 2015). Morphogenetic traits are physical features passed from one generation to the next, following either an autosomal dominant or recessive inheritance pattern. These traits vary widely among populations. Many studies examined their distribution, prevalence, and inheritance patterns across different populations. While the exact mechanism of genetic regulation is still unclear, further research is needed in this area. However, morphogenetic traits are highly important in evolutionary biology, human genetic variation and taxonomy (Das and Sengupta, 2003). Genetic variation in human traits reveals a wide range of morphogenetic characteristics within populations (Anna, 1976). The process of inheritance explains how alleles work together to express morphogenetic traits (Rostand and Terty, 1964). Inherited traits result in a combination of characteristics resembling those of the parents. More than 200 morphogenetic traits are passed down through generations (Amlaku, 2021). While some traits

follow Mendelian inheritance patterns, others deviate from this pattern (Ebeye *et al.,* 2014). These traits can be useful for human identification and demonstrating key genetic principles. Their inheritance patterns may be either monogenic or polygenic and can sometimes be influenced by gender. Fundamental ideas in genetics, the principles of dominant and recessive characteristics affect the phenotypes and behaviors of many different organisms. Recessive alleles only show effects when two copies are present, whereas dominant alleles suppress the expression of another allele. Understanding inheritance patterns and evolutionary strategies requires an understanding of this genetic basis.

To find changes at the genome level, a variety of sequencing methods are used, including single nucleotide polymorphism, micro- and mini-satellites, nucleotide insertions, and deletions (Chakravarti, 1999). However, it is imperative to investigate the expression patterns at the phenotypic level. The examination of morphological characteristics is getting importance in documenting the genetic variation that has transpired within a particular population. A common misconception regarding dominant and recessive traits in populations is the belief that dominant traits will gradually eliminate recessive traits over time. However, this assumption overlooks the complexities of genetic inheritance and population dynamics (Usha *et al.,* 2016). Recessive alleles persist within populations, often remaining unexpressed in heterozygous individuals, thus maintaining genetic diversity across generations. Whereas population genetic studies help explain how disease-related genetic variants are distributed, influenced by past demographic events and adaptations to local environments (Prohaska *et al.,* 2019). Commonly studied traits in genetics include earlobe attachment, dimples, tongue rolling, chin shape, Hitchhiker's thumb, handedness, widow's peak, arm crossing, hair nature, and the length of the index finger.

The earlobe, also referred to as lobules auricular, constitutes the soft and fleshy lower portion situated at the foundation of the external ear. Notably, it stands as the sole segment of the auricle lacking support from cartilage (Drake *et al.,* 2005). The attachment of the earlobe is considered a neutral morphological trait, and investigating its genetic origins is significant as it provides insight into the biological underpinnings of ear development (Shaffer *et al.,* 2017).

The small dip or indentations present on the face or other part of body called as dimple (Anibor *et al.,* 2021). One or both cheeks may exhibit one or multiple dimples, with occurrences on both cheeks being more prevalent than dimples on only one cheek (Pessa *et al.,* 1998).

Tongue rolling have the two traits roller and non-roller, while the genetic basis of tongue-rolling has not been conclusively established, there is speculation that the loci governing this trait could potentially influence variations in personality. However, definitive evidence supporting this connection is still pending (Azimi-Garakani *et al.,* 2008).

Smooth and cleft chin constitute two distinct variations within the chin trait. The presence of a cleft chin is governed by the dominant genotype, while a smooth chin is associated with the recessive genotype (McKusick, 2013). According to a study conducted by Usha et al. in 2016, there is a prevalence of the less dominant trait, specifically the cleft chin, among males. Interestingly, this characteristic displays a similar dominance in females as well.

The morphology of the thumb can be classified into two types: straight or curved, commonly known as Hitchhiker's thumb. A straight thumb exhibits a straight line, possibly with a slight arch when viewed from the side. Notably, a curved thumb is considered dominant over a straight thumb, as indicated by Usha et al. in 2016.Also, right-handedness is the dominant trait observed in the majority of the population, while left-handedness is less prevalent and considered a recessive trait (Usha *et al.,* 2016).

The Widow's peak, also known as mid-digital hairline, is determined by the expression of a gene associated with the hairline. This gene has two alleles: one for the dominant widow's peak and another for the recessive straight-line hairline (McKusick and Lopez 2009).

The index finger, situated between the thumb and middle finger, represents the second digit (2D) and is typically the most dexterous and sensitive finger following the thumb in the human hand (Fink *et al.,* 2004). Length of index finger generally observed three traits index finger is shorter than the ring finger, index finger is longer than that of the ring finger, index finger is the same length as ring finger.

Hair morphology, a qualitative trait in population genetics, exhibits three phenotypes (straight, wavy, curly) with a composition of keratin protein. Thibaut et al. (2007) found that curly hair correlates with a decrease in mesocortical cells, while straight hair shows a higher concentration of mesocorticalmacrofibrils.

OBJECTIVE OF THE STUDY:

These traits are selected for study because they are easily observable, inherited through simple Mendelian patterns, and show clear variations in dominance and recessiveness. Studying such traits helps in understanding basic genetic principles and how specific characteristics are passed down through generations. Additionally, these traits provide more information about the genetic diversity within a population.

STATEMENT OF HYPOTHESIS:

In the Jalgaon district population, the distribution of dominant and recessive morphogenetic traits follows Mendelian inheritance patterns, with certain traits exhibiting a higher prevalence of dominant expression, while others demonstrate a notable recessive expression. The variation in trait expression may also be influenced by genetic diversity and demographic factors unique to the population.

METHODOLOGY:

The study was conducted on an unrelated population of subjects native to the Jalgaon district, located in the northern region of Maharashtra, India. A total of 783subjects, aged between 18 and 70, will be randomly selected for the study. From which 537 are females and 246 are males. Informed consent will be obtained from all participants before data collection. Each participant will be provided with a clear explanation of the research purpose and procedures. Only those with a normal morphological appearance will be included in the study; individuals with deformities will

be excluded. The majority of the sample was collected by student teams during a high-traffic period in the local market. Data were systematically recorded using Google Forms to facilitate efficient data management and analysis. The data were collected following the method described in Table 1 to ensure accuracy and consistency.

Sr. No.	Morphogenetic traits	Dominant	Recessive	References
1.	Earlobe attachment	Free	Attached	(McKusickand Lopez, 2010).
2.	Dimples	Present	Absent	(Ebeye *et al.,* 2014)
3.	Rolling of tongue	Roller	Non roller	(Sturtevant; 1940)
4.	Chin	Cleft chin	Smooth Chin	(McKusick 2013)
5.	Hitchhiker's thumb	Curved	Straight	(Usha,*et al.,*2016).
6.	Handedness	Right-handedness	left-handedness	(Usha, *et al.,*2016).
7.	Widow's peak	Present	Absent	(McKusick and Lopez 2009)
8.	Crossing of arm	Left arm on the top of the right	Right arm on the top of the left	*NA*
9.	Hair nature	Straight *(Partial dominance)*	Curly	(Rehman *et al.,* 2020)

Table 1: Dominant and Recessive Variations of Morphogenetic Traits. (*NA*-Not available)

However, for the trait concerning the length of the index finger, three variations are generally observed: the index finger is shorter than the ring finger, longer than the ring finger, or equal in length to the ring finger. Additionally, literature indicates that this trait is sex-influenced (McDonald and Kemmerle, 2007). In this study, only the prevalence of these variations will be examined, as this trait does not appear to follow Mendelian inheritance patterns.

OBSERVATIONS AND RESULTS:

1. Earlobe attachment

The observed data for the earlobe attachment trait indicate that the free earlobe, a dominant trait, was present in 372 individuals, while the attached earlobe, a recessive trait, was observed in 411 individuals. Despite the dominance of the free earlobe trait, the frequency of the attached earlobe is notably higher.

Earlobe attachment	**Free (Dominant)**	**Dominant Frequency**	**Attached (Recessive)**	**Recessive Frequency**	Grand Total
Frequency	372	52%	411	48%	783

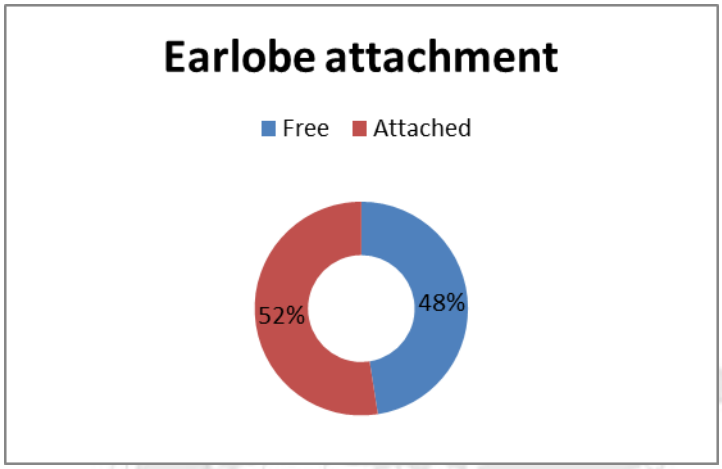

Fig 1- shows the percentage frequency of earlobe attached in population of Jalgaon District

2. Dimples

The observation of the dimple trait indicates that 230 individuals exhibited dimples, which is the dominant trait, while 553 individuals showed no dimples, a recessive trait. These frequencies represent the distribution of the dimple trait in the population studied.

Dimples	**Present (Dominant)**	**Dominant Frequency**	**Absent (Recessive)**	**Recessive Frequency**	Grand Total
Frequency	230	29%	553	71%	783

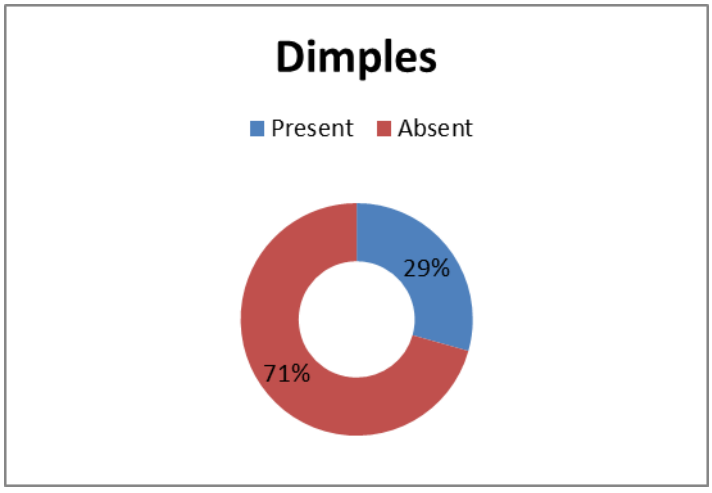

Fig 2- shows the percentage frequency of dimples in population of Jalgaon District

3. Rolling of tongue

The observation of the tongue-rolling trait shows that 446 individuals were able to roll their tongues, which is the dominant trait, while 337 individuals were non-rollers, a recessive trait.

Rolling of tongue	**Roller (Dominant)**	**Dominant Frequency**	**Non roller (Recessive)**	**Recessive Frequency**	Grand Total
Frequency	446	57%	337	43%	783

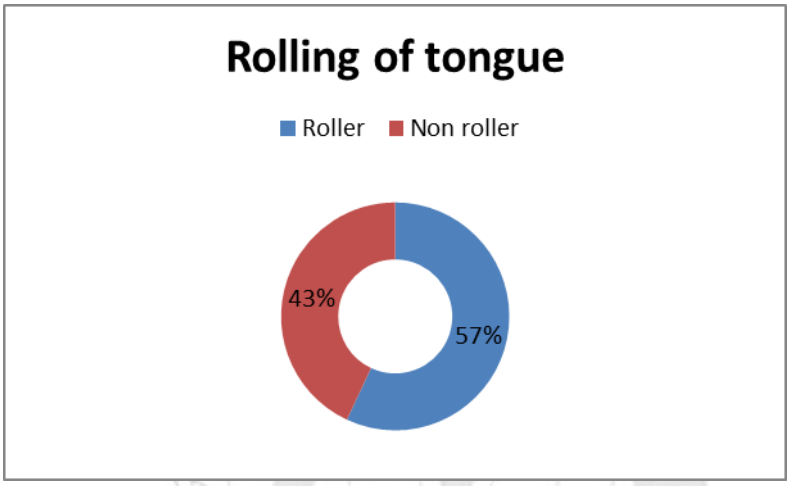

Fig 3- shows the percentage frequency of rolling of tongue in population of Jalgaon District

4. Chin

The observation of the chin cleft trait reveals that 213 individuals had a cleft chin, the dominant trait, while 570 individuals displayed a smooth chin, the recessive trait.

Chin	**Cleft chin (Dominant)**	**Dominant Frequency**	**Smooth chin (Recessive)**	**Recessive Frequency**	Grand Total
Frequency	213	27%	570	73%	783

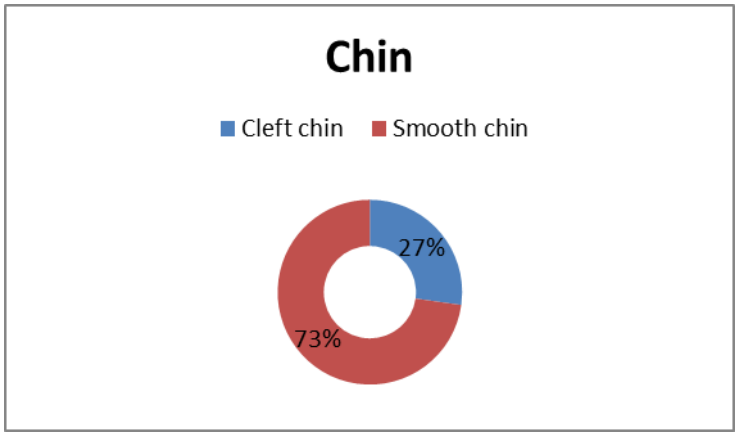

Fig 4- shows the percentage frequency of chin in population of Jalgaon District

5. Hitchhiker's thumb

The observation of the Hitchhiker's thumb trait shows that 374 individuals had a curved thumb, which is the dominant trait, while 409 individuals exhibited a straight thumb, the recessive trait.

Hitchhiker's thumb	**Curved (Dominant)**	**Dominant Frequency**	**Straight (Recessive)**	**Recessive Frequency**	Grand Total
Frequency	374	52%	409	48%	783

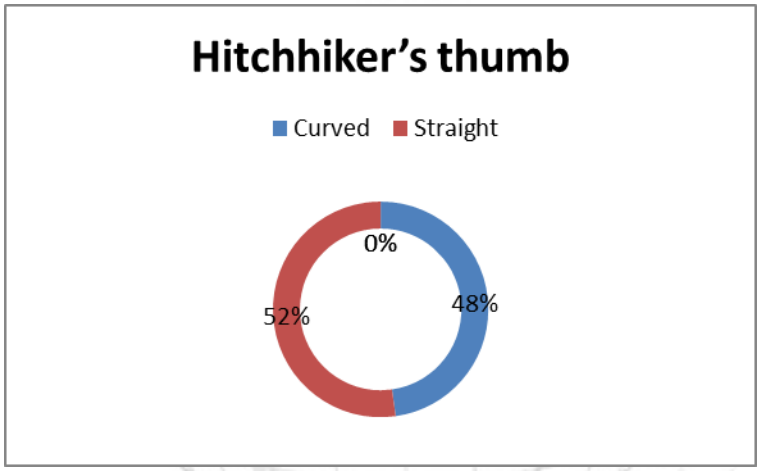

Fig 5- shows the percentage frequency of hitchhiker's thumb in population of Jalgaon District

6. Handedness

The observation of the handedness trait reveals that 623 individuals exhibited right-handedness, which is the dominant trait, while 160 individuals demonstrated left-handedness, the recessive trait.

Handedness	**Right-handedness (Dominant)**	**Dominant Frequency**	**Left-handedness (Recessive)**	**Recessive Frequency**	Grand Total
Frequency	623	80%	160	20%	783

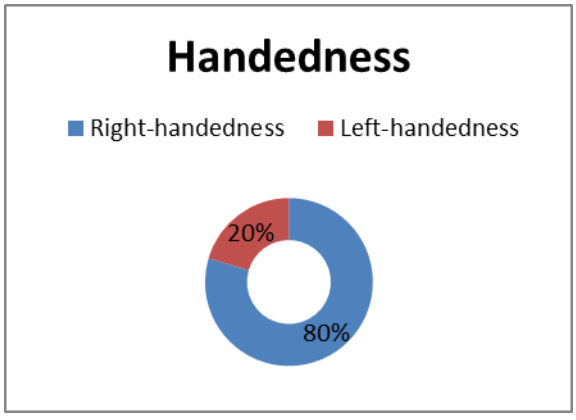

Fig 6- shows the percentage frequency of handedness in population of Jalgaon District

7. Widow's peak

The observation of the widow's peak trait shows that 343 individuals had a widow's peak, the dominant trait, while 440 individuals lacked a widow's peak, the recessive trait.

Widow's peak	**Present (Dominant)**	**Dominant Frequency**	**Absent (Recessive)**	**Recessive Frequency**	Grand Total
Frequency	343	44%	440	56%	783

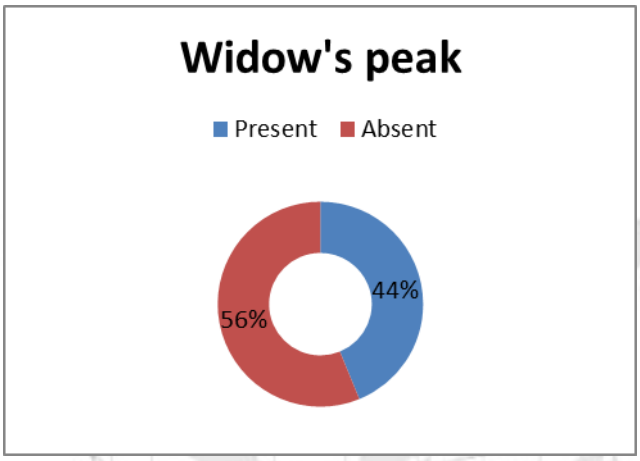

Fig 7- shows the percentage frequency of widow's peak in population of Jalgaon District

8. Crossing of arm

The observation of the arm-crossing trait indicates that 408 individuals exhibited the dominant pattern of placing their left arm over their right, whereas 375 individuals displayed the recessive pattern of placing their right arm over their left.

Crossing of arm	**Left arm on the top of the right (Dominance)**	**Dominant Frequency**	**Right arm on the top of the left (Recessive)**	**Recessive Frequency**	Grand Total
Frequency	408	52%	375	48%	783

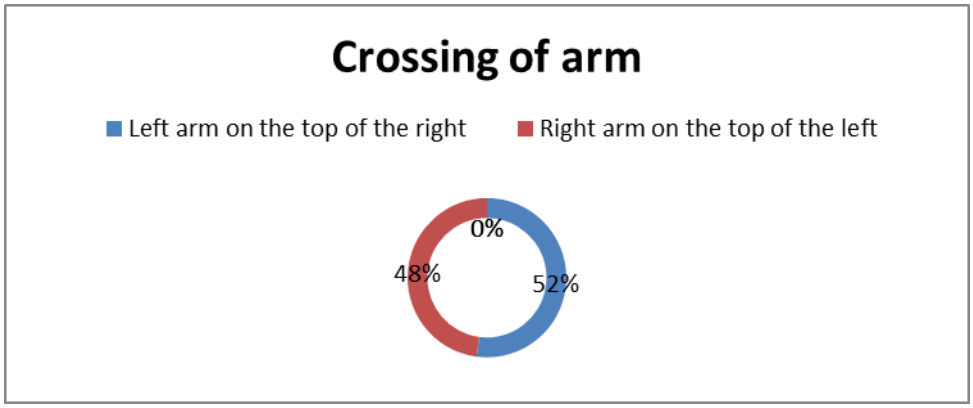

Fig 8- shows the percentage frequency of crossing of arm in population of Jalgaon District

9. Hair nature

The observation of the hair nature trait shows that 605 individuals had straight hair, the dominant trait, while 178 individuals had curly hair, the recessive trait.

Hair nature	**Straight (Dominant)**	**Dominant Frequency**	**Curly (Recessive)**	**Recessive Frequency**	Grand Total
Frequency	605	77%	178	23%	783

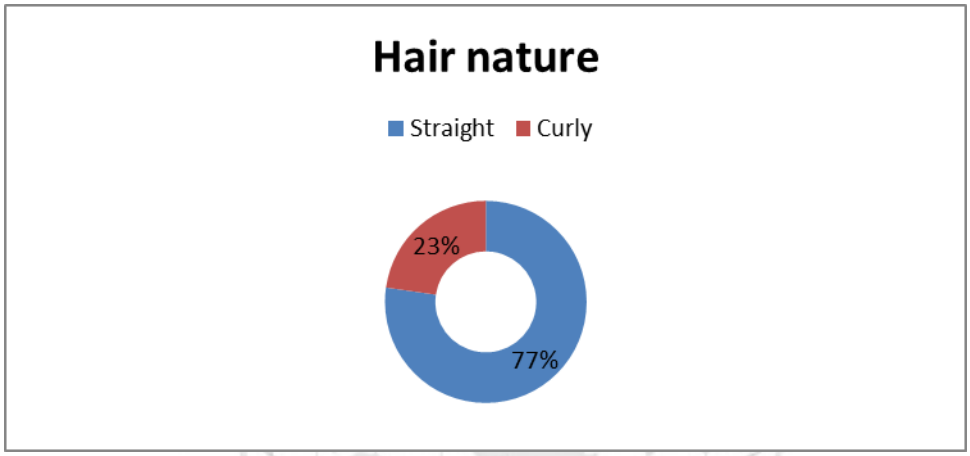

Fig 9- shows the percentage frequency of hair nature in population of Jalgaon District

10. Length of index finger

The observation of the index finger length trait reveals that 289 individuals had an index finger shorter than their ring finger, 258 individuals had an index finger longer than their ring finger, and 236 individuals had an index finger equal in length to their ring finger.

Length of index finger	**Index finger is shorter than the ring finger**	**Index finger is longer than the ring finger**	**Index finger is equal in length to the ring finger**	Grand Total
Frequency	289	258	236	783

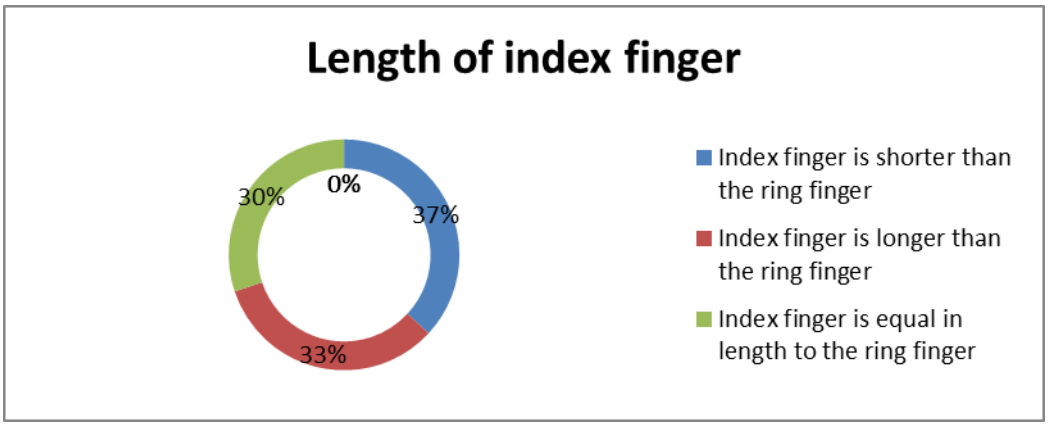

Fig 10- shows the percentage frequency of index finger length in population of Jalgaon District

CONCLUSION:

The results of the study on morphogenetic traits in the population of the Jalgaon district revealed distinct patterns of dominance and recessiveness across the ten traits examined. For traits like handedness, hair nature, and tongue rolling, the dominant variants (right-handedness, straight hair, and tongue rolling) were more prevalent, with a significant majority exhibiting these traits. In contrast, traits like the widow's peak and cleft chin, though dominant, had fewer occurrences, suggesting a more balanced distribution with their recessive counterparts.

Traits such as earlobe attachment and dimple absence displayed a higher frequency of recessive traits, even though the dominant trait is genetically expected to be more common. The study also highlighted those traits like arm-crossing and Hitchhiker's thumb showed nearly equal distributions between dominant and recessive traits, indicating variability in genetic expression within this population.

These observations underscore the complexity of genetic traits in human populations, where dominance at the genetic level does not always translate into higher population frequency. The data provide insight into the genetic diversity of the Jalgaon district population, contributing valuable information for understanding regional morphogenetic patterns. The prevalence of these traits may vary with changes in sample size. In future research, increasing the sample size could lead to different results for the same population, offering a more comprehensive understanding of the genetic distribution of these traits. Further studies will help refine the conclusions drawn from this research.

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Impact of Climate Change on Biodiversity

Bajad P. N.
Department of Zoology
Shri Muktanand College, Gangapur-431109

ABSTRACT

Climate change is the gradual and continuous process results in increasing temperature, biodiversity loss and disturbances in weather cycle. Human activities like deforestation, Pollution, increasing population, greenhouse gases, overexploitation of natural resources are responsible for disrupting climate. This impacts the unpredictable weather and increasing global temperature. Continuous increase in the greenhouse gases like carbon dioxide, methane and nitrous oxide in recent years are the main cause of climate change. Frequent natural disasters, rise in sea level, low agriculture production and continuous decrease in the biodiversity are results of disturbed climatic changes. In this context the different cause of climatic changes and their hazardous effects on biodiversity and environment are briefly discussed.

Keywords: Climate change, biodiversity, greenhouse gases, natural disasters, weather cycle.

INTRODUCTION:

The impact of climate change shows drought conditions, global warming, water scarcity, ocean acidification, rising sea levels, flooding, melting polar ice, unpredictable weather, decreasing biodiversity. Climate change negatively impacts on biodiversity results in changing ecosystem, disturbed food chains, species extinction, habitat loss. Relation between climate change and biodiversity shows both sides of coin, as climate change results in loss of marine and terrestrial biodiversity as well as biodiversity helps to increase climate mitigation and adaptation. Climate change and biodiversity are interdependent, these two environmental factors mutually strengthen each other. Habitat loss is not same around the globe, some species are at more risk than others in different regions. Human activities negatively impact on biodiversity like habitat loss, while urbanization, deforestation, agricultural activities directly decrease the resources and space for living.

Following are some of the factors that reflects the process of climate change which adversely affects the biodiversity and ecosystem:

Habitat alteration and destruction

Habitat destruction is the process involved removal or disturbances of the conditions crucial for survival of plants and animals. Habitat loss is the threat which indirectly increases the mortality and reduces the natality rates, the trend is non-existent or even reversed (Owens and Bennett, 2000; González-Suárez *et al.,* 2013), while the main factor directly affecting biodiversity

loss globally is habitat alteration and destruction. Species with lower average temperatures within their range or narrower temperature ranges are especially at risk due to an increasingly warmer climate (Jiguet *et al.,* 2010; Flousek *et al.,* 2015). In contrast, thriving under broad temperature ranges grants species the necessary flexibility to deal with environmental or climatic change and hence lower their extinction risk (Lootvoet *et al.,* 2015). The dramatic decreases in house sparrow population in India is experienced in recent past. It is linked with pollution caused by electromagnetic radiation from mobile phones. Microwave towers (Balmori and Hallberg, 2007). The vulture has suffered a 99% population decrease in India (Prakash, 2007) and become rare due to poisoning by DDT used as pesticides and also by diclofenac which is used as veterinary non – steroidal anti- inflammatory drug, leaving traces in cattle carcasses which when fed by vultures leads to thinning of egg shells resulting into premature hatching and kidney failure in birds.

Impact Of Green House Gases:

Greenhouse gases (CO_2, CH_4, N_2O, F-2 gases) are present in the atmosphere that traps the heat during day, During night when earth's surface cool down releases heat back into the air. But some amount of heat is trapped by the gases in the atmosphere.

CO_2 gas release from various processes such as burning of fossil fuel, vehicles, factories, forest fires, volcanos, decomposition, respiration and much more. Carbon dioxide is called as greenhouse gas as it warms the environment through the process known as greenhouse effect. Carbon dioxide molecules present in the atmosphere absorbs long-wavelength infrared energy (heat) from the sun and then re-radiate it, some of it back downward.

Methane (CH_4) is a strong and harmful greenhouse gas and responsible for global warming. Burning of fossil fuels, agriculture, coal mines, oil and natural gas systems and waste water emits the methane gas in environment. Human activities add about two-third of methane gas emission globally (Saunois M, *et al.,* 2016)

N_2O is less in atmosphere but more responsible for global warming than CO_2 and methane. It is responsible for ozone depletion. Nitrous oxide releases in environment through application of fertilizers in farms, agricultural soil, crop management practices, management of manure, burning of crop residues. Human activities like combustion of fossil fuels which are used in cars, welding purpose, refining of metals and petrol, food manufacturing. Chronic diseases caused by nitrous oxide are memory loss, deficiency of vitamin B12, brain and nerve damage.

F-2 or fluorinated gases responsible for high global warming as compared to other greenhouse gases. Hence, they contribute more to climate change. These gases are used for cooling purpose like refrigeration, air conditioner, aerosol cans, production of metals and semiconductors.

Decrease In Crop Productivity:

Primarily agriculture get affected by changing weather and climate. (Walsh, M.K., et al. 2020). Agricultural crop depends on quality of land, ample availability of water and natural resources that changing climate affects directly. (Gowda, P., et al.2018). Climatic condition impacts healthier or dreadful for crops in various regions, as rise in temperature, heavy or low

rainfall and frost free environment directly responsible for extending growing period in every region (Gowda, P., et al.2018). Drastic climate change and low adaptation capacity, simulated loss in crop production from 7% to 23% (Ehsan Eyshi Rezaei, *et al.,* 2023). Rise in temperature, disturbed rainfall period affect on plant efflorescence and pollinating agents like butterflies, birds, bees etc. (Walsh, M.K., et al. 2020). If the period of flowering and pollinator emergence not match, then the pollination process could decrease (Walsh, M.K., et al. 2020). Continuous rise in temperature the production of paddy and maize in the East Indian Coastal areas adversely (Kumar *et al.,* 2011).

Rise In Sea Level:

Rise in sea level is adverse effect of climate change. Past records shown from analysis increase of 1-2mm of sea level every year around the world. Every year in kerala coastal fishing group is in danger due to unreliable monsoonal rainfall (Salim et al. 2014). Climate change affects the shoreline, coastal flooding directly damages the coastal communities and disturbed the coastal zone management (Krishnamurthy *et al.,* 2014; Rajasree *et al.,* 2016; Rao, Upadhaya, *et al.,* 2020). Rise in sea level increasing to 3.7mm per year from 2006 to 2018, which is the great trouble for coastal communities (IPCC,2021).

Unpredictable Weather:

Climate change increase the frequency of hot days, drought condition and scarcity of water every year. Number of hot days are more in central part of India and lesser in west coast areas (Kothawale, 2005). While number of rainy days are decreased by 1-5 days, but the severity of rainfall is increased as 1-4 mm/day in the east coast (Geethalakshmi *et al.,*2016).

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Study of spider diversity from campus of Vinayak Vidnyan Mahavidyalaya, Nandgaon Kh. Dist. Amravati (MH)

Dr. Pratibha Mahalle
Department of Zoology,
Vinayak Vidnyan Mahavidyalaya, Nandgaon Khandeshwar,
Dist. Amravati

ABSTRACT

Spiders belonging to Order Araneda are the largest order in the Class Arachnida. Spiders represent the second largest order within the arachnids. The spiders play an important role in maintaining biological balance of nature.

This study focuses on the diversity of spiders in college campus of Vinayak Vidnyan Mahavidyalaya, Nandgaon Khandeshwar. The spiders were observed from all the significant area, photographed and identify using standard identification guide references. Spiders were collected from various areas of college and collected from specific habitat like window, porch, gallery, office, classrooms and garden and plantation areas of college. Spiders are observed and the photograph were taken and recorded. From the study area the family diversity of spider species was recorded Araneidae (04 species), Sparassidae (02 species), Salticidae (04 species), Lycosidae (01 species), Desidae (01 species), Sicariidae (01 species), Opiliones (01 species), Pholcidae (02 species). Thomisidae (01 species). Total 09 families were collected. Among all the families Araneidae and Salticidae both families were dominated the studies over remaining families.

The present study was carried out to report the Spider Diversity in college at Nandgaon Khandeshwar This study is attempted to investigates the identified the status of spider population and their species to find out their occurrence and a detailed investigation around in the college to understand the role of spiders in ecosystem function, and to create the awareness for their conservation. In future need to explore further the study of spider diversity in order to maintain the ecological equilibrium.

Keywords: Spiders, Biodiversity, Nandgaon Kh, Ecosystem

INTRODUCTION:

Spiders are found in the worldwide region. Spiders are the belonging to the class Arachnida and are ancient Arthropods having history of about 350 million years ago. They differ from the class Insecta due to the absence of antennae and wings.Spiders are a diverse and ecologically important order of invertebrates Spiders are among the most diverse groups of organisms globally (Coddington & Levi 1991) with over 45,000 species described worldwide (World Spider Catalog 2015). Arachnids are an important and generally poorly studied group of phylum Arthropoda. Despite increased awareness of the need to consider terrestrial invertebrates in

conservation management (New 2012; Lester et al. 2014), they are one of the most understudied groups of Arachnids. Most invertebrate species are undescribed, their distributions are unknown, and knowledge of their biology and ecology is often inadequate.

India is rich in flora and fauna both and it is a big diverse country. Knowledge about the diversity, Spiders form one of the most ubiquitous groups of predaceous groups in the animal kingdom (Riechert and Lockley 1984). Spiders are unique among all organisms in their modes of silk production. They are considered as biological control agents they help in maintaining the ecological balance in the nature by feeding on the small insects and in return these spiders are eaten by birds and are other bigger insects (Bhattacharya *et al.,* 2017). The body of spiders is divided into two parts comprising the cephalothorax and abdomen where the cephalothorax has 4 pair of legs and the abdomen do not have any segments (Sebastian & Peter, 2017). Spiders can not eat solid food, they have to liquefy the food by using digestive juices and then consume this liquid food. (Dharmaraj *et al.,* 2017).

Spiders belonging to Order Araneda are the largest order in the Class Arachnida. Spiders are representing the second largest order within the arachnids. The spiders are playing an important role in maintaining biological balance of nature. The spiders play very important role in the food chain in the ecosystem. The shelters of the spider are catch different types of the insects and used as food. There are 42,055 species of spiders are occurred in the worldwide.

Spiders are the most diverse groups of Arachnids on the earth, spiders have largely ignored because of the human tendency to favour some organisms over others of equal importance because they are lacking a universal appeal (Humphries et al. 1995). Spiders are playing an important role by exclusively predatory (Wise 1993) and they are regulating insect populations.

MATERIAL AND METHODS:

Study Area:

This study focuses on the diversity of spiders in and around college campus ofVinayak Vidnyan Mahavidyalaya, NandgaonKhandeshwar. The spiders were observed from all the significant area, photographed and identify using standard identification guide references and by comparison to published papers and online material. Spiders were observed from various areas of in and around collegecampus without disturbing their specific habitat like window, porch, gallery, office, classrooms, laboratories, and garden and plantation areas of college. Spiders are observed and the photograph were taken and recorded how many species are observed familywise and note down it.

The spider study was carried out the period from July to December 2023. The survey was conducted in the morning time in between 09 am to 11am.

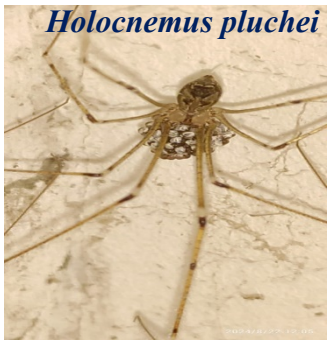
OBSERVATION AND RESULT:

From the study area in and around college campus ofVinayak Vidnyan Mahavidyalaya, Nandgaon Khandeshwar, the family diversity of spider species was recorded Araneidae (01 species), Sparassidae (01 species), Salticidae (03 species), Lycosidae (01 species), Desidae (01

species), Sicariidae (02 species), Phalangiidae (01 species), Pholcidae (02 species). Thomisidae (02 species), Eresidae (01 species).

S.No	Family	Scientific Name	Common Name
1	Araneidae	*Argiope anasuja*	Signature Spider
2	Sparassidae	*Heteropodavenatoria*	Huntsman Spider
3	Salticidae	*Hasariusadansoni*	Adamson's Jumping Spider
		Plexippus paykulli	Pantropical Jumping Spider
		Telamonia dimidiata	Striped Jumper Spider
4	Lycosidae	*Lycosa singoriencies*	Wolf Spider
5	Desidae	*Badumna insignis*	Black House Spider
6	Sicariidae	*Loxoscelesreclusa*	Brown Recluse Spider
		Loxosceleslaeta	Chilean Recluse Spider
7	Phalangiidae	*Opiliones*	Harvestman Spider
8	Pholcidae	*Pholcus phalangioides*	Long Bodied Cellar
		Holocnemuspluchei	Marbled Cellar Spider
9	Thomisidae	*Philodromusmargaritus*	Running Crab Spider
		Misumenopsbellulus	Crab Spider
10	Eresidae	*Stegodyphussarasinorum*	Social Spider – Velvet Spider

Table – 1 Spiders found in study area in and around college campus of Vinayak Vidnyan Mahavidyalaya, NandgaonKhandeshwar.



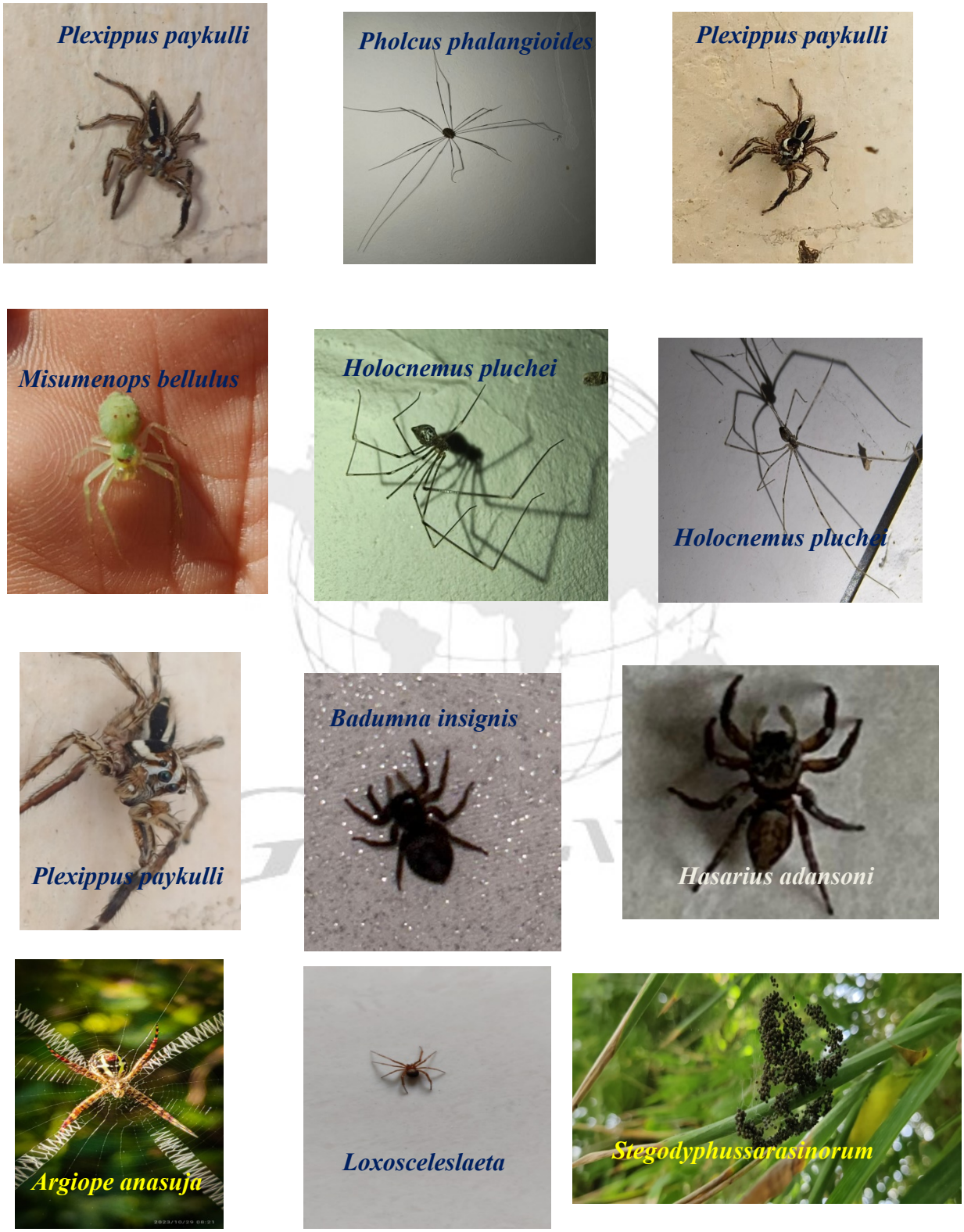


Fig – 1 Spiders Found in and Around College Campus of Vinayak Vidyan Mahavidyalaya, Nandgaon Khandeshwar.

DISCUSSION:

This paper present basic and preliminary survey of spider diversity in and around college campus of VinayakVidnyan Mahavidyalaya, NandgaonKhandeshwar. Spiders are taxonomically diverse and exhibit community level diversity; they are useful indicators of environmental change. (James PG.) R I Pocock and B K Tikadar have spotlighted Indian Arachnology and described 112 new species of spiders from India, several others species are contributed to the field adding and updating the checklist. (Manju S, and et.al. 2005). Spider biodiversity, distribution and their insect feeding habits play an important role in balance of nature (Yong and Edward, 1990).

In this present study total 10 families were observed. Total 15 spider species were observed. Among all the families Salticidae families were dominated and then second one Sicariidae, Pholcidae, Thomisidae families are dominated studies over remaining families.

CONCLUSION:

It is a preliminary study of spider diversity. This was the first attempt to document spider diversity in and around campus of Vinayak Vidnyan Mahavidyalaya College at NandgaonKhandeshwar. Since the study area one side of the campus is a human dominated landscape, they are facing threats like habitat loss, pollution and changes in land use pattern. Appropriate conservation strategies should be developed and implemented to conserve the floral and faunal diversity in and around the college campus.

The present study was carried out to report the Spider Diversity in and around college campus at NandgaonKhandeshwar. This study is attempted to investigates the identified the status of spider population and their species to find out their occurrence and a detailed investigation around in the college to understand the role of spiders in ecosystem function, and to create the awareness for their conservation. In future need to explore the further study of spider diversity in order to maintain the ecological equilibrium in and around the campus area of college.

This preliminary study gives base line information of spider diversity and distribution in and around the college campus. The further detailed and more intensive studies may bring out more information and documentation of more spiders species in and around college campus of Vinayak Vidnyan Mahavidyalaya, Nandgaon Khandeshwar . (MH).

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Highway underpass and nesting habits of birds: A preliminary study to understand biodiversity of birds in urban infrastructure

Dr. Gajendrasingh Pachlore
Vinayak Vidnyan Mahavidyalaya, Nandgaon (kh)
And
Dr. Mamta Chandrakar
Department of Zoology, Bajaj College of Science, Wardha

ABSTRACT

Growing urbanisation is a matter of great concern as it puts a great anthropological pressure on the other living organism from plants to mammals. Loss of habitat, road kills, loss of vegetation result in degrading biodiversity. However few species manage to sustain and adopt themselves in changing habitat. This study tries to understand the use of underpass by some bird's species as their nesting habitat. The choice of such unusual adobe with heavy traffic over the highway intrigued to conduct the study. The Underpass have some structures that are preferred by few bird's species to nest. The study was carried out on NH-6 covering a patch of 40 km and identifying the underpass that inhabit birds species and their diversity.

Key Words: Underpass, Birds Nest, Biodiversity, Highways

INTRODUCTION:

Urbanisation greatly impact the biodiversity more often negatively with loss of habitat, fragmentation and degradation too.[1]The urban infrastructure creates a challenge for many species. Unable to adopt to the sudden change in the habitat could result in loss of species. The urbanisation and urban structure also influence the heat island effect, air, water and noise pollution etc.[2]. In the context of urbanisation, roads and highways plays a crucial role in developing the economy but it also impacts hugely on the biodiversity. However, with growing urban infrastructure, our wild counterparts are left with no option but to either loose the habitat or to adopt to the changing conditions. The avian species have been found to be pretty much around human settlement as food and shelter much needed for the survival could be easily managed around human settlement. The old thatched roof houses in rural areas provided a good supporting structure for many avian species to nest however with growing concretisation the nest building material and also the dwelling place has been lost. The birds show adaptive strategies to overcome such habitat loss and instead have found to make optimum use of anthropogenic structures[3]. The construction of highways requires a large area to be cleared which results in loss of native vegetation and also introduction of non-native vegetation for beautification around the dividers. The dependency birds for nest building material gets hampered by such non-native plants[4,5,6]

It was found in several studies that few birds species like passerine, swallow and starlings inhabit and adapt wel to the anthropogenic structures[7]. The anthropogenic structures like highways underpass are proving to be blessings in disguise for few species.

MATERIAL METHOD

The study was carried out on NH6 highway which is popularly known as Mumbai Kolkata highway it intersects Nandurbar, Dhule, Jalgaon, Buldhana, Akola, Amaravati, Wardha, Nagpur, Bhandara, and Gondiya.In the present study a small patch from Amravati district spanning a length of 40 km from rahatgaon village towards Nagpur side to Kurum village towards Akola side was surveyed to identify the underpass that facilitate the connectivity of the cities and villages. The underpass was specifically visited to site the presence of nest of birds or the presence of birds for resting and perching. Visits were organised on Sundays and other holidaysfor 2 months from July to august. The sites were photographed and observed using binoculars (Olympus 7x35 dps-i).

OBSERVATION:

In stretch of 40 km total of 14 underpass were encountered out of which 7 shows presence of abutment wall with weep holes, pier and beams. The space between abutment and beam were utilized by birds to make nest[8].The house swift nest were most commonly found in almost all the 7 underpasses varying only in the number of nests. The swift's nest was most abundantly found at underpass near chatritalavlake and the underpass near Badnera. Both the sites were found near to the water body a pond and a waste water stream respectively.

The weep holes are inhabitat by passer family.

Beam of an underpass with nest of house swift

Underpass with low heights is not the preferred site of nest building for ves.

RESULT:

At least concern avian species like house swifts & Blue rock pigeon were found to be inhabiting the underpass with abutment, pier and beams. The weep holes present in the abutment walls used for drainage of water that could percolate in the abutment wall and could cause structural damage were used as a nesting site by common house sparrow[9,10,11,12,13]

This selection of unique nesting site by house sparrow suggests adaptaion in accordance with the changing habitat and acclimitsing with anthropogenic structure. Sparrow are also found to be habituated to loud noises and hence the noises of heavy vehicles continuously moving above the nest bothers them the least[14]

CONCLUSION:

The study suggest that anthropogenic structures are getting used by avian specie to inhabit. The otherwise least concern species are optimally using linear structures. Although the linear structures result into habitat loss but adaptation among the birds in utilizing the urban structure could be a boon in disguise. An Mitigatory efforts should be made to adopt design that could help in accommodating more birds species in such urban structures. We wish to carry out this study further to understand how the vegetation around the linear structure influences the abundance of a particular species.

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Some Soil Invertebrates of Washim District, Maharashtra, India

Idhole S. V.
P.G. and Research Department of Zoology
R. A Arts, Shri M.K Commerce and Shri S.R. Rathi Science College Washim

ABSTRACT:

The present study is a primary attempt to describe the soil invertebrates of Washim.Soil invertebrates are an essential part of soil and they regulate productivity and health of soil. Due to various factors, the diversity of soil invertebrates is under threat so, the present study was undertaken to study these soil invertebrates around Washim region. The sampling sites for the present study were chosen randomly in and around Washim Region. The study was carried out in Sixmonths in which photography and identification up to possible lower taxa were done. During the present study about 18 different speciesbelonging to Seven different classes were reported.The class insect was found to be dominant with the maximum number of species. The members of Molluscs, annelids, arachnidans and a species of crustacean were also reported during the present study. This survey recommends that a long-term study of soil invertebrates is needed to know the exact number of communities present in the Washim region.

KEYWORD: Soil invertebrates**,** Diversity, crustaceans, arachnidans, molluscs, annelids etc.

INTRODUCTION

Small animals living in soils, called soil invertebrates, represent a very diverse group of soil inhabitants. They include earthworms, woodlice, spiders, springtails, mites, and some insects. Soil invertebrates feed on dead plants, on fungi and bacteria, or on other soil invertebrates. Soil invertebrates comprise all larval and adult stages living temporarily or permanently in soil and sometimes on the surface. Invertebrates are considered as bioindicators of soil **Paoletti, Favretto, Stinner, Purrington, Bater (1991).** The presence of soil invertebrates alters the physical and chemical structure of the soil rate and extent of the soil process **Stork and Eggleton (1992).** Nematodes are described as elongated, thread-like active animals and other related forms and they help in fertility. The effects of different types of plant cover on the relationship between soil structure and invertebrate communities in an Amazonian savanna were studied by **Franklin, Magnusson, and Luiza (2005).** Soil invertebrates are organisms present in soil that play a key role in nutrient cycling, decomposition and energy flow in the terrestrial habitat. The analysis of soil invertebrate activities shows that may be the best indicator of soil quality **Lavelle, Decans, Aubert, Barot, Blouin, Magerie, Mora, Rossi (2006).** The high diversity of plants, animals, and fungi species in tropical forests creates a variety of biotic and abiotic interactions and processes that lead to high levels of productivity concluded by **Sheehan (2007).** In nature, the soil is one of the integral elements that enable life on earth. Soil invertebrates are the invertebrate thatresides in the soil. The soil invertebrates areinvertebrates that spend all or much of their life in the soil. Soil is the foundation upon which society is sustained and evolveswhich is a vital component of

ecological processes and cycles, as well as the basis on which infrastructure rests **Menta (2012).** Soil represents one of the most important reservoirs of biodiversity. It reflects ecosystem metabolism since all the bio-geo-chemical processes of the different ecosystem components are combined within it.

Soil invertebrates are classified in the following phylum porifera, Cnidaria, Platyhelminthes, Annelida and Mollusca.Many soil invertebratesincrement the health of the soil and therefore plants; however, some soil invertebrates may be detrimental. Arthropods also stimulate mineralization of nutrients in soil **Bagyaraj, Netharavath, Nitin (2016).** The study on soil invertebrate diversity was also carried out by **Jacobs, Nix and Scharenbroch (2017).** Soil invertebrate plays an important role in the ecosystem. Human activities frequently cause degradation of soil environmental conditions which leads to a reduction in the abundance and to a simplification of animal and plant communities thatreside in soil. These days increases in the usage of chemical fertilizers and pesticides adversely affect the distribution of soil invertebrates. They are important in nutrient recycling and the decomposition of litter, which enhance soil productivity and health of soil. Due to this, it is essential to know the kinds of soil invertebrates present in the Washim region. The present study is an attempt to provide a checklist of some soil invertebrates of the Washim region and their classification up to possible taxa**.**

MATERIALS AND METHODS

Study area: Washim is located in the eastern region of Vidharbha. Akola lies to its north, Amravati lies to its northeast, Hingoli lies to its south, Buldhana lies to its west, and Yavatmal lies to its east. River Penganga is the main river of the district. It flows through the Tehsil of Risod. Later it flows through the boundary of the Washim and Hingoli districts. River Kas is the main tributary of Penganga. River Kas meets Penganga about 1 km from the village of ShelgaonRajgure. River Arunavati and its tributaries originate in the Tehsil of Washim and thenflow through the tehsils of Mangrul Pir and Manora into the district of Yavatmal. River Katepurna originates in the hilly areas of the district flows northwards through the tehsil of Malegaon and enters the Akola district. Washim is one of the districts of the Vidarbha region of Maharashtra state of India. It is located at 19^0 30’ and 21^0 13’ N latitude 76^0 13’ N latitude and 76^0 38’ E and 72^0 44’ E longitude. It is 300-600 m above sea level.

Sampling sites and sample collection:

For the present study sampling sites are randomly selected, such as agricultural fields, grasslands and college gardens. Soil invertebrates were collected from selected sampling sites. The specimens were collected by hand picking method and general observations with photographic collection of specimens were done at sampling sites and then these animals were released in their habitat. Hand picking method was used by **Uniyal, and Mathur (1998).**

Identification of specimen: Identification is done by using standard invertebrate identification keys and by internet facilities.

RESULT AND DISCUSSION

Soil invertebrates are the major edaphic factors that determinethe health and productivity of the soil. In recent years distraction of natural habitats and increased use of chemicals such as fertilizers, pesticides and other pollutants directly affected the distribution of soil macrofauna. The present study is an attempt to evaluate the number of soil invertebrates and their species present in and around Washim District.The present research work is carried out from August 2022 to February 2023 for the duration of Six months. The present research reveals about 18 species of soil invertebrates, belonging to Sevendifferent classes. Seven members are from class Insecta, Four members of Malacostraca, one member of Gastropoda, two members of Diplopodaand a single member of Clitellate and Chilopoda, two members of arachnids. The maximumnumber of species were reported from class insects, the study of soil insectswas also done by **Syed, Patil, Chhaba (2016).**

The work is restricted to a very limited period which is for four months. The present study reveals the occurrence of soil invertebrates shows major features of the animal communities that is their diversity. The urgency to adopt soil biodiversity monitoring programs is motivated by both the increasing pressures on soil biodiversity and the limited current knowledge. **Gardi, Montanarella, Arrouays, Bispo, Lemanceau, Jolivet, Mulder, Ranjard, Ro¨Mbke, Rutgers, Menta (2009).** Harpaphehaydadeniana, and Orthoporusornatus belong to the class Diplopoda, Armadillididaevulgare, Metacarcinus magister, and Oniscus belong to the class Malacostraca. Pardosaamentata belong to class Arachnidae.Species of these grouping belong to family Xystodesmidae, Spirostreptida, Veronicelloidae, Oniscidae, Penatatomidae, Formicidae, Lumbricidae, Histeridae, Chrysomelidae, Armadillididae, Cancdridae, Lycosidae, Gryllidae and Dinidoridae.The Soil macrofauna consists of a large number of different animals that live on the soil surface, in the soil pores and in the soil area near tree roots. These include organisms like earthworms, millipedes, centipedes, ants, Coleoptera (adults and larvae), Isopoda, spiders, slugs, snails, termites, Dermaptera, Lepidoptera larvae and Diptera larvae were also reported by **Ali, Bhat, M. Ali (2012)**. The Abundance of Soil Macro-Invertebrates in the Idoro Community in AkwaIbom State, Nigeria was discussed by **Esenowo, Udoidung, Akpan1, Archibong, and Umoh (2017)**. Many of them are very common and their appearance is mostly found and some of them are restricted to certain areas. This information may be potential for further study of soil invertebrates**.**

Sr no	Phylum	Class	Order	Family	Genus	Species
1	Arthropoda	Insecta	Hemiptera	Pentatomidae	Halyomorpha	*Halys*
2	Arthropoda	Insecta	Hymenoptera	Formicidae	Camponotus	*Pennsylvanicus*
3	Arthropoda	Insecta	Coleoptera	Histeridae	Acritus	
4	Arthropoda	Insecta	Coleoptera	Chrysomelidae	Zygogramma	*Bicolarata*
5	Arthropoda	Insecta	Hymenoptera	Formicidae	Camponotus	*Ocreatus*
6	Arthropoda	Insecta	Hemiptera	Dinidoridae	Coridious	*C.Janus*

7	Arthropoda	Chilopoda	Scolopendromorpha	Scolopendridae	Scolopendra	*S. Gigantea*
8	Arthropoda	Malacostraca	Isopoda	Armadillidiidae	Armadillidium	*Vulgare*
9	Artropoda	Malacostraca	Decapoda	Cancridae	Metacarcinus	*Magister*
10	Arthropoda	Malacostraca	Isopoda	Oniscidae	Oniscus	
11	Arthropoda	Diplopoda	Polydesmida	Xystodesmidae	Harpaphe	*H. haydeniana*
12	Arthropoda	Diplopoda	Spirostreptida	Spirosdtreptidae	Orthoporus	*O. ornatus*
13	Mollusca	Gastropoda		Veronicelloidae	Laevicaulis	*Alte*
14	Annelida	Clitellata	Haplotaxida	Lumbricidae	Aporrectedea	*Calignosa*
15	Arthropoda	Arachnida	Araneae	Lycosidae	Pardosa	*Amentata*
16	Arthropoda	Arachnida	Scorpiones	Scorpiones	Heterometrus	*H. laoticus*
17	Arthropoda	Malacostraca	Decapoda	Penaeidae	Fenneropenaeus	*F. Indicus*
18	Arthropoda	Insecta	Orthoptera	Gryllidae	Acheta	*A. domesticus*

SUMMARY AND CONCLUSION

The present research workdeals with the distribution of soil invertebrates in the present study area. It is a qualitative survey of soil invertebrates, carried out over a period of Sixmonths from August 2022 to February 2023. The random sites were selected for the present study in and around the washimRegion. Sampling sites were visited frequently during the present study period and the photographic collection was done at the sampling site. A total of 18 species of soil invertebrates were recorded during the present study. These 18species belongto insects, molluscs, annelids, crustaceans and arachnids. Variation of different species of soil invertebrates has been observed.

Harpaphe haydeniana

Orthoporus ornatus

Laevicaulis alte

		
Oniscus spp.	*Halyomorphahalys*	*Camponotuspennsylvanicus*
		
Apporrectodea caliginosa	*Histerbettle*	*Zygogramma bicolarata*
		
ArmIadilidium vulgure	*Metacarcinus magister*	*Pardosa amentata*

Camponotus ocreatus

Acheta domesticus

Cordius janus

Scolopendra gigantea

Fenneropenaeus indicus

Heterometrus loticus

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An Overview on Organic Manures: Essential Component of Organic Farming

Dr. Madhuri S. Hingankar
Department of Zoology,
Arts & Commerce College, Warwat Bakal
And
Dr. Swati Tantarpale
Department of Zoology,
Bhagwantrao Arts and Science College, Etapalli, Gondwana University.
And
Dr. Shiba Almas Tausef Khan
K. M. Asghar Husain Jr. College, Akola

ABSTRACT

Organic farming and its products are popular and preferred in society these days due to the health benefits they provide over farm-produced products that use chemical fertilisers and are genetically modified. It also satisfies the need of the hour, that is to resolve the issues related to the environment, so we need alternatives to chemical fertilizers. Use of chemicals damages the texture and fertility of soil and also causes pollution. In contrast, organic products are full of essential supplements and nutrition and are harmless to health and the environment. Its core is organic manure. When added to the soil during crop production, the organic manure restores and supplements more nutrition to the soil. While assuming that out of the variety of organic manures, which one is the best for soil, the number of research articles written by many researchers comprises the analysis of different organic manures done by using several methods. They analyse their content and their effectivity on different fields. This review article is an outline of these several articles and, based on the discussion, tries to conclude the best manure and its content that nurtures certain types of fields.

Keywords: Organic manure, organic farming, organic products, soil nutrition.

1. INTRODUCTION

The increasing concern over the environmental impacts of chemical fertilizers has led to a resurgence of interest in organic farming practices. Organic manures, derived from animal and plant residues, are an essential component of these practices **(Singh, A 2021).** Organic Manures. They provide essential nutrients to plants, improve soil structure, and enhance microbial activity. This paper reviews the different types of organic manures and their overall contribution to sustainable agriculture.

This paper provides an overview of the types and benefits of organic manures and highlights their importance in sustainable agricultural practices. The limitations identified suggest

that further research is necessary to address issues related to nutrient content, application methods, and overall efficiency.

2. Types of Organic Manures

Organic manures are broadly classified into several categories based on their sources (**Adekiya, A.O., Ejue, W.S., Olayanju, A. *et al* 2020).**

1. Animal Manures:

- Animal manures, such as cow dung, poultry litter, and pig manure, are rich sources of nitrogen, phosphorus, and potassium (NPK).
- These manures also contain organic carbon, which improves soil structure by enhancing its water-holding capacity and aeration.

2. **Green Manure:**

- Green manures are crops grown specifically for the purpose of being plowed back into the soil.
- Leguminous plants, such as clover and alfalfa, are commonly used as green manures due to their ability to fix atmospheric nitrogen and enhance soil fertility (**Zhang, Z., Dong, X., Wang, S. *et al* 2020).**

3. **Compost:**

- Compost is decomposed organic matter derived from plant and animal residues. The composting process stabilizes organic materials, making nutrients more readily available to plants.
- Well-made compost improves soil texture and supports beneficial microbial populations.

4. Vermicompost:

- Vermicomposting involves the breakdown of organic materials through earthworms. This process produces nutrient-rich organic matter that enhances soil fertility and promotes plant growth (**Tiwari, D D., Pandey R & Rajak, R K 2010).**
- Vermicompost contains essential nutrients in forms that are readily available for plant uptake **(Gupta, R., & Garg, V. K. 2008).**

5. Farmyard Manure (FYM):

- FYM consists of the decomposed mixture of animal dung, urine, straw, and other farm waste.
- It supplies nutrients gradually to the soil, enhances moisture retention, and improves the physical condition of soils.

3. Benefits of Organic Manures:

The application of organic manures offers several advantages over synthetic fertilizers **(Khaitov B *et al.*, 2019).**

1. Soil Fertility Improvement:

- Organic manures improve soil structure by increasing its organic matter content, which enhances water retention, aeration, and root penetration.

2. Nutrient Supply:

- Organic manures provide a balanced supply of essential nutrients such as nitrogen, phosphorus, potassium, calcium, and micronutrients.

3. Microbial Activity:

- Organic manures stimulate the growth and activity of beneficial soil microorganisms, which play a crucial role in nutrient cycling, organic matter decomposition, and disease suppression.

4. Sustainability:

- Organic manures are renewable and environmentally friendly. Their use reduces the need for synthetic fertilizers and helps mitigate soil degradation, water contamination, and greenhouse gas emissions **(El, Nadia *et al.*, 2010)**

5. Enhanced Soil Health:

- The continuous application of organic manures contributes to long-term soil health by improving its biological, chemical, and physical properties (**Weil, R & Brady, N 2017).**

4. Limitations of Organic Manures:

While organic manures offer numerous benefits, they also have some limitations:

1. Nutrient Content:

- Organic manures generally have lower concentrations of nutrients compared to synthetic fertilizers, which means that larger quantities need to be applied to meet crop nutrient requirements.

2. Slow Nutrient Release:

- The nutrients in organic manures are released slowly over time, which may not meet the immediate nutrient needs of fast-growing crops(**Adekiya, A O *et al.*, 2020).**

3. Variable Quality:

- The quality of organic manures can vary widely depending on the source, processing, and storage conditions, affecting their nutrient content and efficacy.

4. Labor and Time-Intensive:

- The preparation and application of organic manures can be labor-intensive and time-consuming, requiring careful management to ensure optimal results.

5. Mechanisms of Soil Improvement:

Organic manures enhance soil health through several mechanisms**(Bajaj, R 2023).**

Improving Soil Structure:

- Organic manures contribute organic matter, which binds soil particles together, reducing compaction and improving soil porosity. This enhances water infiltration and root growth.

2. Enhancing Water Retention:

- Organic matter increases the soil's ability to hold water, which is critical for plant growth, particularly in drought-prone areas.

3. Encouraging Microbial Activity:

- Organic manures serve as food for soil microorganisms, promoting their activity and increasing the breakdown of organic materials into plant-available forms.

4. Reducing Soil Erosion:

- The application of organic manures improves soil structure and cohesion, helping to prevent soil erosion by water and wind.

6. Role in Sustainable Agriculture:

Organic manures are essential in the development of sustainable farming systems. They reduce reliance on synthetic fertilizers, minimize environmental degradation, and promote long-term soil fertility (**Tripathi, L 2022).** By recycling nutrients within the farming system, organic manures contribute to resource efficiency and reduce waste (**Singh, R P and Agrawal, M 2008)**. Sustainable agriculture practices that incorporate organic manures can help mitigate climate change, improve biodiversity, and ensure food security for future generations.

7. CONCLUSION:

Organic manures play a critical role in sustainable agricultural systems by enhancing soil health, providing essential nutrients, and promoting environmental sustainability. Despite certain limitations, their benefits make them a valuable resource for farmers aiming to improve soil fertility while reducing the negative impacts of conventional farming practices. The continued research and development of organic manure management practices will further increase their efficacy and adoption in modern agriculture.

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Physico-chemical water Analysis of Pali Bindusara reservoir in Beed District, (M.S)

Vishal. G. Khadse
Department of Zoology,
Balbhim Arts, Science and Commerce College, Beed. Dist.Beed.
And
Varsha. M. Jayshingpure
Department of Zoology,
Balbhim Arts, Science and Commerce College, Beed. Dist.Beed.

ABSTRACT:

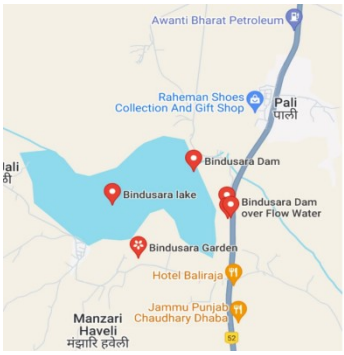
Beed City passes past the Bindusara reservoir. The Bindusara Dam and reservoir are located close to Beed City, a short distance away. In this area, the dam water is used for a variety of things, including irrigation and drinking water. Water is essential to the existence of all living things, including humans, animals, and plants. In order to assess the level of water contamination at Bindusara Pali Dam/reservoir from July 19, 2024, to August 28, 2024, a physicochemical examination of the water is conducted. The current study is conducted by analyzing a few physicochemical characteristics of the reservoir water in the Beed city region and the Bindusara Pali Dam. The physical and chemical characteristics of water, including its temperature, color, taste, and odor, as well as its PH, BOD, COD, total hardness, and TDS

Keywords: Bindusara dam (reservoir), Physicochemical parameters, pH, BOD, COD, TDS etc

INTRODUCTION:

Water is essential to human existence. According to the WHO, 35% of Indians living in cities and 65% of Indians living in rural areas lack access to clean drinking water. Water is essential for human needs as well as those of animals, crops, and plants. Currently, 910 million people worldwide do not have access to clean drinking water. According to estimates from the World Health Organization, contaminated water is the source of 90% of diarrheal and cholera illnesses. The pollution of surface and groundwater has increased due to population growth, urbanization, industrialization, agricultural practices, and other human activities [1.5].

Study area:



Water from Beed City's Bindusara Pali dam (reservoir) is analyzed for water quality using physicochemical criteria in this study. District: Beed. The majority of uses for the reservoir water are household, agricultural, and drinking.

METHODOLOGY:

Between July 19, 2024, and August 11, 2024, physicochemical analyses of water are conducted to determine the level of contamination in the water. A plastic bottle and can were used to gather a sample of water from the Bindusara dam/reservoir early in the morning, between 9:30 and 11:00 am. A thermometer was used to estimate the temperature of the water, and a systronic digital PH meter was used to assess the water's PH. While other characteristics, as directed by APHA [4, 6], were estimated in the laboratory using established techniques, such as total dissolved solids, total hardness, COD, and BOD.

OBSERVATION TABLE: Physicochemical parameters in Bindusara Dam

Sr. No.	Parameters	19/07/2024	29/07/2024	08/08/2024	18/08/2024	28/08/2024
1	Temperature Oc	28	28	27	25	25
2	PH	8.3	8.2	7.9	7.8	7.5
3	BOD	1.27	1.45	1.60	1.85	2.15
4	COD	17	16	14	13	18
5	TDS	215	233	241	250	254
6	Total hardness ppm	116	120	126	134	144

RESULT AND DISCUSSION:

In the present study, the temperature of water sample range from 25 O c to 28 O c. Water temperatures plays key role which influence the chemical, biochemical and biological characteristics of water body. The total dissolved solid is in range of 215mg/l to 254 mg/l from cite in given time period, it shows high due to rainfall. The P H is a term used to indicate the alkalinity or acidity of a substance as ranked on side from 1.0 to 14.0. In the present investigation P H varies from 7.5 to 8.3 which arein desirable limits. The hardness of water is due to the presence of Calcium and Magnesium salts of carbonates, chlorides and sulphates. Total hardness was determined by titrating against EDTA. The total hardness actual present is more than desirable limits.

CONCLUSION:

According to the current water analysis results, the cite water has higher total dissolved solids and total hardness than the WHO and Indian standards for water quality. Water's pH measurement indicates that it is somewhat alkaline and falls outside of the desired range. Filtration and aeration should be used to make water more drinkable.

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Comparative Study Of Hemin Crystal Of Domestic Mammals Structural And Statistical Analysis

Dr. Snehal G. Rodge
Assistant professor
Department of Zoology
Shri Shivaji Arts, Commerce and Science College,
Akot, Maharashtra (India)

Abstract –

The current laboratory study was carried out to demonstrate the structural difference in some domestic mammals on the basis of hemin crystal. Heme is the iron containing split portion of hemoglobin. During this study some domestic mammal's blood were examined. During this investigation hemin crystal was made by all the blood samples of domestic mammalian species and when it is compared hemin crystal of with human being some significant and also some nonsignificant results were obtained. Statistical calculation was also done to find the structural differences and it was also found that there is huge difference in their length where as the breadth maintain consistency

Key words: hemin crystal, domestic mammals, structural difference.

Introduction

A crystalline by product of hemoglobin is hemin. Red blood cells from human blood are processed to create heme. Hemeis the iron containing split portion of hemoglobin. When a sodium chloride, a drop of glacial acetic and some bloods are heated on a slide a typical microscopic reddish-brown crystal -C34H32N4O4.Feclis formed. Hemin Functions by reducing the body's synthesis of a specific enzyme. (Banerjee *et al.,* 2000). The hemoglobin is present on RBC's it is respiratory pigment containing iron and (globin) protein. The heme Substance of hemoglobin react with acetic acid and to form heme in crystal. (Das *et al.,* 2012). Ludwik Karol Teichmann first crystalized haemin from blood in 1853. Hemin crystals are also known asTeichmann crystals. The hemin crystals are prepared by heating of the blood with Nippe's reagent. This ruptures the RBCs and the hemoglobin is released. Also, in this process the ferrous form of iron is converted to ferric form. The globin protein gets denatured by heating with acetic acid; while, heme is converted to oxidized heme called haematin. The haematin combines with halogens such as chloride ions to form insoluble haemin which appear as rhombic crystal of chocolate brown colour. The haemin crystals or hydrochloride of heme are characteristic of blood and are thus, used for identification of blood stains (Chattopadhyay 2010)

The present work was carried out to demonstrate the structural difference in some domestic mammals on the basis of hemin crystal.

MATERIAL AND METHODS

Test Animal

For the present study of haemin crystal different species of domestic animals were selected. All the selected animals are economically important to man All the domesticated mammals provide meat and hides, some provide milk, wool and hair; others serve for transport, draft or hunting. Here horse, dog, cow, ox, goat, buffalo these domestic animals were selected for this experiment.

Requirements - pricking needle, syringes, anti-coagulant, test tube, Blood sample, spirit, cotton, glass slide, acetic acid, spirit lamp, dropper, compound microscope. etc.

Collection of blood sample

In case of human the blood sample was collected by using pricking needle by pricking the ring figure and take the drop on clean slide for the experiment but in case of horse, dog, cow, ox, goat, buffalo the blood sample was collected by using syringes or with the help of veterinary doctor. different blood sampleswere collected in test tube containing anticoagulant.

Experimental Method

For this Experiment take a glass slide and clean it with spirit. Take a drop of sample blood on the one end of the glass slide, Then take second slide hold in hand Vertically to put on first slide in this way the lower end of the slide touch the blood and the second slide move toward the forward direction and to form the thin film or blood smear.The slide allow for drying up to 5 to 10 minutes.After drying the blood particle collect with the help of another slide then blood partials collect in the center of slide.Then add two to three drop of acetic acid on the blood particle. Then the slide hold on the flame of spirit lamps up to bubble formation. Then the slide allow for cooling and it is ready for observation.All the slides of different animals hemin crystal were observed under the compound microscope and length and brength of hemin crystal were calculated by ocular scale.

Statistical Analysis

Following are the length and breadth obtained of hemin crystals. The measurement was done in ocular stage micrometer. Where one ocular is equal to mm, i.e. 1 ocular =0.04 mm

Mean of length of Haemin crystal of animal- $X = \sum x/N$

Mean of breadth of haemin crystal of animal- $X = \sum x/N$

Standard deviation of length and breadth of hemin crystals in different Mammals is calculated. Standard deviation is used for measuring absolute dispersion. The concept of standard deviation was introduced by Karl Pearson. The greater the standard deviation of the values from their mean.

$$\text{S.D. OR } \sigma = \sqrt{\frac{\Sigma x^2}{n} - \left(\frac{\Sigma x}{n}\right)^2}$$

x = mean of length in mm, n = number of samples

RESULTS AND DISCUSSION

The preparation is allowed to examine under a microscope, initially under low magnification and then under heigh magnification.

Samples	Structure
Human	Rhomboidal plates or rectangular and prism often arranged in star shaped cluster with round edges
Goat	Rectangle with sharp edges, breadth portion is somewhat inwardly projected.
OX	Rectangular shape with narrow plates and sharp edges and mostly star shape cluster are found.
Buffalo	Spindle and rhomboidal shape, some has the pointed edges on both side and some having the blunt end on both sides.
Horse	Circular or Spindle shape structure, blunt at both the end, arranged in various shapes like star shape with sharp edges
Dog.	Rhomboidal plates, spindal shaped with blunt end on the both sides.
Cow	Brown colour, rectangular shape with sharp edges projecting out word direction

Table 1 Structures of hemin crystals of various animal were observed microscope

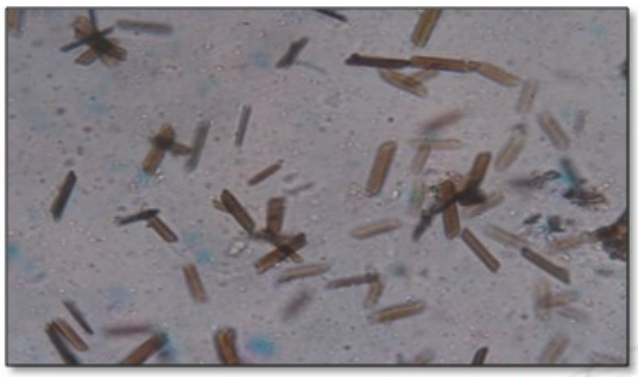


Figure a) Human being

Figure b) Ox

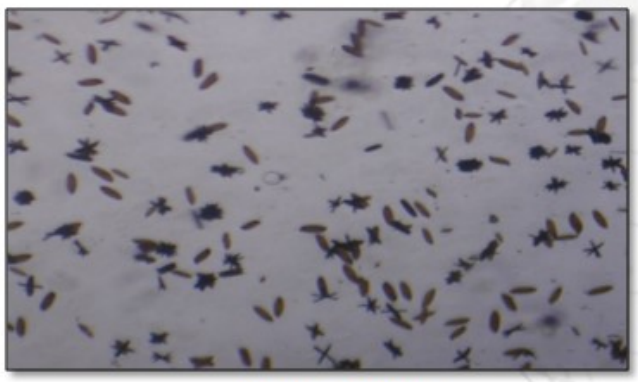


Figure c) Horse

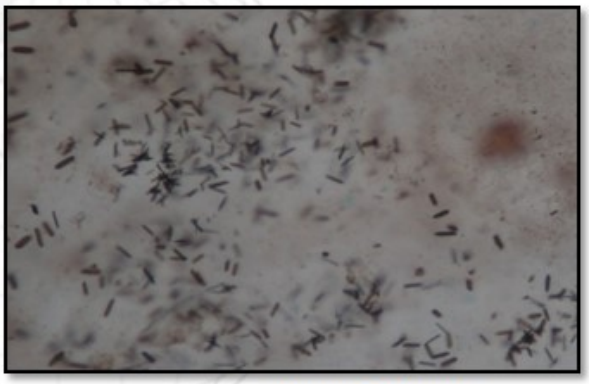


Figure d) Goat

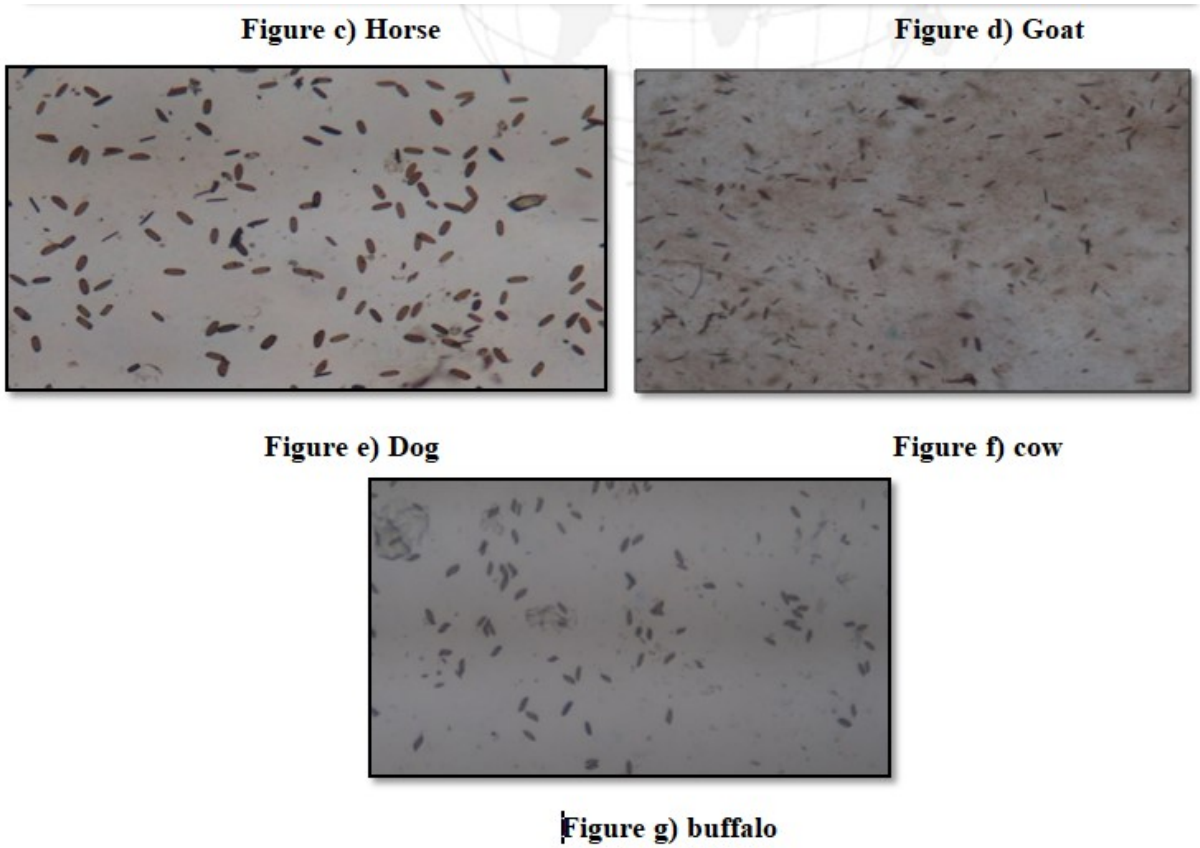


Figure 1: Different structures of hemin crystals are seen under microscope.

In the table 1 different shape of hemin crystals were observed under compound microscope. Rhomboid, spindle shape star shaped pointed, chocolate brown crystal is shown in figures of different seven mammalian species. Crystals are homogeneous solids bounded by plane faces and having a geometric shape. The shape of hemin crystal is varying in different species and thus blood stains of human can be confirmed. Another advantage of hemin test is that it can be performed with the dried blood stains

Sample	X Mean of Length (in mm)	X^2 Mean of Length (in mm)	X Mean of Breadth (in mm)	X^2 Mean of Breadth (in mm)
Human	0.444	0.1971	0.097	0.009409
Goat	0.441	0.1944	0.091	0.008281
OX	0.124	0.0153	0.038	0.001444
Buffalo	0.127	0.0161	0.052	0.002704
Horse	0.135	0.0182	0.044	0.001936
Dog.	0.083	0.0068	0.031	0.000961
Cow	0.225	0.0506	0.049	0.002401
	$\Sigma x = 1.579$	$\Sigma x^2 = 0.499$	$\Sigma x = 0.402$	$\Sigma x^2 = 0.028$

Table 2: Standard deviation of length of hemin crystal in different vertebrate

According to the formula

Length σ = $\sqrt{\frac{0.499}{7} - \left(\frac{1.579}{7}\right)^2}$

= $\sqrt{0.0713 - (0.226)^2}$ = $\sqrt{0.0073}$ = 0.085 mm

So, deviation in length of different haemin crystal in 0.085 mm

According to the formula

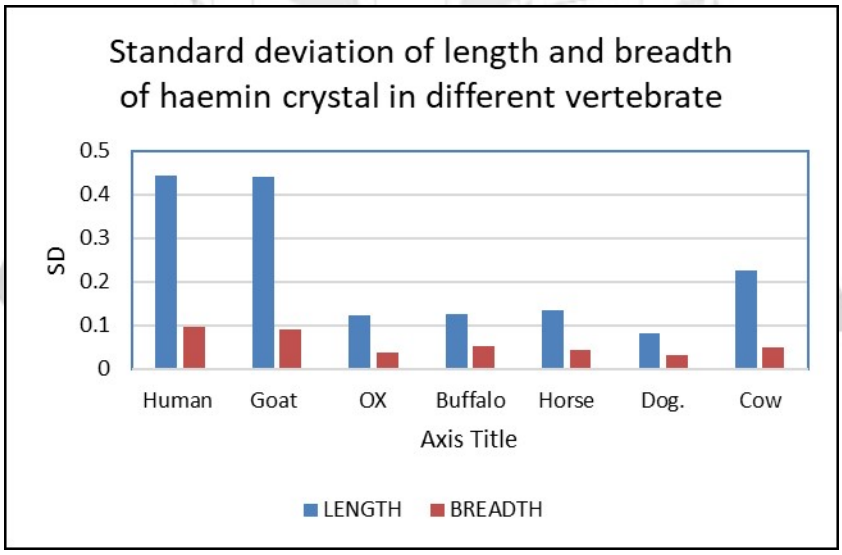
Breadth σ = $\sqrt{\frac{0.028}{7} - \left(\frac{0.402}{7}\right)^2}$

= $\sqrt{0.004 - (0.058)^2}$

= 0

So, in breadth of different haemin crystal there is no deviation.

By standard deviation it is seen that breadth shows consistency in measurement in all the seven mammalian species but length shows differences. It indicates that as per as breadth is concern it maintain consistency.



Graph 1: Standard deviation of length (mm) and Breadth (mm) of hemin crystal in different mammalian species

The study conducted to identify the structural differences in the hemin crystals of various mammals, including Felis catus (domestic cat), Canis lupus (domestic dog), Bos taurus (cattle), Capra aegagrus hircus (domestic goat), cow, buffalo and Homo sapiens (human). the comparison of hemin crystals obtained from different mammal species with that of Homo sapiens (human). The significant and non-significant results obtained from the comparison would be elaborated upon. (Sinha and Chattopadhyay 2010). The statistical calculations conducted to determine the

structural differences, including the mean values of length and breadth of the mammals and the calculation of standard deviation, reported by (Pradhan and parida 2020.)

The present observation supports the recent finding of Das *et al.,* (2012); Pradhan and parida (2020); Rohman. *et al.,* (1908) and name a few. The ability to identify the animal species from which blood samples belong to based on the shape and size of hemin crystals would be discussed as a valuable tool for forensic investigations or veterinary applications. The researcher may mention any potential limitations or challenges associated with using hemin crystals as a means of identifying mammal species, and suggest future research directions to overcome these limitations Rohman. *et al.,* (1908).

CONCLUSION

The shape of hemin crystal is varying in different species and thus blood stains of human can be confirmed. It is important in medico-legal test for the detection of blood. It helps to give an opinion to proof whether a stain is blood or something else. It is also useful in the difference of bloods of difference within species depending upon the shape of hemin crystal. Another advantage of hemin test is that it can be performed with the dried blood stains. Rhomboid, spindle shape star shaped pointed, chocolate brown crystals are shown in figures of different seven mammalian species. During this investigation hemin crystal was made by all the blood samples of domestic mammalian species and when it is compared hemin crystal of with human being some significant and also some nonsignificant results were obtained. Statistical calculation was also done to find the structural differences and it was also found that there is huge difference in their length where as the breadth maintain consistency.

The crystals of hydroclorate of hematin are observed. In case of goat and cow's hemin crystal the difference with human hemin crystal is nonsignificant. but significant differences are seen in ox, buffalo, horse and dog hemin crystal to that of human being blood. Standard deviation in length is seen in breadth there is no dispersion. By forming hemin crystals of any blood (unknown samples) it is easy to identify that from which animal the blood belongs to it is also useful to find differences of bloods of different species depending upon the shape and size of the crystal.

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Exploring the Resilience of Artemia: The Effects of Temperature Variability on Survival

Deshmukh S. D.
Arts & Commerce College Warwat Bakal Tq. Sanrampur Dist. Buldana
And
Patil P. S.
R. A. Arts, Shri M. K. Commerce & Shri S. R. Rathi Science Mahavidyalaya, Washim

ABSTRACT:

The present study explores the impact of various temperature ranges on the survival of Artemia, a hypersaline aquatic organism found in salt pans, saline inland lakes, and occasionally in seawater. Artemia, belonging to the class Branchiopoda and order Anostraca, is widely utilized as live feed for the early developmental stages of fish and other commercially important aquatic species. Its remarkable adaptability to diverse ecological conditions makes it an ideal model organism for research. In this investigation, one-day-old Artemianauplii were cultured under six different temperature ranges over a period of 14 days. At the end of the study, the total number of surviving Artemia was counted. The findings revealed that the highest survival rate occurred at 28°C, with 64 individuals surviving, while the lowest survival rate was observed at 36°C, indicating a decline in viability with higher temperatures. This research provides valuable insights into the thermal tolerance of Artemia, which can inform its use in aquaculture and ecological studies.

Key words: Artemia, Branchiopoda, hypersaline, live feed, naupliae

INTRODUCTION:

*Artemia*is one of the fascinating animals belonging to the phylum Arthropoda of animal kingdom. It was extensively exploited for many purposes such as, a model organism for research experiment especially in toxicological assays, as live feed for growing fishes and molloscs and crustaceans and as water quality indicator. Basically, *Artemia* is a macrozoplankton belonging to order Anostraca, found in saline habitats such as salt pans, hyper saline inland lakes, occasionally in shallow sea water. *Artemia* is well known for its ability to adapt to harsh environmental conditions and thrive in environments where no one can withstand. The effect of temperature on survival, biomass production and hatchability of *Artemia* cyst was extensively examined by **P. Vanhaecke and P. Sorgeloos (1989).** Effect of Light, Temperature and salinity on the growth of *Artemia* was studied by **G. Raj Kumar and Prof. D.E. Babu (2015).** The growth and survival of *Artemia* are significantly affected by temperature and salinity, with their interactions playing a crucial role. Research indicates that these two factors should be considered in tandem due to their reciprocal effects on aquatic invertebrates, a relationship that has been substantiated for *Artemia*. Despite the general consensus that brine shrimp are both eurythermal and euryhaline, variations in

survival rates among different strains highlight the complexity of these interactions. Temperature plays a crucial role in growth and development of *Artemia*, higher temperature ranges can cause increased stress and mortality in *Artemia*, extreme low temperatures also result in slower growth or even cause mortality apart of this some of the species of *Artemia* can tolerate extreme low and high temperature in varied environment. Brine shrimp display distinct distribution patterns influenced by salinity and temperature. Research by **Vanhaecke *et al.*, (1987)** shows that Artemia are absent in cold tundra and frost climates, where consistently low temperatures hinder their development. However, various strains thrive in continental regions such as the continental USA, China, Central Asia, and South Siberia. These areas experience harsh winters but also hot summers, which promote the hatching of cysts and subsequent colonization. A notable exception is *Artemiatibetiana*, which has adapted physiologically to low temperatures. This strain inhabits a unique carbonate lake on the Tibetan high plateau, with a salinity of approximately 60 parts per thousand (ppt).

The lake experiences extreme environmental conditions, with annual temperature fluctuations ranging from -26°C to +24°C and an average annual air temperature of about 1.6°C. During the cyst production season, maximum daily water temperatures reach around 15°C **(Abatzopoulos *et al.*, 1998).** This Tibetan Lake, located at an altitude of 4,490 meters, is the highest known habitat for Artemia **(Zheng, 1997).** Despite its widespread recognition, *Artemia* harbors untapped potential, especially in its adaptability to diverse environmental conditions. In the context of India, however, a notable gap exists in comprehensive data regarding the impact of ecological variables on Artemia growth. The present research aims to investigate the impact of temperature variation on survival of *Artemia*.

MATERIALS AND METHOD

Collection of Cyst

The cyst of Artemia was brought from reliable online platform for the present research work.

Preparation of brine (Artificial salt solution)

For the present investigation artificial salt solution was prepare as prescribed in (FAO Fisheries Technical Paper 1996), as depicted in following table,

NaCl	31.08gm
$MgCl_2$	6.09gm
$CaCl_2$	1.53gm
KCl	0.97gm
$MgSO_4$	7.74gm
$NaHCO_3$	1.80gm
Distilled Water	1L

To evaluate the impact of temperature on instar I Nauplii of *Artemia* the following protocol was established in the PG and research laboratory of Zoology, R. A. College Washim. The *Artemia* cysts were exposed to various temperature levels in a 1-liter conical flask, with proper aeration and light provided. The temperature was varied using an aquarium heater to achieve higher temperatures, while a water bath was utilized to maintain lower temperatures.All other parameters, such as pH and salinity, were kept constant within their optimal ranges during the temperature variation experiments.

The specific temperature ranges to which instar I, nauplii of *Artemia* were exposed are provided in the following table,

Temperature	Abbreviations
16^0C	T1
20^0C	T2
24^0C	T3
28^0C	T4
32^0C	T5
36^0C	T6

Survival Rate

The survival rate of Artemia was recorded after 14 days of exposure, the total 100 freshly hatched naupli were exposed to above mentioned conditions separately. After 14 days of exposure total survival was estimated by following formula,

Survival rate %= total number of survived individuals / Total number of exposed Artemia x 100.

RESULTS AND DISCUSSION

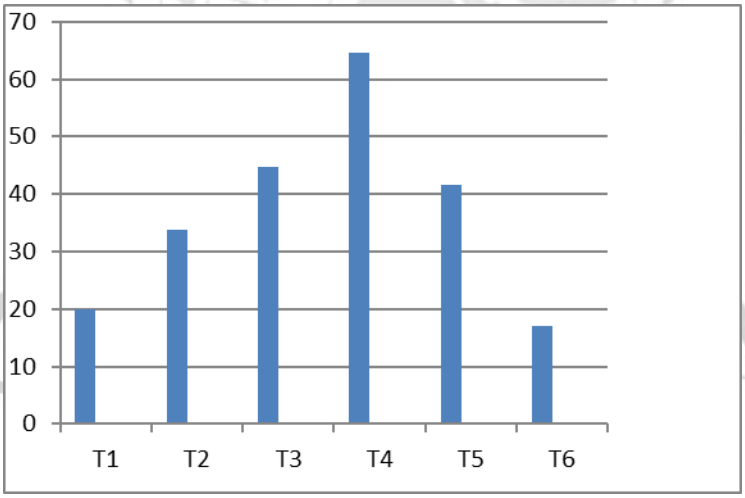
The survival rates of *Artemia* under various temperature treatments provide insight into the species' adaptability and optimal environmental conditions**.** The treatment with the highest survival rate is T4 (64.67 ± 2.52), indicating that this specific temperature is likely within the optimal range for *Artemia* survival. This aligns with previous research indicating that *Artemia* thrive in warmer temperatures, typically between 25-30°C (**Browne and Wanigasekera, 2000; Clegg, 1997**). Treatments **T1 (20 ± 1)** and **T6 (17 ± 1)** exhibited the lowest survival rates, suggesting that lower temperatures might induce stress or limit metabolic processes necessary for survival. According to studies by **Vanhaecke *et al.* (1984)**, lower temperatures can hinder the growth and reproductive success of *Artemia*.

Intermediate treatments such as T2 (33.67 ± 1.15), T3 (44.67 ± 3.51), and T5 (41.67 ± 2.52) show a gradual increase in survival, indicating that these temperatures provide a conducive environment, though not as optimal as T4. These results support the notion that *Artemia* can tolerate a range of temperatures but demonstrate improved survival at higher levels. The standard deviations highlight variability in the survival rates across treatments. The larger standard

deviation in T3 (± 3.51) suggests a wider range of individual survival outcomes, possibly due to environmental fluctuations or individual resilience.

% Survival of Artemia	
Treatments	Mean ±Standard deviation
T1	20±1
T2	33.67±1.15
T3	44.67±3.51
T4	64.67±2.52
T5	41.67±2.52
T6	17±1

* Surviving individuals after 14 days of culture under various temperature ranges



CONCLUSION

The results suggest that *Artemia* exhibit significantly improved survival rates at higher temperatures, particularly around T4. These findings are consistent with the existing literature on *Artemia* biology and environmental tolerances. Future studies could explore the mechanistic aspects of temperature effects on metabolic rates and reproductive success in this resilient species.

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The Effect of Scientific Research on Sustainable Development: A Political Overview

Dr. Rajendra S. Korde
Assistant Professor, Department of Political Sciences,
Arts & Commerce College Warwat Bakal
Tq. Sangrampur Dist. Buldhana 444202

ABSTRACT:

In the context of global environmental challenges, such as climate change, resource depletion, and biodiversity loss, sustainable development is increasingly recognized as a vital goal. However, political views significantly influence the way scientific research is conducted, funded, and implemented in policy-making. This paper analyses how different political ideologies—ranging from conservatism and liberalism to socialism and environmentalism—view the role of scientific research in promoting sustainable development and how these views shape national and international policy agendas. This paper highlights the impact of political views on scientific research and its role in sustainable development, emphasizing the need for political systems to recognize and support science-based policies to ensure a sustainable future.

Keywords: Scientific research impact, Political views on scientific research, Sustainable Development.

INTRODUCTION:

Sustainable development, defined by the United Nations as development that meets the needs of the present without compromising the ability of future generations to meet their own needs, has become a central concern in global policy-making. Scientific research plays a critical role in advancing sustainable development by providing data-driven insights into environmental degradation, renewable energy, climate adaptation strategies, and more. However, the extent to which scientific research impacts policy and development practices is heavily influenced by political ideologies. The Sustainable Development Goals were launched as a worldwide governance framework, but little is known about their actual political impacts.

Political actors often interpret scientific findings through the lens of their broader philosophical, economic, and social priorities, which can either accelerate or impede the implementation of sustainable development goals (SDGs) (Bexell, M. & Jönsson, K.,2019). This paper examines the diverse political perspectives on the role of scientific research in achieving sustainable development and how these perspectives impact policy and global cooperation.

1. Historical Context of Science and Sustainable Development:

In 1987, sustainable development was defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” (HajianM. & Kashani S. J., 2021)

I) The Evolution of Sustainable Development:

The concept of sustainable development began to take shape in the mid-20th century with the rise of environmental movements and growing awareness of the ecological consequences of industrialization (Mensah, J., & Ricart Casadevall, S., 2019). The publication of The Limits to Growth by the Club of Rome in 1972, the 1987 Brundtland Report (Our Common Future), and the establishment of the United Nations' SDGs in 2015 solidified sustainable development as a guiding principle for global governance.

Throughout this evolution, scientific research has been instrumental in identifying the environmental, social, and economic dimensions of sustainability. The development of renewable energy technologies, ecological conservation strategies, and climate modelling has largely been driven by the scientific community. However, the integration of these findings into policy frameworks has varied according to political context.

II) The Role of Politics in Shaping Scientific Agendas:

The relationship between politics and scientific research is complex, with funding, policy priorities, and ideological beliefs all playing significant roles in determining the direction of scientific inquiry. Political ideologies affect which areas of research receive attention, how results are interpreted, and whether findings are implemented in policy-making (Suhay, E., 2017, January 25).

2. Political Ideologies and Their Perspectives on Scientific Research in Sustainable Development:

I) Conservative Views:

Conservative political ideologies tend to emphasize free markets, individualism, and limited government intervention. While acknowledging the importance of environmental stewardship, conservatives often prioritize economic growth and national interests over environmental regulations. Consequently, they may advocate for scientific research that promotes technological solutions, such as carbon capture and storage, rather than systemic changes in consumption and production patterns.

In many conservative governments, scepticism about the urgency of climate change and other environmental crises has led to resistance against policies based on scientific consensus. For instance, conservative political leaders in countries like the United States and Australia have often downplayed the role of human activities in climate change, influencing the funding of scientific research in renewable energy and environmental protection (Suhay, E.,2017, January 25).

However, some branches of conservatism, such as “green conservatism” or “eco-conservatism,” recognize the role of scientific research in sustainable development, especially when framed in terms of conserving resources for future generations, promoting innovation, and reducing dependency on foreign energy sources.

II) Liberal Views:

Liberal political ideologies generally place a stronger emphasis on government

intervention in addressing market failures, including environmental degradation. Liberals tend to support policies based on scientific research that highlight the risks of environmental damage and advocate for the transition to renewable energy, energy efficiency, and sustainable agricultural practices.

In liberal governments, scientific research is often central to the design of regulatory frameworks, such as carbon pricing, emissions trading schemes, and subsidies for clean energy. For example, the European Union's liberal political leadership has been instrumental in shaping the bloc's commitment to sustainable development, with science-based climate targets driving legislation such as the European Green Deal (Tamma P*et al.,* 11 December 2019) & (Simon F., 11 December 2019).

Liberals also promote the integration of scientific research in education and public policy, arguing that evidence-based decision-making is crucial for addressing the long-term challenges of sustainability.

III) Socialist and Left-Wing Views:

Socialist and left-wing political ideologies often advocate for systemic changes to address the root causes of environmental degradation, which they view as inherently linked to capitalism and social inequality. They argue that scientific research should focus not only on technological innovation but also on exploring new models of economic development that prioritize social justice, environmental sustainability, and public ownership of natural resources.

Left-wing political movements are often at the forefront of promoting scientific research into renewable energy, sustainable agriculture, and public health in the context of climate change. For instance, countries with socialist governments, such as Cuba and Bolivia, have promoted agroecological approaches to agriculture based on scientific research that emphasizes biodiversity and the rights of indigenous peoples (Mede NG *et al.,* 2022 August8).

In the global context, left-wing parties often advocate for greater investment in scientific research in developing countries, arguing that sustainable development must be pursued through an equitable distribution of resources and knowledge.

IV) Environmentalism and Green Politics:

Environmental political movements, often represented by Green Parties, place the highest emphasis on sustainability and ecological balance. These movements prioritize scientific research that highlights the finite nature of Earth's resources and the need for urgent action to mitigate environmental damage. Green political ideologies often advocate for radical shifts in consumption, production, and governance, pushing for policies that are deeply rooted in ecological science (Jermier J*et al.,* 2006).

For instance, Green Parties in Europe and elsewhere have championed policies such as transitioning to 100% renewable energy, divesting from fossil fuels, and supporting research in sustainable agriculture, circular economy models, and zero-waste initiatives. Environmentalists argue that scientific research should guide all aspects of policymaking to ensure that development

is genuinely sustainable and does not harm future generations.

3. Political Challenges to Implementing Science-Based Sustainable Development:

I) Ideological Conflicts:

One of the primary challenges in implementing science-based sustainable development is the ideological divide between political factions. Conservative and libertarian views, which prioritize market-based solutions and economic growth, often clash with the regulatory approaches advocated by liberals, socialists, and environmentalists. This ideological polarization can lead to inconsistent policies, particularly in democratic countries, where leadership changes frequently (Kumar, J.S & Dr. Shobana D., 2024).

II) Economic Interests vs. Environmental Sustainability:

Political decisions regarding sustainable development are also influenced by economic interests, especially in regions dependent on fossil fuel industries or resource extraction. Political leaders may resist science-based recommendations if they are perceived as threatening to economic growth or national security. For example, some oil-producing nations have been slow to adopt scientific findings on climate change due to the economic significance of fossil fuels (Suhay, E. 2017, January 25).

III) International Cooperation and Multilateralism:

Sustainable development is a global challenge that requires international cooperation. However, political disagreements between nations—often fuelled by differing views on scientific research—can impede progress. Countries that prioritize short-term economic gains over long-term sustainability goals may resist global agreements like the Paris Climate Accord, weakening the overall impact of science-driven policies (ScottJ., 2024).

CONCLUSION:

The role of scientific research in sustainable development is undeniable, providing critical insights into how human activities affect the environment and how societies can transition toward sustainability. However, political views significantly influence how scientific research is integrated into policy-making. From conservative scepticism to environmentalist advocacy for radical change, political ideologies shape the trajectory of sustainable development efforts.

The challenge for the future lies in fostering greater political consensus on the importance of science-based policy-making for sustainable development. By bridging ideological divides and promoting evidence-based dialogue, political leaders can harness the power of scientific research to create a more sustainable, equitable, and resilient world.

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The Historical Basis of Wildlife and Human Conflicts: An Evolutionary Perspective

Dr. Subhash S. Pawar
Associate Professor, Department of History,
Arts & Commerce College Warwat Bakal
Tq. Sangrampur Dist. Buldhana 444202

ABSTRACT:

Wildlife and human conflicts have deep historical roots, shaped by factors such as habitat encroachment, resource competition, cultural practices, and socio-political developments. This paper explores the origins and evolution of these conflicts from prehistory to modern times, with particular emphasis on how agriculture, hunting, colonialism, industrialization, and climate change have transformed human-wildlife interactions. It also discusses efforts to address these conflicts, including conservation practices, policy reforms, and indigenous knowledge systems. Understanding the historical context of these conflicts is critical for devising sustainable solutions in a rapidly changing world.

Keywords: Wildlife & Human, Human-Wildlife Relationships, Resource Exploitation, Environment demolition.

INTRODUCTION:

Human-wildlife conflicts are not new phenomena but have persisted throughout history, with changing dynamics as human societies evolved. As humans transitioned from nomadic lifestyles to settled agriculture and urbanization, their relationship with wildlife shifted from one of coexistence to competition. This paper seeks to outline the key historical moments that contributed to the escalation of these conflicts and to understand how they shaped modern human-wildlife interactions (Somu Y. & Selvaraj P., 2022).

1. Prehistoric Human-Wildlife Relationships:

Before the advent of agriculture, early humans lived as hunter-gatherers, relying on wildlife for food, clothing, and tools. Human populations were small, and the impact on wildlife was minimal, resulting in a relatively balanced relationship. However, even in prehistory, conflicts existed in the form of predator threats, particularly from large carnivores such as lions, wolves, and leopards, which would sometimes attack human camps or settlements (Woodroffe R *et al.,* 2005).

Subsistence Hunting and Gathering: Early humans depended on wildlife for sustenance. Archaeological evidence from sites like Olduvai Gorge suggests that humans competed with scavengers like hyenas and vultures for food, highlighting early resource competition between humans and wildlife.

Domestication and Early Conflicts: With the domestication of animals such as dogs, humans gained allies in their defense against predators, but also increasingly competed with wild herbivores for grazing lands.

2. Agricultural Expansion and Habitat Encroachment:

The development of agriculture around 10,000 years ago marked a significant turning point in human-wildlife relations. The clearing of forests and grasslands for farming and grazing led to habitat destruction, pushing wildlife into smaller, more isolated areas (Redford, K. H., & Stearman, A. M., 1993).

Deforestation and Land Conversion: Early agricultural communities in Mesopotamia, the Nile Valley, and the Indus Valley altered ecosystems on a significant scale. Large herbivores, such as deer and elephants, began raiding crops, while predators attacked livestock.

Rise of Permanent Settlements: As humans settled in one place, they erected barriers between themselves and wildlife. Fences, walls, and ditches became physical representations of the growing divide between humans and animals.

3. Hunting and Overexploitation in Ancient and Medieval Periods:

As civilizations expanded, organized hunting for food and sport became common. While some cultures developed religious or legal protections for certain animals, others engaged in large-scale hunts that pushed many species to the brink of extinction (Reynolds J & Peres C., 2006).

Subsistence vs. Sport Hunting: In ancient Egypt, Mesopotamia, and Greece, hunting was a way of life. While subsistence hunting was necessary, sport hunting became a popular activity among the elite, sometimes leading to overexploitation of wildlife. Lions, tigers, and bears were particularly targeted for their perceived status and threat (Ramírez B P & Calmé S, 2015).

Cultural and Symbolic Conflicts: Many animals held symbolic or religious significance in ancient cultures, from the sacred cows of Hinduism to the hunting deities of Greece and Rome. These beliefs sometimes protected species from extinction, but also led to the persecution of animals viewed as malevolent or threatening (Madhusudan M. D. & Mishra C., 2003).

4. Colonialism and the Escalation of Wildlife Conflicts:

The era of European colonialism (15th–20th centuries) dramatically intensified human-wildlife conflicts. Colonizers brought with them new farming practices, weaponry, and livestock, transforming ecosystems and intensifying competition between humans and wildlife.

Introduction of Non-Native Species: European colonizers often introduced new species (e.g., livestock, crops) that further strained ecosystems, as in the case of Australia's introduction of rabbits and foxes, which disrupted local wildlife populations.

Commercial Hunting and Resource Exploitation: The colonial period saw the rise of commercial hunting for fur, ivory, and other animal products. This led to the near extinction of many species, such as the American bison, African elephant, and various species of whales (Anand S & Radhakrishna S 2017).

Conservation and Game Reserves: Ironically, colonial powers also initiated some of the first wildlife conservation efforts, such as the establishment of game reserves in Africa and India. However, these often-marginalized indigenous peoples, exacerbating conflicts over land use and rights.

5. Industrialization and Urbanization: Fragmentation of Wildlife Habitats:

The Industrial Revolution (18th–19th centuries) marked another turning point in human-wildlife relations. Rapid industrialization and urbanization led to massive habitat loss, as cities expanded and natural landscapes were transformed.

Infrastructure Development: The construction of roads, railways, and factories fragmented ecosystems, cutting off animal migration routes and leading to an increase in human-wildlife encounters.

Pollution and Environmental Degradation: Industrial pollution from factories and urban centers further degraded wildlife habitats, making it harder for animals to find food and shelter (Maurya P *et al.,* 2020).

6. Modern Conservation and Wildlife Management:

By the 20th century, human-wildlife conflicts became a global issue, with the rise of conservation movements seeking to preserve biodiversity while mitigating conflicts. The establishment of national parks, wildlife reserves, and the reintroduction of species like wolves and bison exemplified efforts to balance human and wildlife needs (Treves A *et al.,* 2009).

Protected Areas: While national parks and wildlife reserves have provided safe havens for wildlife, they also create conflicts when animals leave these areas and enter human territories. Poaching, crop raids, and livestock predation remain common issues.

Rewilding Efforts: Rewilding programs, such as the reintroduction of predators into ecosystems, have had mixed results. While they help restore ecological balance, they can also reignite conflicts with rural communities.

7. Climate Change and Future Challenges:

Climate change has added a new dimension to wildlife-human conflicts by altering ecosystems, migration patterns, and food availability. Rising temperatures and changing precipitation patterns are pushing wildlife into new areas, leading to increased human-wildlife encounters (Abbass K *et al.,* 2022)

Changing Migration Patterns: Species such as elephants, polar bears, and wolves are increasingly encroaching on human settlements in search of food and water as their natural habitats shrink due to climate change.

Adaptive Conservation: Modern conservation strategies must adapt to the realities of climate change, incorporating both traditional knowledge and innovative technologies to ensure sustainable coexistence (Western, D & Pearl, M. C., 1989).

CONCLUSION:

The historical basis of wildlife-human conflicts is complex and multifaceted, shaped by cultural, economic, and environmental factors. Understanding the historical context of these conflicts is critical for formulating effective strategies to manage and mitigate them. As human populations continue to grow and the impacts of climate change intensify, finding ways to coexist with wildlife in a sustainable and equitable manner is more important than ever.

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DNA Barcoding in Forensic Entomology: A Review of Applications, Challenges, and Future Directions

Archana L. Mahakalkar
Department od Forensic Biology
Governmrnt Institute of Forensic Science, Civil Lines, Nagpur, MH, India.
And
Lina Bhoyar
Research Scholar, Department of Forensic Medicine & Toxicology
All India Institute of Medical Sciences, Raipur, Chhattisgarh, India.

ABSTRACT

The use of DNA barcoding in forensic entomology has transformed the field by enabling rapid and accurate species identification of insects. This review provides a comprehensive overview of the current state of DNA barcoding in forensic entomology, highlighting its applications, limitations, and future prospects. We examined the existing literature on the use of cytochrome c oxidase subunit I (COI) and other genetic markers for insect species identification, post-mortem interval estimation, and geographic origin determination. While DNA barcoding has shown great promise, challenges remain, including the need for comprehensive reference databases, standardised protocols, and integration with traditional morphological methods. Future directions include the development of multi-locus barcoding approaches, machine learning integration, and expansion to other forensic applications. This review aims to provide a concise and original summary of the current status and future prospects of DNA barcoding in forensic entomology.

Key words: DNA Barcoding, COI, Forensic entomology, PMI

❖ INTRODUCTION:

Insects, drawn to the decaying remains of a corpse by their innate olfactory senses, serve as nature's necrophile detectives. Their presence and behavior at a crime scene offer a wealth of information. Forensic entomology, the scientific study of insects and their arthropod relatives in the context of legal investigations, has emerged as an invaluable tool in solving criminal cases. (Alam M *et al.,* 2024). When a body decomposes, it attracts an array of insect species, each with a distinct timeline for colonization. These insects, particularly flies and beetles, are crucial in determining key details about a crime, such as the post-mortem interval. By observing insect succession and development, forensic entomologists can estimate the PMI, gather evidence of possible corpse relocation, or even detect the presence of toxins. Traditionally, this process has relied on morphological identification, where the physical features of insects are examined to determine their species. However, due to the complexity of insect morphology and the similarities among species, accurate identification often requires a high level of expertise.

In recent years, advancements in molecular techniques have offered a more reliable alternative. DNA barcoding, a method that sequences specific regions of an organism's DNA for species identification, has gained prominence in forensic entomology. This approach is particularly valuable for identifying insect species associated with decomposing remains, especially when traditional morphological methods are hindered by specimen damage or immature stages. A key advantage of DNA barcoding is its ability to differentiate between closely linked species, which can be difficult with conventional techniques. By sequencing standardized gene regions, such as the mitochondrial cytochrome c oxidase subunit I (COI) gene, accurate species identification becomes possible (Huang *et al.,* 2018).

This review paper explores key objectives related to the applications of DNA barcoding in forensic entomology. It begins by explaining the fundamental principles and methodologies of DNA barcoding as applied to the field, outlining how this technique enhances species identification. Additionally, the paper assesses the current applications of DNA barcoding, focusing on its role in forensic investigations, particularly in estimating post-mortem intervals (PMI). Furthermore, it critically evaluates the challenges and limitations associated with the carrying out of DNA barcoding. Alongside this, the recent advancements in DNA barcoding technologies have improved the accuracy and efficiency of forensic investigations. Lastly, the paper proposes future directions for expanding the utilisation of DNA barcoding in forensic entomology.

❖ DNA Barcoding:

(Hebert *et al.,* 2003a, b) introduced a groundbreaking technique that employs a primer set to amplify a 648-base pair (bp) region of the mitochondrial cytochrome-c oxidase subunit 1 (COI) gene. This method, designed to enable the quick and precise identification of biological specimens, became known as “DNA barcoding”.

DNA barcoding serves as a highly effective tool for species identification and discovery by using standardized short DNA regions for taxon identification. With the advent of advanced sequencing technologies like Next-generation sequencing (NGS), ONT MinIONnanopore sequencing, and PacBio sequencing, DNA barcoding has become more precise, efficient, and reliable. Its ability to quickly identify species has made it invaluable in various fields, including forensic science (Antil S *et al.,* 2023).

To advance DNA barcoding as the global standard for sequence-based identification of eukaryotes, the Barcode of Life project was launched. In 2004, the Consortium for the Barcode of Life (CBOL) was established to lead this effort, focusing on developing a standardized protocol for DNA barcoding and building a comprehensive DNA barcode library. The worldwide Barcode of Life project (iBOL), a significant worldwide collaboration comprising 26 countries, was recently launched, marking the beginning of a new phase for the Barcode of Life project. Using a DNA barcode library that includes all eukaryotes, iBOL seeks to create an automatic identification system (Jinbo U *et al.,* 2011).

❖ **Principle of DNA Barcoding:**

In DNA barcoding, a short and highly conserved gene segment, such as the mitochondrial cytochrome c oxidase subunit I (COI) gene, serves as a molecular identifier. This gene region contains conserved and variable sections, allowing species-level differentiation while providing the essential primer binding sites for PCR amplification. (Odah, M A A., 2023).

Steps in DNA Barcoding (Kress & Erickson, 2012)**:**

1. **Building the Barcode Library:**

   A comprehensive DNA barcode reference library is established by carefully selecting one or more individuals from each species to act as reference samples. These samples are obtained from live specimens in their natural habitats or, when necessary, from preserved tissue samples stored in museums and herbaria. Voucher specimens play a imperative role in maintaining a permanent link between the DNA barcode and the identified species. Taxonomists are tasked with the important responsibility of creating and confirming the DNA barcodes for the species under their study.

2. **DNA Extraction and Sequencing:**

   DNA is extracted from tissue samples, and targeted regions are amplified through polymerase chain reaction (PCR). The resulting amplified DNA is then sequenced to generate a DNA barcode, which is essential for species identification.

3. **Comparison with Barcode Library:**

   In the process of identifying an unknown specimen, the DNA barcode sequence is compared to a reference library containing sequences of known species. Various algorithms, such as BLAST (Basic Local Alignment Search Tool), Kimura-2-Parameter Distance, and Smith-Waterman Algorithm, are utilized to determine the closest matching sequence, ultimately aiding in the identification of the unknown species (Erickson DL *et al.,* 2008)

4. **Sequence Alignment:**

   Sequence alignment algorithms are utilized to determine the genetic distance between DNA sequences. The precision with which species are identified is directly correlated to the level of similarity between the unknown sample and the reference barcode. The closer the match, the more precise the identification will be.(Ratnasingham S& Hebert PDN, 2007).

❖ **Application of DNA barcoding in Forensic Entomology:**

- **Species identification:**

Accurate identification of insect species is a critical aspect of forensic entomology, but it can be challenging, particularly when dealing with damaged specimens or immature stages of insects. In such cases, molecular techniques like DNA barcoding have emerged as invaluable, involving sequencing a standardized region of an organism's DNA and comparing it to a reference database of DNA sequences for known species. This approach enables precise and reliable identification of insect species, even when traditional morphological characteristics are unavailable

or inconclusive. DNA barcoding has significantly improved the accuracy of species identification in forensic entomology, enhancing the field's ability to provide more reliable evidence in criminal investigations and contributing to more accurate post-mortem interval estimations. It is important to note that DNA barcoding should be used in conjunction with other entomological methods to ensure comprehensive and robust analyses (Joseph *et al.,* 2011).

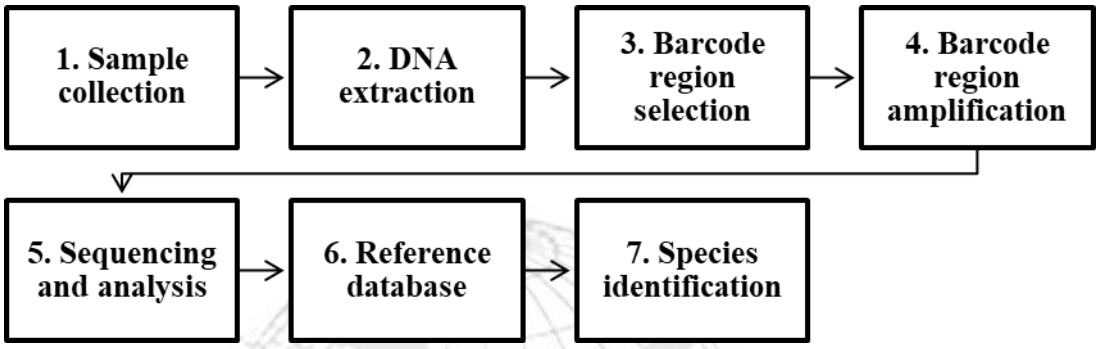

Figure 1. Overview of the Steps Involved in Species Identification Using the DNA Barcoding Method **(**Alam M *et al.,* 2024**).**

- **Postmortem Interval Estimation:**

DNA barcoding aids in estimating the postmortem interval (PMI) by identifying the specific insect species present on decomposing remains. Different insects colonize carcasses at different stages of decomposition, and their presence can provide vital details about the PMI. For example, studies have shown that certain fly species can be reliably identified at various life stages using DNA barcoding, which helps forensic experts make more informed estimations regarding PMI. (Grzywacz A *et al.,* 2021)

- **Evidence Preservation:**

DNA barcoding offers a highly efficient tool for analyzing degraded biological evidence. Even when samples are fragmented or have poor DNA preservation, such as insect fragments or DNA extracted from insect eggs, DNA barcoding can still provide valuable insights. To overcome the challenges associated with degraded samples, researchers have developed mini-barcodes**.** These shorter barcode regions, compared to traditional full-length barcodes, are less susceptible to degradation. By targeting specific, conserved regions within the DNA sequence, mini-barcodes can often yield reliable identification results even from highly degraded material. This innovation has significantly expanded the applicability of DNA barcoding in forensic investigations, allowing for the analysis of evidence that might otherwise be lost. (Guo M *et al.,* 2022)

- **Illegal trade involving endangered or protected insects:**

DNA barcoding is useful for identifying endangered or protected insect species involved in illegal trade, which has significant applications in forensic entomology. Accurately identifying insect species, helps investigators track illegal activities and contributes to ecological forensics. This tool can also assist in determining the geographic origin of species, providing crucial evidence in wildlife trafficking cases, and supporting legal proceedings related to biodiversity

crimes. (Jinbo U *et al.,* 2011)

❖ **Challenges in Implementing DNA Barcoding in Forensic Entomology**

DNA barcoding in forensic entomology is an essential tool. However, several challenges hinder its widespread application in forensic investigations. Below are some key challenges:

- **Reference Database Limitations:**

An extensive DNA barcode reference library is crucial for reliable species identification. However, existing databases frequently lack adequate representation of all species relevant to forensic investigations, resulting in potential identification errors or exclusions. For example, one study demonstrated the creation of a reference library containing sequences from 502 arthropod species, underscoring the need for further expansion of these databases to enhance identification accuracy (Chimeno *et al.,* 2018).

- **Sample Contamination and Misidentification:**

During DNA extraction and processing, specimens may become contaminated or mislabelled, resulting in erroneous barcode sequences. Human errors, including sample confusion and contamination during the extraction process, significantly contribute to inaccuracies in the data (Cheng Z *et al.,* 2023; OdahMAA*et al.,* 2023). These issues can lead to misidentification of species, which is particularly critical in forensic contexts where precise identification is paramount.

- **Technical Limitations of DNA Barcoding:**

The conventional methods of DNA barcoding rely on sequencing specific gene regions, such as the cytochrome c oxidase I (COI) gene. However, this method can be hindered by DNA degradation in older or processed samples, making it difficult to recover usable sequences (OdahMAA*et al.,* 2023) Additionally, the amplification of longer DNA fragments can be problematic when dealing with compromised specimens, limiting the method's applicability in certain forensic situations.

- **Intraspecific Variability:**

High levels of genetic variability within species can complicate the identification process. Studies have shown that some species exhibit significant intraspecific genetic divergence, which may lead to challenges in distinguishing between closely related species using standard barcoding techniques (Piper AM *et al.,*2019; Grzywacz A *et al.,*2021). This variability necessitates careful consideration of barcode selection and may require supplementary morphological analysis for accurate identification.

- **Bioinformatics Challenges:**

The integration of bioinformatics tools is crucial for analyzing and interpreting DNA barcode data. However, the complexity of analyzing large datasets generated through high-throughput sequencing can pose challenges. Mislabelling and errors in public reference databases further complicate the analysis process, leading to potential misidentifications. (Piper AM *et al.,*2019; Cheng Z *et al.,* 2023)

- **Cost and Resource Limitations:**

While DNA barcoding is generally considered cost-effective compared to traditional morphological methods, the costs associated with high-throughput sequencing and comprehensive database development can be significant. This financial barrier may limit access to advanced barcoding techniques for some forensic laboratories (OdahMAA *et al.,* 2023).

Despite its potential benefits in forensic entomology, DNA barcoding faces several challenges that must be addressed to enhance its reliability and applicability. Expanding reference databases, improving extraction protocols to minimize contamination risks, addressing intraspecific variability issues, and investing in bioinformatics capabilities are essential steps toward overcoming these hurdles. Continued research and collaboration among forensic scientists will be vital for refining DNA barcoding methodologies and ensuring its effectiveness in forensic investigations.

❖ **Recent Advances in DNA Barcoding Technology:**

DNA barcoding has gained recognition as a highly impactful approach in forensic entomology, enabling more accurate and rapid identification of insect species associated with decomposing remains. Recent advances have expanded the applications and improved the efficiency of this technology.

- **Expanded Reference Databases**

One of the most significant advances has been the development of reference databases for insect DNA barcodes. The Barcode of Life Data System (BOLD) now includes a comprehensive collection of DNA barcodes for forensically important insect species. (Meiklejohn KA *et al.,* 2019)

- **Improved Extraction Techniques**

Researchers have developed more efficient DNA extraction methods from insect samples, including those that are degraded or contaminated. (Pereira FCarneiro *et al.,* 2020)

- **Next-Generation Sequencing (NGS) Integration**

The integration of NGS technologies has allowed for more rapid and cost-effective DNA barcoding of multiple insect species simultaneously. (Shokralla S *et al.,* 2015)

- **Machine Learning Integration**

Machine learning algorithms have been developed to improve the precision with which species are identified based on DNA barcode data. (Weitschek E *et al.,*2020). These advances have significantly enhanced the capabilities of DNA barcoding in forensic entomology, improving the accuracy and efficiency of insect species identification in criminal investigations.

❖ **Future directions:**

There are several avenues for future research to enhance its application in this field.

- **Expansion of DNA Barcode Databases**:

The accuracy and scope of DNA barcoding in forensic entomology depend on comprehensive reference databases. As the technology progresses, the expansion of global DNA

barcode libraries for forensic-relevant species will become crucial. Greater international collaboration between forensic entomologists, taxonomists, and conservation biologists will lead to more extensive databases that cover a wider range of species, including those in underrepresented regions or ecosystems. (Chimeno *et al.,* 2018)

- **Development of Species-Specific Barcodes**: Advances in genomics may lead to the identification of more precise species-specific DNA barcodes. Current barcoding technologies rely on specific gene regions like COI (cytochrome c oxidase I), but future research may focus on identifying unique genetic markers that allow for even finer differentiation between closely related species. This will further improve the accuracy of forensic investigations, especially in cases where multiple insect species colonize a body.
- **Integration with Advanced Technologies:**

The integration of next-generation sequencing (NGS) technologies is revolutionizing DNA barcoding methodologies. High-throughput sequencing allows for the simultaneous analysis of multiple samples, which is particularly beneficial in forensic contexts where bulk insect samples are collected from crime scenes. This capability expedites the process of identification while simultaneously improving the detection of cryptic and rare species that may be vital to investigations. (Odah MAA *et al.,* 2023)

- **Automation and Standardization:**

As DNA barcoding techniques become more refined, there is potential for increased automation in sample processing and data analysis. The development of standardized protocols will facilitate reproducibility and reliability in forensic applications. Furthermore, automated systems can streamline workflows, reducing human error and enhancing throughput in forensic laboratories (Grant *et al.,* 2021; Cheng Z *et al.,* 2023)

- **Advancing DNA Barcoding Technology:**

Next-Generation Sequencing (NGS): Utilizing NGS technologies can accelerate the process of DNA barcoding and enable the analysis of multiple samples simultaneously. This will improve the efficiency and cost-effectiveness of forensic investigations.(Lumsden GA., 2021)

Mini-Barcodes: Developing shorter DNA sequences (mini-barcodes) can simplify the analysis process and reduce the risk of contamination.

❖ CONCLUSION:

DNA barcoding has emerged as a powerful tool in forensic entomology, offering accurate and rapid species identification. While facing challenges such as limited reference databases and potential contamination, ongoing research, and technological advancements are addressing these issues. In the future, DNA barcoding is expected to play an even more pivotal role in determining post-mortem intervals, identifying species, and linking suspects to crime scenes. By integrating with other forensic techniques, it will provide a more comprehensive understanding of criminal events.

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A Study on Ground Water quality in and Around Warwat Bakal Tq. Sangrampur (MH)

N. Khandagale
Arts and Commerce Warwat Bakal Sangrampur
And
M. R. Solanke
Arts and Commerce Warwat Bakal Sangrampur
And
J. R. Somatkar
Late Pundalikrao Gawali Arts and Science Mahavidyalaya
Shirpur (Jain), Taluka Malaegaon Dist-Washim, Maharashtra State INDIA.

Abstract:

Ground water is one of the major sources of drinking water for major rural and urban population in almost all the areas of country, especially in villages and smaller cities. Borewells and wells are predominantly exploited for routine use of water for domestic purpose, irrigation purpose, industrial use and many more. According to WHO report it suggests that lack of clean drinking water adversely affect the human health and life expectancy. Hence analysis of groundwater becomes necessary. The present investigation is based on physico-chemical analysis of Ground water collected from different sampling locations of Warwat Bakal. The physico-chemical parameters analyzed during the present study includes temperature, pH, electrical conductivity, total dissolved solids (TDS), free carbon dioxide (CO2), carbonate, bicarbonate (HCO3), and total hardness. The present analysis shows significant variability among the sites regarding water parameters providing insights into the groundwater quality status in the region, which can benefit in developing a water protection strategy.

Introduction

Water is a crucial component of life on the earth. Water is transparent and nearly colourless chemical substance that is the main constituent of Earth's streams, lakes, and oceans, and the fluids of most living organisms. It occurs in nature as snow, glaciers, ice packs and icebergs, clouds, fog, dew, aquifers, and atmospheric humidity. Water is vital for all known forms of life. About 75% of the world's surface area is covered with water. Out of which 97% of the earth's water is in the ocean, not fit for human use due to its high salt content. Remaining 2% is locked in polar ice caps and only 1% is available as fresh water in rivers, lakes, streams reservoirs and ground water, suitable for human consumption **(Singh, Tiwari, Singh, 2015)**. A greater quantity of water is found in the earth's interior. Water continuously moves through the water cycle of evaporation, precipitation, transpiration and runoff usually reaching to the sea. Evaporation and transpiration contribute to the precipitation over land. Large amounts of water are also chemically combined or adsorbed in hydrated minerals. The water present below the earth surface in soil pore space is also

known as ground water. Groundwater is water located beneath the earth's surface in soil pore spaces and in the fractures of rock formations. Groundwater is recharged from, and eventually flows to, the surface naturally; natural discharge often occurs at springs and seeps, and can form oasis or wetlands. Groundwater is also often withdrawn for agricultural, municipal and industrial use by constructing and operating extraction wells **(Sundar, Sankar, Venkatraman, Mohan,2015)**.In our technologically advanced society, there is a growing indifference to our natural heritage, leading to the exploitation and contamination of vital water sources like rivers, lakes, and oceans. This pollution seeps into groundwater, a crucial source of drinking water. Groundwater can become contaminated through several pathways, including polluted surface water that recharges aquifers, hazardous substances leaching through soil, and continuous contamination sources forming groundwater plumes.

Groundwater consists not only of water in shallow aquifers but also includes soil moisture, permafrost, and water from deeper geological formations. While groundwater is often cheaper and less vulnerable to pollution than surface water, it is also more challenging to remediate once contaminated. Major pollution sources include improper waste disposal, industrial chemicals, agricultural fertilizers and pesticides, mining waste, and leaking storage tanks. Addressing groundwater pollution is critical for protecting this essential resource.

Methodology

Description of study area

Warwat Bakal is one of the major villages in Sangrampur tahesil district Buldana State Maharashtra. The Latitude of Warwat Bakal is 20.9258333. The Longitude of Warwat Bakal is 77.7647222.

Groundwater samples were collected from four directions around Warwat Bakal and divided into eight distinct sites: Site I (East), Site II (Southeast), Site III (South), Site IV (Southwest), Site V (West), Site VI (Northwest), Site VII (North), and Site VIII (Northeast). These samples were then transported to the laboratory for analysis of various physical and chemical parameters. The analysis included measurements of temperature, pH, electrical conductivity, total dissolved solids (TDS), free carbon dioxide (CO2), carbonate (CO3), bicarbonate (HCO3) and total hardness. All parameters were evaluated using the standard methods outlined by **APHA (1998).**

Results and Discussion

The results of the present study shows analysis of various water parameters of ground water collected from eight sites (Site I- Site VIII) are depicted in the table given below:

Parameters	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8
Temperature in °c	20.5 ± 1.53	27 ± 1	28± 1	27.33 ± 1.52	26.33 ± 2.08	26.67 ± 0.70	26.67 ± 1.15	29.67 ± 0.57

pH	7.47 ±0.14	7.51 ± .02	7.71 ± 0.06	6.72 ± 0.10	7.48 ± 0.22	7.67 ± 0.06	7.61 ± 0.09	7.57 ± 0.09
Electric conductivity	832.06 ± 1.43	834.03 ± 1	1680 ± 0.05	1090 ± 0.01	887.5 ± 1.02	497.23 ± 2.05	501.73 ± 0.66	643.16 ± 1.75
TDS (ppm)	426.43 ± 0.73	426.03 ± 1	811.03 ± 1.11	563.9 ± 6.53	460.03 ± 5.35	287.43 ± 1.69	291.5 ± 1.5	358.83 ± 1.98
CO_2 (mg/lit)	10 ± 4	6.67 ± 3.06	12.67 ± 1.15	17.33 ± 7.57	2.67 ± 1.15	13.33 ± 1.15	6.67 ± 3.05	8.66 ± 1.15
CO_3 (mg/lit)	8.67 ± 3.05	10.67 ± 6.43	26 ± 2	19.34 ± 4.16	14 ± 4	18.67 ± 5.03	16.67 ± 1.15	14 ± 3.46
HCO_3 (mg/lit)	172.67 ± 10.06	172 ± 3.46	230.67 ± 6.42	167.33 ± 6.11	156 ± 3.46	194 ± 6	171.33 ± 6.11	208 ± 9.16
Chloride (mg/lit)	99.26 ± 7.09	113.44 ± 18.75	184.53 ± 7.09	148.89 ± 4.18	186.70 ±21.66	108.71 ± 8.18	120.53 ±14.18	115.80 ±16.37
Salinity (g/lit)	179.19 ± 12.8	204.78 ± 33.85	333.09 ±12.81	268.77 ±25.59	337.02 ±39.09	196.25 ±14.77	217.58 ±25.59	209.05 ±29.55
Total hardness (mg/lit)	201 ±1.34	268 ±5.29	630.67 ± 9.45	394 ±4	490 ±12.16	174.67 ± 5.03	166 ±7.21	148.67 ± 8.32

The temperature of groundwater across the eight sites in Warwat Bakal varied significantly, ranging from 20.5°C at Site 1 to 29.67°C at Site 8. Site 1 recorded the lowest average temperature, with a standard deviation of ±1.53°C, indicating relatively cooler groundwater compared to other sites. In contrast, Site 8 had the highest average temperature, with a standard deviation of ±0.57°C, showing a notable increase. **Mahananda *et al.* (2010)** noted minimal temperature differences between dug wells and bore wells in Baragrah district, Odisha, which they attributed to water depth. Similarly, **Balamurugan *et al.* (2012)** found groundwater temperatures in Madurai, Tamil Nadu, ranging from 24.3°C to 26.3°C, linked to the winter season.

The pH levels across the sites varied from 6.72 at Site 4 to 7.71 at Site 3. Most sites exhibited pH values around neutral (7.0), with Site 4 being slightly more acidic. The pH values were consistent, suggesting that the groundwater is predominantly neutral to slightly alkaline. **Ananthakrishnan *et al.* (2012)** reported that groundwater pH levels across three seasons remained within permissible limits. Electrical conductivity (EC) ranged from 497.23 µS/cm at Site 6 to 1680 µS/cm at Site 3. Site 3 exhibited the highest EC, indicating elevated levels of dissolved ions, while Site 6 had the lowest. This variation suggests differences in mineral content and overall ionic strength. **Balamurugan *et al.* (2012)** reported similar findings regarding electrical conductivity. Total dissolved solids (TDS) levels ranged from 287.43 ppm at Site 6 to 811.03 ppm at Site 3. Higher TDS values at Site 3 suggest a greater concentration of dissolved substances, while Site 6 indicated relatively lower mineral content. The variability in TDS aligns with the differences in electrical conductivity observed across the sites.

CO2 concentrations ranged from 2.67 mg/L at Site 5 to 17.33 mg/L at Site 4, with Site 4 having the highest CO2 level and Site 5 the lowest. This variation could be attributed to different sources of CO2 in the groundwater, including natural processes and anthropogenic influences. Carbonate concentrations varied from 8.67 mg/L at Site 1 to 26 mg/L at Site 3, with Site 3 exhibiting the

highest concentration, which may influence groundwater hardness and alkalinity. **Mahananda *et al.* (2010)** found no significant difference in carbonate alkalinity between dug wells and bore wells. Bicarbonate levels ranged from 156 mg/L at Site 5 to 230.67 mg/L at Site 3, with the latter indicating a higher buffering capacity of the groundwater. The variation in bicarbonate levels across sites may impact overall water chemistry and hardness. Chloride concentrations ranged from 99.26 mg/L at Site 1 to 186.70 mg/L at Site 5, with higher levels at Site 5 suggesting increased salinity and potential pollution sources. Salinity levels ranged from 179.19 g/L at Site 1 to 337.02 g/L at Site 5, reflecting higher ion concentrations in the groundwater. Sites with elevated salinity levels also exhibited higher chloride and TDS values, confirming a direct relationship between salinity and dissolved ionic content. Total hardness ranged from 148.67 mg/L at Site 8 to 630.67 mg/L at Site 3, with Site 3 having the highest hardness, indicative of a high concentration of calcium and magnesium ions. Site 8, with the lowest hardness, represents relatively softer water.

Conclusion

The present groundwater quality analysis shows significant variability among the sites, suggesting differing local geological and anthropogenic influences. Sites 3 and 4 exhibit higher mineral content, possibly indicating contamination or natural sources of hardness. The pH levels suggest most sites are within acceptable ranges for aquatic life, though Site 4's lower pH may require further investigation. Sites with elevated salinity and chloride levels warrant monitoring due to potential impacts on water quality. Overall, ongoing assessments and potential remediation strategies may be necessary for the affected sites to ensure safe and sustainable groundwater resources. The present work will make people, and the government to be aware of the dilemma of poor groundwater quality prevailing in these areas. Since, in the future the groundwater will have the major share of water supply schemes, plans for the protection of groundwater quality is needed.

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Preliminary Phytochemical Investigation of Some Weeds in Ahmednagar

Sable K. V.
Rayat Shikshan Sanstha's Radhabai Kale Mahila Mahavidyalaya, Ahmednagar
And
Bhagwat M. G.
Rayat Shikshan Sanstha's Radhabai Kale Mahila Mahavidyalaya, Ahmednagar

Abstract:

Weeds are the plants that grow at waste places. They also grow at the places like farm yards, play grounds, public places, water bodies, etc. Weeds although present in large amounts also show a large negative impact on the surroundings. These weeds can be controlled by different methods. One such way is to use these weeds for the welfare of the human beings. Apart for being noxious, the weeds also have certain medicinal properties. Therefore, the qualitative phytochemical screening of some weeds viz; Alternanthera sessilis, Amaranthus spinosus, Achyranthes aspera, Lantana camara, Amaranthus viridis, Leucas longifolia, Xanthium strumarium was carried out. The preliminary phytochemical investigation of these weeds reveals the presence of different secondary metabolites in them.

Keywords: *Alternanthera sessilis, Amaranthus spinosus, Amaranthus viridis, Leucas longifolia, Achyranthes aspera, Lantana camara, Xanthium strumarium.*

Introduction:

Weeds are the plants growing out of place and out of time. They have occupied hectares of fertile as well as non-fertile land. They compete with crops for space, water and minerals. Weeds are plants that grow at waste places, water bodies, etc. and are usually considered as unwanted plants. All the unwanted plants are not necessarily the weeds. Weeds are highly medicinal but are generally neglected to be used on a large scale. The plant resources play an important role in the welfare of human beings. They fulfill many needs viz; food, fuel, fiber and medicine. Indian ancient literature observed that every plant on this planet is useful in medicine, industry and allelopathy. The different phytochemicals like Alkaloids, Cellulose, Carbohydrates, Saponins, Tannins, Flavonoids, Glycosides, Phenols, Triterpenoids, Steroids, Quinones, Terpenoids and many others screen out in the plants are key reservoirs of many new essential drugs.

Phytochemical analysis is the primary investigation for the discovery of new useful drugs. Plants are resources of drugs of traditional systems of chemical, medicine and phytochemical intermediates entities for synthetic drugs. The weed flora of Ahmednagar district is very rich with Asteraceae, Amaranthaceae and Poaceae as dominant families. Most of the weeds are common in both Kharif and Rabbi Seasons. During the study, preliminary phytochemical analysis of the following weeds was carried out using standard methods

Materials and Methods:

Extraction of plant material

The weed plants of leaves were dried and converted into powder; this 2gm of dried powder was successively dissolved in 25ml of distilled water. The extract was filtered using the Buchner funnel.

Phytochemical analysis

Various phytochemical tests are conducted to identify represented of different phytochemicals flavonoids, glycosides, tannins, terpenoids, alkaloids and phenolic compounds based on the methods available in the literature.

Test of Alkaloids (Wagner's Test): -

1ml of plant extract + 3-5 drops of Wagner's reagent give the formation of a reddish-brown precipitate or coloration that indicates the presence of alkaloids.

Test of carbohydrates (Molisch's test):-

1ml of plant extract + 3-5 drops of Molisch's reagent + 1ml of conc. Sulphuric acid (H_2SO_4) down the side of the test tube. Allow the mixture to stand for 2-3 min. The formation of a red or dull violet color at the interface of the two layers indicates the presence of carbohydrates.

Test for Cardiac Glycosides (Keller Kelliani's Test): -

1ml extract + 1ml of glacial acetic acid and 2-3drops of 5% ferric chloride solution. To this mixture add 0.5ml of conc.H_2SO_4. Formation of a brown ring at the interface indicates the presence of deoxysugar which is a characteristic of cardenolides. It may also develop a violet ring below; while a green ring may develop in the acetic acid layer.

Test for Flavonoids (Alkaline reagent Test): -

1ml of extract + 3-5 drops of 20% Na OH solution. The formation of an intense yellow color, which becomes colorless with the addition of 0.5 ml dilute HCl indicates the presence of flavonoids.

Test for Phenols (Ferric Chloride Test): -

1ml of extract + 5-6 drops of aqueous ferric chloride solution; the formation of deep blue or black color indicates the presence of phenols.

Test for Amino acid and Proteins (1% Ninhydrin solution in Acetone)

1ml of extract + 2-5 drops of aqueous Ninhydrin solution and keep it in a boiling water bath for 1-2 min; the formation of purple color indicates the presence of amino acids.

Test for Saponins (Foam test)

1ml of extract + 5ml distilled water and shake vigorously. The formation of persistence foam for 10-15 min confirms the presence of saponins.

Test for Tannins (Braymer's test)

1ml of extract + 1ml of 10% alcoholic ferric chloride solution; the formation of a blue or greenish color indicates the presence of tannins.

Test for Terpenoids (Salkowski Test)

1ml of extract + 0.5ml of conc. HCl; the formation of yellow precipitate or coloration indicates the presence of terpenoids.

Test for Quinones

1ml of extract + 5ml distilled water, if the solution turns turbid; it indicates the presence of quinones.

Result and Discussion:

The phytochemical analysis of weeds was carried out and showed a positive test (**Table No. 1 & Photo Plate I)** for saponins, phenol, terpenoids & tannin compounds and negative for quinones. Only *Xanthium strumarium* gives a negative response to flavonoids. *Amaranthus spinosus, Leucas longifolia and Achyranthus aspera,* these all weed plants under study showed a positive test for Alkaloids. The presence of Alkaloids, saponins, tannins, and flavonoid compounds in weeds has curative activity against several disorders and therefore weeds are using traditionally for the treatment of various illnesses. Weeds plants are rich in alkaloids, tannins and cardiac glycosides and show antimicrobial activity against several microorganisms Saponin has been shown to have immense significance as hypotensive, anti-hyper cholesterol and cardiac depressant properties. The presence of tannins suggests the ability of this plant to play a major role as an antidiarrheal and anti-hemorrhagic agent.

Weeds show a positive test for phenols, they have biological properties such as anti-diuretic, anti-inflammatory, anti-aging, anti-apoptosis, anti-carcinogen, cardiovascular protection and improvement of endothelial function, as well as inhibition of angiogenesis and cell proliferation activities. The Glycosides are present only in *Amaranthus spinosus*. Glycoside is a major bioactive component that has anti-secretory and antiulcer effects. Cardiac glycosides are used as stimulants in cases of cardiac failure. Plant glycosides inhibit chloride transport in the stomach and are not toxic when taken orally.

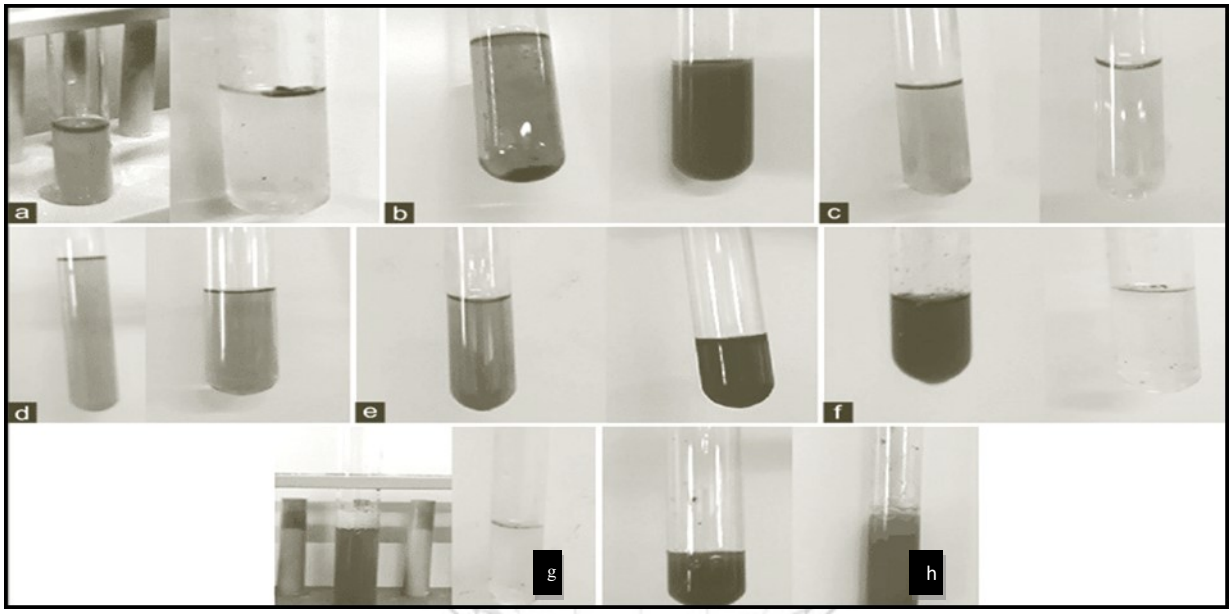
Table no.1 - Preliminary phytochemical screening of some weeds

Sr. No.	Phyto Constituents	*Alternanthera sessile*	*Amaranthus spinosus*	*Lantana camera*	*Xanthium strumarium*	*Amaranthus viridis*	*Leucas longifolia*	*Achyranthus aspera*
1	**Alkaloids**	--	++	--	--	--	++	++
2	**Carbohydrates**	++	++	++	--	++	++	++
3	**Cardiac glycosides**	--	++	--	--	--	--	--
4	**Flavonoids**	++	++	++	--	++	++	++
5	**Phenol**	++	++	--	++	++	--	++
6	**Amino acids/ Proteins**	++	++	--	++	++	++	++
7	**Saponins**	-	++	--	++	--	--	--

8	**Tannins**	++	++	++	++	++	--	--
9	**Terpenoids**	++	++	--	++	++	++	--
10	**Quinones**	--	--	--	--	--	--	--

++- Positive, -- Negative

Photo Plate I



a Terpenoids test, b-Carbohydrate test, c- Flavonoids Test, d-Protein test, e-Amino acid test, f-Alkaloids test, g –Saponin test, h – Phenolic test

Conclusion:

The positive response of weeds to the presence of secondary metabolites indicates that these weeds can be used in medicine as per the requirement of secondary metabolites. It is evident from the results & literature available that the presence of phenol indicates the usefulness of these weeds as antidiuretic, antiaging, antiapoptosis, anticarcinogen, and anti-inflammatory agents.

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Synthesis and Characterization of Medicinal Cigarette

Jadhao A. S.
Department of Botany
And
Shaikh F. T.
Department of Botany
And
Sirsat D. R.
Department of Botany
And
Bathe P. N.
Department of Zoology
And
Agrawal N. K.
Department of Microbiology
Bapumiya Sirajoddin Patel Arts, Commerce and Science College,
Pimpalgoan Kale, Ta. Jalgoan (Jamod), Dist. Buldhana (M.S)

ABSTRACT

Smoking of tobacco cigarette causes most lung cancers and can also cause cancer almost anywhere on the body along with breathing problems, chronic respiratory conditions heart disease, stroke and blood circulation problems. Tobacco smoke consists of more than 4000 chemical compounds and approximately 60 known carcinogens. Present research was undertaken to overcome these problems, in this study different medicinal plants viz., Curcuma longa (rhizome), Zingiber officinale (Rhizome), Ocimum tenuiflorum (leaf), and Camellia sinensis (tea) in different combinations. Smoke of medicinal cigarette revealed existence of various secondary metabolites which such as Glycoside, Steroid, Tannin and Alkaloids whereas smoke of tobacco cigarette showed presence of Tannin only. Standardization of secondary metabolites from the smoke of medicinal cigarette is necessary for further study.

Keywords: Medicinal cigarette, phytochemical, tobacco cigarettes

Introduction:

Tobacco is presently an important cash crop grown on 0.4 million hectares in the country and accounts for approximately 0.27% of the net cultivated area. The annual production is around 700 million kg and Indiaranks third in the world in production after China and Brazil (ctri.icar.gov.in). Smoking refers to inhaling and exhaling the vapour produced by combustion of plant material, it is mostly linked with different tobacco products such as cigarettes, cigar and pipes. Nearly 1.1 billion smoker's arte worldwide and causing more than 8 million deaths yearly

(Ferrarini *et al.,* 2022).Smoking causes cancer, heart disease, stroke, lung diseases, diabetes, and chronic obstructive pulmonary disease(COPD), which includes emphysema and chronic bronchitis(ncbi.nlm.nih.gov/books).

In 1992, the US Environmental Protection Agency classified environmental tobacco smoke as one of the most dangerous cancer-causing agents in humans, a Group A carcinogen. Tobacco smoke consists of more than 4000 chemical compounds and approximately 60 known carcinogens. Half of these compounds occur naturally in the green tobacco leaf, where the remainder is generated when the tobacco is burned. The complex mixture of chemicals in tobacco smoke includes carbon monoxide, hydrogen cyanide, benzene, formaldehyde, nicotine, phenol, polycyclic aromatic hydrocarbons (PAHs) and tobacco-specific nitrosamines (TSNAs).It should be noted that only the particulate phase, approximately 5% of the cigarette's total output, is visible(Stephen Hecht, 2011).

Herbal cigarettes are the type of cigarette that is made from various combinations and mixture of medicinal herbs and other natural ingredients; they are tobacco and nicotine free. Herbal cigarette are alternative to traditional tobacco cigarette, it still produce some harmful chemicals as tobacco cigarettes like tar and carbon monoxide. China was the first country to create herbal tobacco cigarettes between 1959 and early 1970's for the treatment of asthama and bronchitis patients (Abdel Rehman *et al.,* 2022).

Material and Methods:

Selected medicinal plants viz., *Curcuma longa* (rhizome), *Zingiber officinale* (Rhizome), *Ocimum tenuiflorum* (leaf), *Camellia sinensis* (tea) were collected form the surrounding and identified by using the floristic literature (Diwakar and Sharma, 2000; Sharma *et al*, 1996; Singh, *et al*, 2001). Selected plant material were shade dried for 5-6 days. Different samples of various combinations were used to prepared medicinal cigarette and named as sample no. as 1, 2, 3, 4 and 5 whereas tobacco cigarette sample used as control.The smoke of medicinal cigarette and tobacco cigarette were collected in the sample bottle and dissolved in ethyl alcohol. Different phytochemical detection test viz., alkaloid, steroid, Amino acid, Tannin, Phytosterol etc. were carried out in the laboratory (Sahu and Saxsena, 2012, Chauhan *et al.,* 2015).Finally results of the medicinal cigarette were compared with the standard.

Experimental Results:

Table no. 1: Preliminary phytochemicals test of medicinal cigarette

Sr. No	Test	Sample1 (CL + OT + ZO)	Sample2 (CL + ZO + CS)	Sample3 (OT + ZO + CS)	Sample 4 (CL + OT + ZO + CS)	Control5 (Tobacco)
1	Glycoside	++	++	++	--	--
2	Steroid	++	++	++	--	--
3	Amino acid	--	++	--	++	--

4	**Phytosterol**	--	++	--	--	--
5	**Terpenoids**	--	--	--	++	--
6	**Tannin**	++	++	++	++	++
7	**Alkaloids**	++	++	++	++	--
8	**Phenol**	--	--	--	--	--

(++) = Present and (--) = Absence, C L: *Curcuma longa* (rhizome), Z O: *Zingiber officinale* (rhizome), O T: *Ocimum tenuiflorum* (leaf), C. S.: *Camellia sinensis* (leaf)

The preliminary phytochemical detection of smoke of sample no. 1 revealed the detection of glycoside, steroid, Tannin and alkaloids; whereas sample no. 2 showed positive test for glycoside, steroid, amino acid, phytosterol, tannin and alkaloids. The smoke of medicinal cigarette of sample no. 3 showed presence of glycoside, steroid, tannin and alkaloids. Sample no 4 showed the positive test for presence of amino acid, terpenoids, tannin and alkaloids. Whereas sample of tobacco cigarette used as the control revealed the existence of Tannin (table no. 1).As medicinal cigarette shows presence various secondary metabolites, further study needs to screen these metabolites individually and also need to study their harmful effects on the human body.

Conclusion:

It is clear from the results that, smoke of medicinal cigarette in different combination revealed existence of various secondary metabolites such as glycoside, steroid, tannin, phytosterol and alkaloidswhichhave different medicinal values,and also possess effective functions on the treatment of different kinds of diseases.Smoke of Tobacco cigarette showed the existence of only Tannin. During the present study smoke of tobacco cigarette does not showedthe existence of secondary metabolites and hence cannot restrict carcinogens.

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Antifungal Activity of Selected Plants in Different Solvent from Akot Tehsil of Akola District Against *Candida albicans.*

Mr. Sumitkumar L. Mirge
And
Dr. Santosh N. Patole
Shri Shivaji Arts,
Commerce and Science College, Akot. 444101

ABSTRACT

Fungi resistance to substances has led to the need for novel medications to treat infectious disorders caused by these microbes. Natural compounds, such as Candida albicans, have been used to treat infections. This study assessed the antifungal activity of different plant extracts using Amphotericin B disc as a positive control.Boswellia serrata Roxb. ex Colebr, Gardenia latifolia Aiton, Woodfordia fruticosa (L.) Kurz and Wrightia tinctoria (Roxb. ex Colebr.) R. Br. plant extract was prepared in Acetone, Ethanol, petroleum ether and distilled water. By using the disk diffusion method the minimum zone of inhibition was recorded at different concentrations from 0 µg to 1000 µg. Acetone, petroleum ether and ethanol shows the antifungal activity at higher concentrations but Aqueous extract dose not shows the antifungal activity at any concentrations.

Keywords – Antifungal activity, *Candida albicans.*

Introduction:

The resistance that fungi have developed to various substances has been one of the biggest problems in treating them recently. This necessitated the employment of novel medications to treat infectious disorders brought on by these microbes (Bastos et al. 2011; Newman & Cragg 2016). In this field, the usage of natural compounds has been a major source of novel drug development (Newman & Cragg 2016; Biasi-Garbin et al. 2016). According to many studies (Maregesi *et al*. 2008; Svetaz *et al*. 2010; Bastos *et al*. 2011; Violante *et al*. 2012), local inhabitants utilize plants to cure infectious ailments, including those caused by fungus. This information has been used to guide research.

A fungus called *Candida albicans* is present on your body by nature. *Candida* is a form of fungus that is usually present in trace levels in your intestines, skin, and mouth. *Candida* equilibrium is regulated by the microbiome, the healthy microorganisms in your body. Whenever *Candida* is out of balance, then *Candida* frequently overgrows and becomes infected, leading to candidiasis.

Candidiasis is frequently caused by *Candida albicans*. The microbiome, which is in charge of preserving the harmony of beneficial bacteria in the body, controls its imbalance. New research on *Candida* species resistance to synthetic drugs has highlighted the need for novel antifungal

drugs with minimal adverse effects. Common medicinal plants with strong antimicrobial qualities include *Boswellia serrata* Roxb. ex Colebr, *Gardenia latifolia* Aiton, *Woodfordia fruticosa* (L.) Kurz and *Wrightia tinctoria* (Roxb. ex Colebr.) R.Br. are selected for the present studyby using Amphotericin B disc as a positive control to assess the antifungal activity of different plant extracts in selected solvents.

Material and Methodology:

2.1 Collection and extraction of plant material:

The plants *Boswellia serrata* Roxb. ex Colebr, *Gardenia latifolia* Aiton, *Woodfordia fruticosa* (L.) Kurz and *Wrightia tinctoria* (Roxb. ex Colebr.) R.Br. was identified by Dr. Santosh N. Patole, Botany department, shri shivaji arts, commerce and science college, Akot. The fresh and matured leaves of *Boswellia serrata* Roxb. ex Colebr, *Gardenia latifolia* Aiton, *Woodfordia fruticosa* (L.) Kurz and *Wrightia tinctoria* (Roxb. ex Colebr.) R.Br. also, the fruits of *Gardenia latifolia* Aiton was collected from Popatkhed, Shahanur, Khatkali and Narnala of Akot Tehsil of Akola District (M.S.). The leaves and fruits were given a wash of running tap water followed by washed with distilled water in order to remove dust and impurities on the leaves. The leaves were shade dried for 7 days and finely powered then stored for further use.

2.2 Preparation of plant extract for Phytochemical Analysis:

By using the Soxhlet extractor the leaf extract of *Boswellia serrata* Roxb. ex Colebr, *Gardenia latifolia* Aiton, *Woodfordia fruticosa* (L.) Kurz and *Wrightia tinctoria* (Roxb. ex Colebr.) R.Br.also the fruit extract of *Gardenia latifolia* was prepared in Acetone, Petrolium ether, ethanol in soxhlet and aqueous extract was prepared by boiling the leaves powder in dist. Water at 50 to 60 º C for 30 minutes and then filter through Whatman No. 01 Filter paper. After preparation of all extract the solvent get evaporated to get the concentrated extract and store it for further use.

2.3 Antifungal Activity for *C. albicans*

By using the zone inhibition method, the antifungal activity was examined (Kirby-Bauer method). To inoculate the SDA plates, 100 µl of *C. albicans* fungal culture (adjusted to 0.5 McFarland Unit - Approx cell density (1.5 X 108 CFU/mL) was spread out, and then discs containing 10 µl of various concentrations (0 to 100 mg/ml) were placed. Each plate had one disc filled solely with solvent, acting as the vehicle control, and one disc with 50 µg of amphotericin B was used as the positive control. The *C. albicans* plates were cultured for 24 hours at 37 °C in an incubator provided by Basil Scientific Corp. India. Measurements and records were made of the cleared zones that around the disk.

Result and Discussion –The results of the antifungal activity of plant extract in different solvents are as per the following table 01.

Table 01 - The Zone of inhibition (mm) of plant extract in different solvent against *C. albicans*

Plant Name	Amount (µg/disk) Solvents → ↓	Zone of Inhibition (mm)							Photo Plates
		P.C.	0	50	125	250	500	1000	
Boswellia serrata Roxb. ex Colebr (Leaves)	Acetone	21	0	10	10	11	11	14	**A**
	Petroleum Ether	20	0	10	10	11	11	15	**B**
	Ethanol	23	0	5	10	13	15	16	**C**
	Dist. Water	22	0	0	0	0	0	0	**D**
Gardenialatifolia (Leaves)	Acetone	20	0	5	5	5	7	12	**E**
	Petroleum Ether	25	0	10	11	10	10	12	**F**
	Ethanol	18	0	10	11	11	11	14	**G**
	Dist. Water	19	0	0	0	0	0	0	**H**
Gardenialatifolia (Fruits)	Acetone	15	0	5	5	6	6	10	**I**
	Petroleum Ether	17	0	8	8	7	7	9	**J**
	Ethanol	20	0	10	11	11	12	14	**K**
	Dist. Water	19	0	0	0	0	0	0	**L**
Woodfordia fruticosa (Leaves)	Acetone	18	0	6	6	7	7	11	**M**
	Petroleum Ether	19	0	9	9	9	10	10	**N**
	Ethanol	18	0	6	6	6	7	14	**O**
	Dist. Water	17	0	0	0	0	0	0	**P**
Wrightia tinctoria (Roxb. ex Colebr.) R.Br. (Leaves)	Acetone	19	0	4	5	5	7	11	**Q**
	Petroleum Ether	22	0	6	7	7	7	8	**R**
	Ethanol	21	0	5	6	7	7	14	**S**
	Dist.Water	17	0	0	0	0	0	0	**T**

Graph Showing Antifungal Activity of selected plants extracts against *Candida albicans*

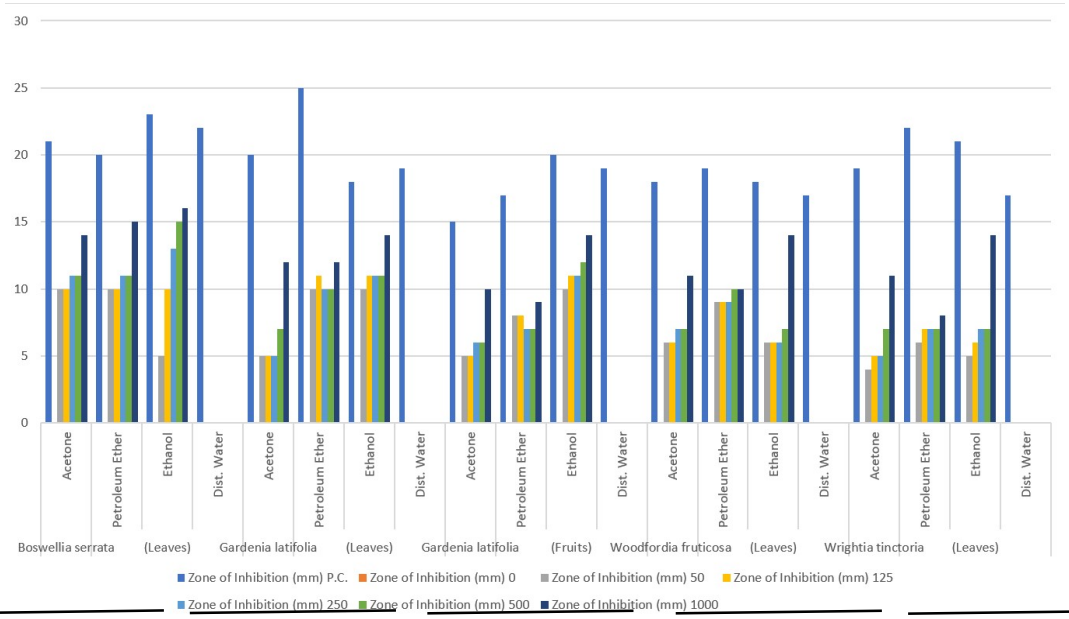
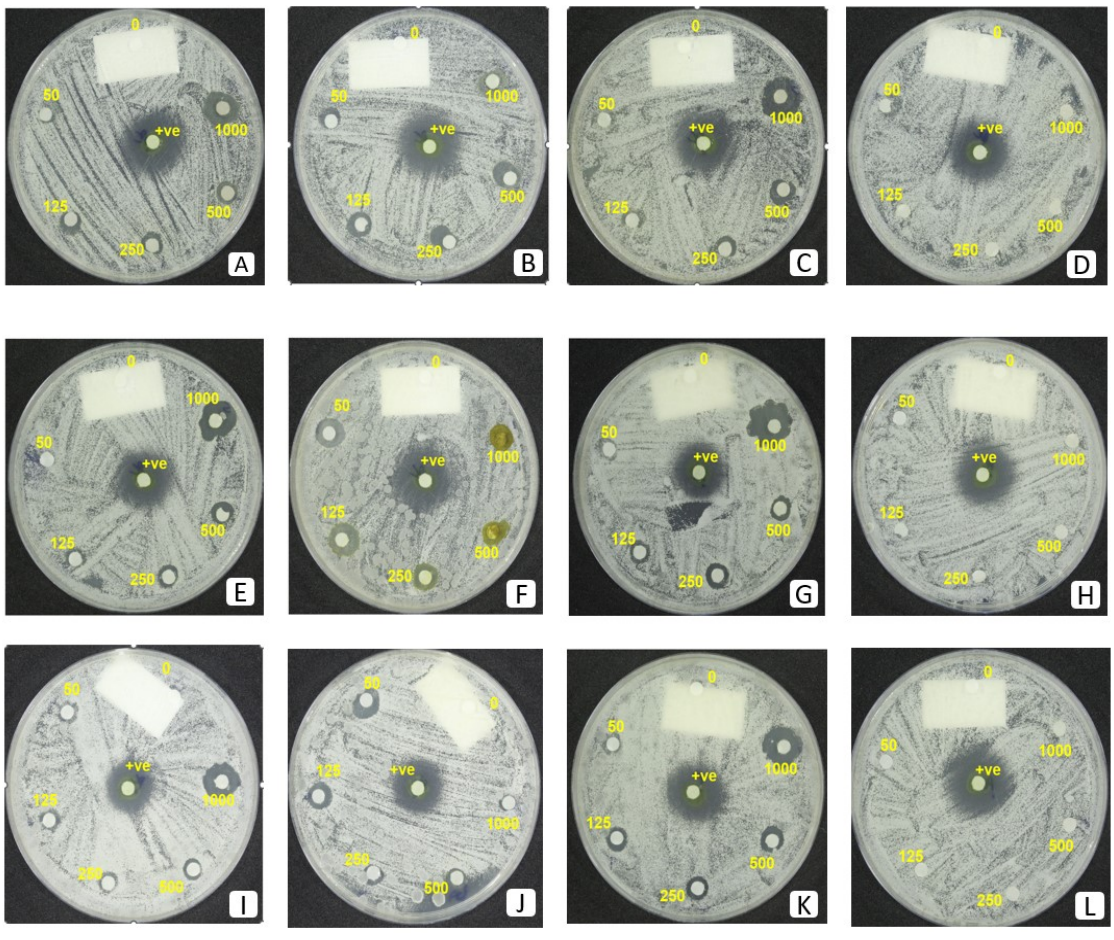
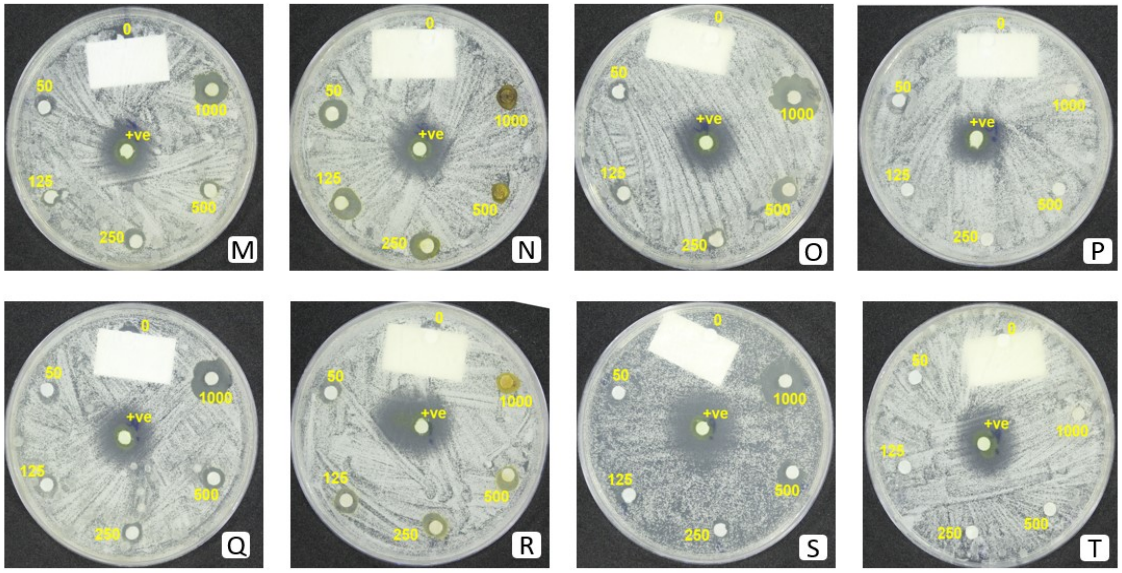


Photo Plates (A – T) ShowingThe Zone Of InhibitionOf Plant Extract In Different Solvent As Per Table No. 01





Concussion:

From the antibacterial activity of leaf extracts of *Boswellia serrata* Roxb. ex Colebr, *Gardenia latifolia, Woodfordia fruticosa* (L.) Kurz and *Wrightia tinctoria* (Roxb. ex Colebr.) R.Br.from the different solvent it can be concluded that leaves of *Boswellia serrata* Roxb. ex Colebr, *Gardenia latifolia, Woodfordia fruticosa* (L.) Kurz and *Wrightia tinctoria* (Roxb. ex Colebr.) R.Br.. show antibacterial activity against *Candida albicans*in Acetone, Petroleum ether and Ethanol extract. The ethanolic, acetone and petroleum ether extract show the highest antifungal activity at higher concentration, as the concentration increases the size of zone of inhibition also increases and the aqueous extract dose not shows the antibacterial activity. Also, at zero concentration no zone of inhibition observed which shows that the only solvent dose not shows antifungal activity so it concluded that the above zone of inhibitions is purely shown by plant extracts.

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Qualitative and Quantitative Analysis of Phytochemicals and Medicinal Value of Some Dye Yielding Medicinal Plants

Sable K. V.
Radhabai Kale Mahila Mahavidhyalaya, Ahmednagar
And
Sherkar D. K.
Arts & Commerce College, Warwat Bakal, Tal. Sangrampur, Dist. Buldana

ABSTRACT

The plants are due to specific phytochemicals present like tannins, flavonoids, glycosides, saponins, steroids and andalkaloids. Acacia catechu, Acacia concina, Bixa orellana, Butea monosperma, Emblica officinalis, and Hibiscus rosa-sinensis, are dye yielding plants. The qualitative analysis carried out for these plants show that tannins, saponins, flavonoids, terpenoids and alkaloids are present. In Acacia catechu and Acacia concina plants are Catechin only present in them. Bixa orellana and Butea monosperma plants are Bixin and Butin components repectiviely present in them. The petroleum ether and chloroform extract of Emblica officinalis does not show potential for oil and fat components whereas all the extract of Emblica officinalis show positive test for carbohydrates. The identification of colouring chemical constituents of natural products together with their therapeutic properties is studied.

Key words: phytochemical constituents, dyeyielding plants, chemical constituents etc.

INTRODUCTION

The worldwide demand for natural dyes is nowadays of great interest due to the increased awareness on therapeutic properties of natural dyes in public[1]. Natural dyes are derived from naturally occurring sources such as plants, insects, animals and minerals. Organic pigments are large and often complex organic molecules responsible for the different colours of plants and foods. Besides giving the vegetable their characteristic colour, they are also responsible for critical plant functions. The different variations of colours are due to combinations of pigments. A spectrum of beautiful natural colours ranging from yellow to black exists in the above sources. These colours are exhibited by various organic and inorganic molecules (pigments) and their mixtures are due to the absorption of light in the visible region of 400-800 nm. This absorption of light depends on the structure or constituents of the colouring pigment/ molecules contain various chromophores present in the dye yielding plant to display the plethora of colours.

The use of natural products together with their therapeutic properties is as ancient as human civilization and for a long time, mineral, plant and animal products were the main sources of drugs. Among the all- natural dyes, plant-based pigments have wide range of medicinal values. Many of the plants used for dye extraction are classified as medicinal and some of these have recently been shown to possess remarkable antimicrobial activity[2]. Natural dyes are not only used

to impart colour to an infinite variety of materials such as paper, textiles, wood etc. but also they are widely used in cosmetic pharmaceutical and food industry.

MATERIALS AND METHODS

Collection of plant samples

The flowers of *Hibiscus rosa sinensis*, *Butea monosperma,* are collected from the Ahmednagar and pods of *Acacia concina, Bixa Orellana, Emblica officinalis* and *Acacia catechu* was taken from the Ahmednagar area.

Processing of plant samples

The dried pods of *Acacia concina,* and *Emblica officinalis* were taken from the market, crushed to powder form, and then taken in the soxhlet apparatus for hot extraction with organic solvents. The fresh flowers of *Hibiscus rosa sinensi, Bixa orellana and Butea monosperma* collected from the Ahmednagar area, were shade dried and soxhleted with methanol and then separated with different organic solvents according to their polarity gradient. The powdered form of *Acacia catechu* was poured into the two separate beakers containing methanol and pet ether for cold extraction.

Preparation of aqueous extract of plant sample

The aqueous extract of each plant sample is prepared by soaking10 g of powdered samples in 200 ml of distilled water for 12 h. The extracts are then filtered using filter paper or Whattman filter paper.

Preparation of Organic extract of plant sample

The selected plants are dried in air. The dried and crushed material of these plants was extracted with the help of different solvents of varied polarity like petroleum ether, chloroform, ethyl acetate and alcohols at their boiling points successively. The various crude extracts so obtained were analyzed qualitatively for various components.

Phytochemical analysis

Chemical tests are performed on different organic and aqueous extracts of each plant with standard methods for various secondary metabolites

Qualitative analysis of phytochemical constituents

Test for Alkaloids

Take some petroleum ether extract of *Acacia catechu* in a test tube and add 2-3 drops of Dragendroff's reagent (potassium bismuth iodide solution) appearance of pale yellow colour indicates that absence of alkaloids in this extract. Again perform the same experiment with chloroform; methanol and water extract in another test tube appearance of pink colour indicates that absence of alkaloids in these extracts. Appearance of brown colour indicates that presence of alkaloids.

Test for Tannins

Take some petroleum ether extract of this plant and add few drops of ferric chloride solution in it, pale yellow colour appears, in chloroform extract yellow colour appears in methanol

and water extract appearance of brownish black colour indicates the absence of tannins in all these extracts.

Test for Flavonoids

Take some petroleum ether extract in a test tube then add few fragments of magnesium ribbon and after this add concentrated hydrochloric acid drop wise, absence of colour means absence of flavonoids in this extract, same test is repeated with chloroform extract of *Acacia* and also absence of colour. In methanol and water extract there is appearance of reddish colour shows the presence of flavonoids in these extracts.

Test for Sterols and Triterpenoids

Treat the petroleum ether and chloroform extract of *Acacia* with few drops of conc. sulphuric acid then shake well, no colour appears in these two indicates disappearance of sterols and triterpenoids. Further same treatment of methanol and water extract was done and appearance of reddish colour in the lower layer means presence of steroids appearance of yellow colour in the lower layer indicates presence of triterpenoids.

Test for Carbohydrates

Treat the all four extract with Benedict's reagent (alkaline solution of cupric citrate complex) absence of red precipitates boiling on water bath indicates the absence of carbohydrates.

Test for Fats and Oils

Treat all the four extract with 0.5N alcoholic potassium hydroxide with a drop of phenolphthalein separately and heat on water bath for 1-2 hours. There is formation of soap or partial neutralization means fixed oils and fats are present in these extracts.

Test for Glycosides

Take all the four extract of this plant separately then add dilute sulphuric acid into it. The solution was boiled and filtered. The filtrate was cooled, and then adds 2-3 drops of benzene. The solution was shaken well, organic layer got separated. After this add equal volume of ammonia solution to the organic layer, ammonical layer did not turn pink, which indicates absence of glycosides in these extracts.

Test for Saponins

Take all the four extracts separately in test tubes and add some water into them and shake well no persistent foam is formed which indicates absence of saponins**.**

RESULTS AND DISCUSSION

Quantitative analysis on phytochemical constituents

The quantity of phenols is determined using the spectrophotometer method. The plant sample is boiled with 50 ml of $(CH_3CH_2)_2O$ for 15 min. 5 ml of the boiled sample is then taken into 50 ml flask, and 10 ml of distilled water is added. After the addition of distilled water, 2 ml of NH_4OH solution and 5 ml of concentrated CH_3 $(CH_2)_3CH_2OH$ is added to the mixture. The sample is made up to the mark and left for 30 min to react for colour development and measured at 505 nm wavelength using a spectrophotometer.

Alkaloids

5 g of the plant sample is prepared in a beaker and 200 ml of 10% CH_3CO_2H in C_2H_5OH is added to the plant sample. The mixture is covered and allowed to stand for 4 h. The mixture then filtered and the extract is allowed to become concentrated in a water bath til it reaches 1/4 of the original volume. Concentrated NH_4OH is added until the precipitation is complete. The whole solution is allowed to settle and the precipitate is collected and washed with dilute NH_4OH and then filtered. The residue is alkaloid, which is then dried and weighed.

Tannins

Quantity of tannins is determined by using the spectrophotometer method. 0.5 g of plant sample is weighed into a 50 ml plastic bottle. 50 ml of distilled is added and stirred for 1 h. The sample is filtered into a 50 ml volumetric flask and made up to mark. 5 ml of the filtered sample is then pipetted out into test tube and mixed with 2 ml of 0.1 M $FeCl_3$ in 0.1 M HCl and 0.008 M $K_4Fe(CN)_6.3H_2O$. The absorbance of the sample is measured with a spectrophotometer at 395 nm wavelength within 10 min.

Saponins

The plant samples were ground and 20 g of each plant sample is put into a conical flask and 100 ml of 20% C_2H_5OH is added to the plant sample. The sample is heated over a hot water bath for 4 h with continuous stirring at about 55^{o}C. The mixture is then filtered and the residue re-extracted with another 200 ml of 20% ethyl alcohol. The combined extracts are reduced to 40 ml over a water bath at about 90^{o}C. The concentrated is then transferred into a 250 ml separating funnel and 20 ml of $(CH_3CH_2)_2O$ is added to the extract and vigorously shaken. The aqueous layer is recovered while the $(CH_3CH_2)_2O$ layer is discarded and the purification process is repeated. 60 ml of n-C_4H_9OH is added and the combined n-C_4H_9OH extracts is washed twice with 10 ml of 5% NaCl. The spectrophotometer method. 0.5 g of plant sample is weighed into a 50 ml plastic bottle. 50 ml of distilled is added and stirred for 1 h. The sample is filtered into a 50 ml volumetric flask and made up to mark. 5 ml of the filtered sample is then pipetted out into test tube and mixed with 2 ml of 0.1 M $FeCl_3$ in 0.1 M HCl and 0.008 M $K_4Fe(CN)_6.3H_2O$. The absorbance of the sample is measured with a spectrophotometer at 395 nm wavelength within 10 min.

Flavonoids

10 g of plant sample is repeatedly extracted with 100 ml of 80% aqueous methanol at room temperature. The whole solution is then filtered through filter paper and the filtrate is later on transferred into a water bath and solution is evaporated into dryness. The sample is then weighed until a constant weight, Pharmacological properties of *Emblica officinalis*, *Acacia catechu*, *Acacia concina* and *Hibiscus rosa-sinensis. Emblica officinalis* (*Phyllanthus emblica* Linn.), also known as amla, the foremost plants utilized from ancient time to date, has been used in Ayurveda the ancient

Indian system of medicine among rejuvenative herbs" and the "best among the sour

fruits". It is distributed in tropical and subtropical areas of china, India, Indonesia and the Malay Peninsula. It is highly vulnerable due to its magnificent vitamin C content. The fruits act as antioxidants immunomodulatory agents, cytoprotective against chromium, protects against oxidative stress in ischemic reperfusion injury etc. The fruits of emblica contain a wide variety of phenolic compounds, such as tannins, phyllembelic acid, phyllemblin, rutin, curcuminoides and emblicol[2].

The fruit have a broad range of therapeutic effects including antitumour and induction of apoptosis. The root, bark and leaves are also used for the treatment of indigestion, diarrhea, dysentery, eczema and warts. Traditionally, the fruit is beneficial as an astringent, cardiac tonic, diuretic, laxative, liver tonic, diuretic, refrigerant, stomachic, restorative, antipyretic, anti-inflammatory, hair tonic and digestive medicine[3].

***Acacia catechu* Willd**

It is highly valuable plant, useful internally as well as externally. The bark, wood, fruits, gum and flowering tops, all parts of *Acacia catechu* are used for medicinal purpose. It is used to cure bleeding in gums for its powerful astringent and antioxidant activities. The decoction of resin is an effective gargle in case of sore throat, cough and hoarseness of voice and tonsillitis. The paste is beneficial, externally, in skin diseases and wounds. The bath of its decoction is an effective panacea for various skin affection[7]. In stomatitis, halitosis, dental caries and cavities, halitosis, dental caries and cavities, khadira (*Acacia catechu* in Sanskrit is known) is used with great benefit, due to vitiation of kapha doshas. It dries up the mucous secretions and regains the taste sensation. The extracts of *Acacia catechu* exhibit various pharmacological effects like antipyretic, anti-inflammatory, antidiarrheal, hypoglycaemic, hepatoprotective, antioxidant and antimicrobial activities[9].

Shikakai

Acacia concinna is an important medicinal plant belonging to family Acaciaceae, grown commercially in India and far East Asia. The drugs used in indigenous system of medicines like Ayurveda in India has about 18,000 species of angiosperms, of which about 3,000 species are considered as important sources of medicinal and aromatic chemical compounds. *Acacia concinna'*s fruits have been used for hair care in India for centuries. The plant parts used as dry powder or the extract of the bark, leaves or pods. It is a common shrub found in jungles throughout India. The bark contains high levels of Saponins, which are foaming agents that are found in several other plant species. Some of the important medicinal plants having antimicrobial activity and also possess secondary metabolites· The saponin of the bark has spermicidal activity against human semen[12]· In aqueous state it has a low pH.

Hibiscus rosa sinensis

Hibiscus a genus of family Malvaceae is herbs, shrubs and trees. Its 250 species are widely distributed in tropical and subtropical regions of the world and are reported to possess various medicinal properties. *Hibiscus rosa sinensis* (Malvaceae) is widely cultivated in the tropics as

an ornamental plant. Chinese hibiscus is the English name of *Hibiscus rosa sinensis*. The plant has been used as powerful antioxidant, anti-inflammatory, cardioprotective, antidiabetic, hepatoprotective and anticancer agent[13]. *H. rosa sinensis* contain numerous phytochemicals such as quercetin glycoside, riboflavin, niacin, anthocyanin, anthocyanidin, malvalic acid, gentisic acid and lauric acid.

Butea monosperma

Butea monosperma is a species of *Butea* native to tropical and sub-tropical parts of South Asia and Southeast Asia, ranging across Bangladesh, India, Nepal, Sri Lanka, Myanmar, Thailand, Malaysia and western Indonesia. Common names include **flame-of-the-forest**, **dhak**, **palash**, and **bastard teak**. ***Butea monosperma*** is stunning as a specimen tree. The flowers are used to prepare a traditional Holi colour called "Kesari". It is also used as a dye for fabric. Butein, a vibrant yellow to deep orange-red dye made from the flowers, is used mostly for dying silk and occasionally for dying cotton. Hindus ink their foreheads with this colour. Barks contain gallic acid, kino-tannic acid, pyrocatechin[1]. Barks also contain allophanic acid, butolic acid, shellolic acid, butrin, alanind, palasitrin, etc.

Bixa Orellana

Bixa is a genus of plants in the family Bixaceae. It is native to Mexico, Central America, Caribbean, and South America, and naturalized in other places. *Bixa orellana* is a perennial, tall shrub that can reach 6–10 m (20–33 ft) high. It bears clusters of 5 cm (2 in) bright white or pink flowers, resembling single wild roses that appear at the tips of the branches. The fruits of the *Bixa orellana* are globular, ovoid capsules arranged in clusters resembling spiky looking red-brown seed pods covered in soft spines. Each capsule, or pod, contains 30–45 cone-shaped seeds covered in a thin waxy blood-red aril. When fully mature, the pod dries, hardens, and splits open, thereby exposing the seeds.

The red-orange annatto dye is rich in the carotenoid pigments, 80% which consists of bixin (the red pigment) and norbixin or orelline (the yellow pigment) Annatto oil contains tocotrienols, beta-carotene, essential oils, saturated and unsaturated fatty acids, flavonoids, and vitamin C.

Table 1(1): Test for Phytoconstituents for different extract of *Emblica officinalis*

Test for various secondary metabolites	Pet. ether extract	Chloroform extract	Methanol extract	Water extract
Test for alkaloids: (Dragendroff's test)	Absent	Absent	Present	Present
Test for tannins: (Ferric chloride test)	Absent	Absent	Absent	Absent
Test for flavanoids: (Shinoda test)	Absent	Absent	Present	Absent
Test for steroids and terpenoids: (Salkowaski test)	Absent	Absent	Present	Present
Test for carbo-hydrates: (Benedict reagent test)	Present	Present	Present	Present
Test for glycosides:(Borntrager'stest)	Absent	Absent	Absent	Absent
Test for oils and fats:	Absent	Absent	Present	Present

Test for saponins	Absent	Absent	Absent	Absent
Test for sugars(Bromine water test)	Absent	Absent	Absent	Absent

Table 1(2): Test for Phyto constituents for different extract of *Acacia catechu*

Test for various secondary metabolites	Pet. ether extract	Chloroform extract	Methanol extract	Water extract
Test for alkaloids: (Draggendorff's test)	Absent	Absent	Present	Present
Test for tannins:(Ferric chloride test)	Absent	Absent	Absent	Absent
Test for flavonoids: (Shinoda test)	Absent	Absent	Present	Present
Test for fats and fixed oils:(Saponification test)	Absent	Absent	Absent	Absent
Test for steroids and terpenoids: (Salkowaski test)	Absent	Absent	Present	Present
Test for carbo-hydrates: (Benedict reagent test)	Absent	Absent	Present	Present
Test for glycosides:(Borntrager'stest)	Absent	Absent	Absent	Absent
Test for saponins	Absent	Absent	Absent	Absent
Test for free sugars (Bromine water test)	Absent	Absent	Absent	Absent

Table 1(3): Test for Phytoconstituents for different extract of *Acacia concinna*

Test for various secondary metabolites	Pet. ether extract	Chloroform extract	Methanol extract	Water extract
Test for alkaloids: (Dragendroff's test)	Absent	Absent	Present	Present
Test for tannins: (Ferric chloride test)	Absent	Absent	Absent	Absent
Test for flavonoids: (Shinoda test)	Absent	Absent	Present	Present
Test for steroids and terpenoids: (Salkowaski test)	Absent	Absent	Absent	Absent
Test for carboo-hydrates: (Benedict reagent test)	Absent	Absent	Absent	Absent
Test for glycosides: (Borntrager'stest)	Absent	Absent	Absent	Absent
Test for oils and fats:	Absent	Absent	Present	Present
Test for saponins	Absent	Absent	Absent	Absent
Test for sugars: (Bromine water test)	Absent	Absent	Absent	Absent

Table 1(4): Test for Phytoconstituents for different extract of *Hibiscus rosa-sinensis*

Test for various secondary metabolites	Pet. ether extract	Chloroform extract	Methanol extract	Water extract
Test for alkaloids: (Dragendroff's test)	Absent	Absent	Present	Present
Test for tannins: (Ferric chloride test)	Absent	Absent	Absent	Absent
Test for flavonoids: (Shinoda test)	Absent	Absent	Present	Present
Test for steroids and terpenoids: (Salkowaski test)	Present	Absent	Present	Present
Test for carboo-hydrates: (Benedict reagent test)	Absent	Absent	Absent	Absent
Test for glycosides: (Borntrager'stest)	Absent	Absent	Absent	Absent
Test for oils and fats:	Absent	Absent	Present	Present
Test for saponins	Absent	Absent	Present	Present
Test for sugars:(Bromine water test)	Present	Present	Present	Present

Table 1(5): Test for Phytoconstituents for different extract of *Butea monosperma*

Test for various secondary metabolites	Pet. ether extract	Chloroform extract	Methanol extract	Water extract
Test for alkaloids: (Dragendroff's test)	Absent	Present	Present	Present
Test for tannins: (Ferric chloride test)	Absent	Absent	Absent	Absent
Test for flavonoids: (Shinoda test)	Absent	Absent	Present	Present
Test for steroids and terpenoids: (Salkowaski test)	Present	Absent	Absent	Present
Test for carboo-hydrates: (Benedict reagent test)	Absent	Absent	Absent	Absent
Test for glycosides: (Borntrager'stest)	Absent	Absent	Absent	Absent
Test for oils and fats:	Absent	Absent	Present	Present
Test for saponins	Absent	Absent	Present	Present
Test for sugars:(Bromine water test)	Present	Present	Present	Present

Table 1(6): Test for Phytoconstituents for different extract of *Bixa orellana*

Test for various secondary metabolites	Pet. ether extract	Chloroform extract	Methanol extract	Water extract
Test for alkaloids: (Dragendroff's test)	Absent	Present	Present	Present
Test for tannins: (Ferric chloride test)	Absent	Absent	Absent	Absent
Test for flavonoids: (Shinoda test)	Absent	Absent	Present	Present
Test for steroids and terpenoids: (Salkowaski test)	Present	Absent	Present	Present
Test for carboo-hydrates: (Benedict reagent test)	Absent	Absent	Absent	Absent
Test for glycosides: (Borntrager'stest)	Absent	Absent	Absent	Absent
Test for oils and fats:	Present	Absent	Present	Present
Test for saponins	Absent	Absent	Present	Present
Test for sugars:(Bromine water test)	Present	Present	Present	Present

Table 2: Quantitative analysis of phytochemical constituents (%)

S. No	Plants	Phenols	Alkaloids	Tannins	Saponins	Flavonoids
1	*Emblica officinalis*	0.23±0.03	11.2±0.16	1.1±0.05	0.55±0.13	0.037±0.19
2	*Acacia catechu*	0.30±0.06	11.3±0.15	2.1±0.11	0.53±0.20	0.718±0.23
3	*Acacia concina*	0.53±0.12	10.2±0.15	2.3±0.11	0.51±0.20	0.719±0.23
4	*Hibiscus rosa-sinensis*	0.52±0.16	8.5±0.21	2.0±0.09	0.41±0.15	0.680±0.10
5	*Butea monosperma*	0.37±0.06	14.3±0.15	2.4±0.11	0.53±0.20	0.725±0.23
6	*Bixa orellana*	0.31±0.06	12.3±0.15	2.0±0.12	0.50±0.20	0.608±0.20

CONCLUSION

The secondary metabolites are different in various organic extracts of all the six plants. Their qualitative analysis revealed their appearance where as their quantitative analysis give almost approximate idea for their quantity present. The medicinal study showed their application part.

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Exploring the Riverside Biodiversity of Wan Sankul: Insights from Wan Forest, Maharashtra

Mr. Bharat R. Nagare
Department of Botany
Shri Shivaji Arts, Commerce and Science College, Akot.
Dist. Akola, Maharashtra. 444101
And
Dr. Santosh N. Patole
Department of Botany
Shri Shivaji Arts, Commerce and Science College, Akot.
Dist. Akola, Maharashtra. 444101

ABSTRACT

This study investigates the biodiversity of the Wan Wildlife Sanctuary, focusing on the riverside area of Wan Sankul. The sanctuary, a crucial repository of both flora and fauna, hosts a wide range of species with significant ecological and medicinal value. Key plant species identified include Lannea coromandelica (Houtt.) Merr, Sterculia urens Roxb., and Wrightia tinctoria, (Roxb.) R. Br. all vital to traditional medicinal systems such as Ayurveda, Unani, and Siddha. The studies recorded 26 plant species, 05 bird species 02 reptile species, 02 insect species, and 06 mammals' species. The Indian Peafowl was notably abundant, alongside other species like the Black Stork, Four-horned Antelope, and Sambar Deer, each contributing to the sanctuary's ecological balance. Non-invasive data collection methods were employed to minimize environmental disturbance, although this approach limited the depth of analysis. The findings underscore the sanctuary's essential role in biodiversity conservation and the preservation of traditional medicinal knowledge, highlighting the importance of ongoing protection and research efforts.

Keywords - Biodiversity, Wan Wildlife Sanctuary, Medicinal plants, Conservation, Ecological balance.

1. Introduction

1.1 Background

Wan Wildlife Sanctuary, nestled in the Vidarbha region of Maharashtra, India, is a vital ecological haven within the Akot wildlife division of the Akola district. Covering approximately 211 square kilometers, this sanctuary forms a significant part of the Melghat Tiger Reserve, home to three Meadows (rehabitate villages) (Ingle & Pawar, 2023). Positioned within coordinates that underscore its ecological and cultural importance, the sanctuary serves as a refuge for a diverse array of flora and fauna. The sanctuary's biodiversity is not only a reflection of the region's natural heritage but also plays a crucial role in traditional medicine systems such as Ayurveda, Unani, and

Siddha. These medicinal practices have long valued the therapeutic potential of the sanctuary's plant species, which are rich in secondary metabolites like alkaloids, glycosides, and volatile oils (Sandhiya et al., 2010). This resurgence of interest in natural medicines underscores the enduring significance of plant-based remedies, particularly in areas like the Western Ghats, where biodiversity is integral to both ecological balance and traditional livelihoods (Rothe, 2003).In particular, the riverside regions of Wan Sankul are noted for their rich medicinal flora, which has been traditionally used in local healing practices. However, the sanctuary's biodiversity faces increasing threats from human activities and environmental changes, making conservation efforts more urgent than ever. This paper aims to explore the biodiversity of Wan Wildlife Sanctuary, focusing on its medicinal plant species, their traditional uses, and the conservation challenges that must be addressed to preserve this critical habitat.

1.2 Objectives

1. Document the plant and animal species found along the riverside of Wan Sankul.
2. Explore the medicinal importance of the identified plant species.

2. Materials and Methods

2.1 Study Area –

The study was conducted in the Wan Sankul area, a riverside region within Wan Forest in Maharashtra. The forest features tropical dry deciduous vegetation and encompasses mountainous and hilly regions, creating a varied landscape that supports a diverse array of species. The biodiversity in this region is particularly rich due to the presence of the river, which provides essential resources for many species, further enhancing the ecological diversity of the area.

2.2 Data Collection –

Data collection utilized the line transect method, focusing on species identification and photographic documentation. Due to restrictions on sample collection, observations were recorded non-invasively. Additionally, local knowledge was incorporated to explore the medicinal uses of plants.

2.3 Data Analysis –

The collected data were analyzed to categorize species by taxonomy and medicinal value. Medicinal uses were cross-referenced with authoritative sources in traditional medicine to ensure accuracy and relevance.

3. Results

3.1 Plant Diversity and Medicinal Importance –

The riverside of Wan Sankul is home to numerous plant species with medicinal properties. Table 1 provides an overview of key species identified their vernacular names, parts used, and their medicinal importance.

S. N.	Scientific Name	Vernacular Name (Hindi/Marathi)	Family	Part Used	Medicinal Importance
1.	*Lannea coromandelica* (Houtt.) Merr.	Hindi:Moi, Marathi: Modad	Anacardiaceae	Bark, Leaves	Used in treating various microbial-related conditions such as dysentery, sore eyes, leprosy, and genital wounds (Kaur, Jaiswal, & Jain, 2013).
2.	*Sterculia urens* Roxb.	Hindi: Kadaya, Marathi: Kullu	Malvaceae	Gum	Indigenous remedies against various ailments like oligospermia, leucorrhoea, constipation, body swelling, throat infection, wound healing, *etc*. (Mamta Dhiman, Abhijeet Singh, Madan Mohan Sharma,2019)
3.	*Wrightia tinctoria* (Roxb.) R.Br.	Hindi: Indrajau, Marathi: Kala Kuda	Apocynaceae	Bark, Seeds	Traditional remedies address a range of ailments, including oligospermia, leucorrhoea, constipation, body swelling, throat infections, and wound healing (Mamta Dhiman, Abhijeet Singh, & Madan Mohan Sharma, 2019).
4.	*Schleichera oleosa* (Lour.) Oken	Hindi: Kusum, Marathi: Kusumb	Sapindaceae	Oil, Leaves	In Ayurveda, the plant is utilized for conditions such as helminthiasis, acne, itching, menorrhea, malaria, dysentery, rheumatism, and hair loss. Scientific evaluations have demonstrated its anti-inflammatory, antiulcer, anticancer, antibacterial, and antioxidant properties (Goswami & Singh, 2017).
5.	*Aegle marmelos* (L.) Correa	Hindi: Bael, Marathi: Bel	Rutaceae	Fruit, Leaves	The plant exhibits a wide range of properties, including antidiarrhoeal, antimicrobial, antiviral, radioprotective, anticancer, chemopreventive, antipyretic, ulcer-healing, antigenotoxic, diuretic, antifertility, and anti-inflammatory effects, making it valuable in both preventing and treating various diseases (Rahman & Parvin, 2014).
6.	*Buchanania lanzan* Spreng.	Hindi: Charoli, Marathi: Piyal	Anacardiaceae	Seeds, Bark	The plant's wound healing potential is strongly supported by its pronounced antibacterial activity (Pattnaik& Sarkar, 2013).

7.	*Anogeissus latifolia* (Roxb. ex DC.) Wall. Ex Guill. & Perr.	Hindi: Dhaora, Marathi: Dhawda	Combretaceae	Leaves, Bark	The plant is utilized for treating a wide range of conditions, including vomiting, whooping cough, cold, diarrhea, dysentery, snake and scorpion bites, fever, skin diseases, diabetes, anemia, piles, fistula, stomach ache, sexual debility, and urinary discharge (S.N. &Prashith, 2020).
8.	*Madhuca longifolia* (J.Konig ex L.) J.F.Macbr.	Hindi: Mahua, Marathi: Moha	Sapotaceae	Flowers, Seeds	The plant is used medicinally to treat a variety of ailments, including headache, diarrhea, and skin and eye diseases (Dave, 2018).
9.	*Ficus benghalensis* L.	Hindi: Bargad, Marathi: Vad	Moraceae	Leaves, Bark	The plant exhibits a broad range of activities including antioxidants, antidiabetic, anti-inflammatory, anticancer, antitumor, antiproliferative, antimutagenic, antimicrobial, anti-helminthic, hepatoprotective, wound healing, anticoagulant, immunomodulatory, antistress, and mosquitocidal effects, with additional insights from toxicity studies (Murugesu & Selamat, 2021).
10.	*Terminalia bellirica* (Gaertn.) Roxb.	Hindi: Bahera, Marathi: Baheda	Combretaceae	Fruit	The plant is constituted of Glucoside, Tannins, Gallic acid, Ethyl Gallate, Chebulinic acid which serves as an antioxidant, antimicrobial, antidiarrheal, anticancer, antihypertensive, hepatoprotective& antipyretic agent.(Anindita Deb, Sikha Barua, Dr. Biswajit Das2016)
11.	*Vitex negundo* L.	Hindi: Nirgundi, Marathi: Nirgundi	Lamiaceae	Leaves, Seeds	Bioactive compounds show anti-inflammatory, antioxidant, antidiabetic, anticancer, and antimicrobial activities (Gill & Mehra, 2018).
12.	*Bauhinia racemosa* L.	Hindi: Apta, Marathi: Aapta	Fabaceae	Leaves	Flowers, buds and dried leaves are used to treat dysentery. Root bark is used in inflammation of liver. Seeds are tonic and aphrodisiac. Leaves have antidiabetic Action. Plant is used in snake bite and scorpion string. (Rashed K, Butnariu M.2014)

13.	*Terminalia arjuna* (Roxb. ex DC.) Wight & Arn.	Hindi: Arjun, Marathi: Arjun	Combretaceae	Bark	*Terminalia arjuna* is widely used for cardiovascular issues, including heart disease, chest pain, high blood pressure, and high cholesterol, and also for earaches and urinary tract disorders. It effectively prevents LDL oxidation and heart injury while reducing atherogenic lipid levels (Amalraj & Gopi, 2016).
14.	*Crotalaria* juncea L.	Hindi: San, Marathi: Randhul	Fabaceae	Seeds, Leaves	In traditional medicine, the leaves, branches, and roots of the plant are used for their cooling properties. The plant juice is beneficial for treating gout, eczema, hydrophobia, pain and swelling, wounds and cuts, infections, kidney pain, abdominal issues, rheumatism, and joint pain (Saboon, 2015).
15.	*Gymnosporia montana* (Roth) Benth.	Hindi: Bhugrund, Marathi: Vikran	Celastraceae	Bark, Leaves	It is used to purify the blood; cures peptic ulcer and haemorrhoids. It relieves Kapha, inflammation, burning sensation, thirst and corneal opacity.(Patel PB, Patel TK,2010)
16.	*Woodfordia fruticosa* (L.) Kurz	Hindi: Dhataki, Marathi: Dhayati	Lythraceae	Flowers	The plant is effective for treating various ailments, including bowel disorders. Recent studies in modern biology have highlighted its potential as a rich source of chemical constituents with promising anti-tumor and anti-inflammatory activities (Das & Goswami, 2007).
17.	*Butea monosperma* (Lam.) Taub.	Hindi: Palash, Marathi: Palas	Fabaceae	Bark, Flowers, Seeds	*Butea monosperma* exhibits antibacterial, antifungal, hypoglycemic, and anti-inflammatory activities. Additionally, it is recognized for its tonic, astringent, aphrodisiac, and diuretic properties (Dhakad & Sayali, 2023).
18.	*Syzygium cumini* (L.) Skeels	Hindi: Jamun, Marathi: Jambhul	Myrtaceae	Fruit, Seeds, Bark	The plant demonstrates beneficial effects against cardiometabolic disorders, including antihyperglycemic, hypolipemiant, anti-inflammatory, cardioprotective, and antioxidant activities (Teles & Martins, 2015).

19.	*Lantana camara* L.	Hindi: Raimuniya, Marathi: Ghaneri	Verbenaceae	Leaves, Roots	Leaf extracts of *Lantana* demonstrate antimicrobial, fungicidal, insecticidal, and nematicidal properties, along with antimicrobial, immunosuppressive, and anti-tumor activities. *Lantana* oil is also utilized for treating skin itches, serving as an antiseptic for wounds, and is applied externally for leprosy and scabies (Reddy, 2013).
20.	*Tectona grandis* L.	Hindi: Sagwan, Marathi: Sagwan	Lamiaceae	Wood, Leaves, Bark ,Flower	Roots treat anuria and urine retention, while flowers, with their acrid and bitter qualities, are used for bronchitis, biliousness, and urinary issues. The bark, also acrid, is beneficial for bronchitis. The wood serves as an acrid, sedative, and anthelmintic agent, addressing conditions like gravid uterus, piles, leucoderma, dysentery, headache, and liver pain. Wood ashes applied to swollen eyelids are believed to enhance vision (Goswami & Nirmal, 2009).
21.	*Senegalia catechu* (L.f.) P.J.H.Hurter& Mabb.	Hindi: Khair, Marathi: Khair	Fabaceae	Heart wood, Bark	The bark of this plant exhibits strong antioxidant, astringent, anti-inflammatory, antibacterial, and antifungal properties. Its extract is utilized for treating sore throats and diarrhea and is also effective for high blood pressure, dysentery, colitis, gastric issues, bronchial asthma, cough, leucorrhea, and leprosy. Additionally, it serves as a mouthwash for oral health concerns including gum infections, gingivitis, and sore throat (Negi & Dave, 2011).
22.	*Bauhinia variegate* L.	Hindi: Kachnar, Marathi: Kanchan	Fabaceae	Bark, Flowers	The plant demonstrates antitumor, antimicrobial, anti-inflammatory, antioxygenic, hepatoprotective, and hemagglutination properties (Mali & Mahajan, 2007).
23.	*Bambusa vulgaris* Schrad. ex Wendl.	Hindi: Baans, Marathi: Vedha	Poaceae	Shoots, Leaves	The plant is utilized for its astringent, acrid, sweet, cooling, expectorant, diuretic, cardiotonic, and hemostatic properties. Its sprouts are particularly effective for treating inflammations, ulcers, and wounds (Sriraman & Ramanujam, 2015).
24.	*Boswellia serrate* Roxb. ex Colebr.	Hindi: Salai, Marathi: Salai	Burseraceae	Gum resin, Bark	The plant is primarily used for treating inflammatory conditions and some cancerous diseases, promoting wound healing, and exhibiting antimicrobial activity (Siddiqui, 2011).

25.	*Cassia fistula* L.	Hindi: Amaltas, Marathi: Bahava	Fabaceae	Fruit pulp, Seeds	The plant exhibits antioxidant, anti-inflammatory, and anti-diabetic properties, along with various other biological activities (Rahmani, 2015).
26.	*Eucalyptus spp.* L.Her.	Hindi: Safeda, Marathi: Nilgiri	Myrtaceae	Leaves, Oil	The plant demonstrates antimicrobial, antioxidant, and anti-inflammatory properties (Vecchio &Loganes, 2016).

3.2 Avian Diversity - The area is home to a variety of bird species that contribute to the ecological balance. The observed species are listed in Table 2.

S.N	Scientific Name	English Name	Vernacular Name (Hindi/Marathi)	Family
1	*Pavo cristatus*	Indian Peafowl	Hindi: Mor, Marathi: Mor	Phasianidae
2	*Gallus sonneratii*	Grey Junglefowl	Hindi: Ban Murga, Marathi: JangliKombda	Phasianidae
3	*Copsychus saularis*	Oriental Magpie-Robin	Hindi: Dhyal, Marathi: Dayal	Muscicapidae
4	*Spilopelia chinensis*	Spotted Dove	Hindi: ChitthiKabootar, Marathi: Poturaj	Columbidae
5	*Ciconia nigra*	Black Stork	Hindi: Kala Sarus, Marathi: Kala Saras	Ciconiidae

3.3 Mammalian Diversity -The presence of diverse mammalian species highlights the ecological richness of Wan Sankul. Table 3 details the key mammalian species found in the area.

S.N	Scientific Name	English Name	Vernacular Name (Hindi/Marathi)	Family
1	*Tetracerus quadricornis*	Four-horned Antelope	Hindi: Chousingha, Marathi: Chowsingha	Bovidae
2	*Semnopithecus spp.*	Hanuman Langur	Hindi: Langur, Marathi: Langur	Cercopithecidae
3	*Macaca mulatta*	Rhesus Macaque	Hindi: Bandar, Marathi: Makad	Cercopithecidae
4	*Felis chaus*	Jungle Cat	Hindi: Jungli Billi, Marathi: JungliManjar	Felidae
5	*Rusa unicolor*	Sambar Deer	Hindi: Sambar, Marathi: Sambar	Cervidae

3.4 Reptile Diversity - The Wan Sankul area is home to a diverse range of reptile species that play a crucial rolein maintaining the ecological balance of the forest. These reptiles are vital for controlling the population of various prey species, acting as both predators and prey within the food web. The observed reptile species are listed in Table 4.

S. N	Scientific Name	English Name	Vernacular Name (Hindi/Marathi)	Family
1	*Naja naja*	Indian Cobra	Hindi: Nag, Marathi: Nag	Elapidae
2	*Calotes versicolor*	Oriental Garden Lizard	Hindi: Girgit, Marathi:Kapdya, Sarda.	Agamidae

3.5 Insect Diversity

Insects in the Wan Sankul area contribute significantly to the forest's ecological health by participating in pollination, decomposition, and serving as a food source for various other species. The insect population is an indicator of the health of the ecosystem, and their presence reflects the biodiversity of the region. The observed insect species are listed in Table 5.

S.N	Scientific Name	English Name	Vernacular Name (Hindi/Marathi)	Family
1	*Solenopsis invicta*	Red Imported Fire Ant	Hindi: Lal Cheenti, Marathi: Lal Chidi, Lal Mungi.	Formicidae
2	*Lasius niger*	Black Garden Ant	Hindi: Kali Cheenti, Marathi: Kali Chidi, Mungala, Makoda.	Formicidae

4. Discussion:

Wan Wildlife Sanctuary, especially the riverside region of Wan Sankul, is an ecologically significant area with substantial plant and animal diversity. This study has documented a range of plant species with notable medicinal properties, such as *Lannea coromandelica*, *Sterculia urens*, and *Wrightia tinctoria*. These plants are essential to local traditional medicine systems, including Ayurveda, Unani, and Siddha. For example, *Lannea coromandelica* is used to treat microbial infections and wounds (Kaur et al., 2013), while Wrightia tinctoria is effective against jaundice and skin disorders (Srivastava, 2014).The sanctuary also supports a variety of animal species. The avian diversity, featuring species like the Indian Peafowl and Black Stork, plays a crucial role in maintaining ecological balance (Champion & Seth, 1968). Mammals such as the Four-horned Antelope and Sambar deer contribute to the sanctuary's rich biodiversity. The presence of diverse reptile and insect species further indicates a healthy, functioning ecosystem.The study's non-invasive data collection methods, including species identification and photographic documentation, were essential for minimizing disturbance in this protected area. However, the restriction on sample collection limits the depth of analysis and highlights the need for innovative research

methods and conservation strategies. Alternative approaches are necessary to enhance understanding and preservation efforts while respecting the sanctuary's protected status.

5. Conclusion:

The Wan Wildlife Sanctuary, particularly the riverside area of Wan Sankul, is a critical biodiversity hotspot rich in both ecological and medicinal resources. The study highlights the sanctuary's diverse plant and animal species, emphasizing their importance in traditional medicine and ecological balance. Despite the limitations of non-invasive data collection, the findings underscore the need for innovative research and conservation strategies to protect and fully understand this vital ecosystem. Continued efforts are essential to preserve the sanctuary's biodiversity and the traditional knowledge it supports.

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Colorful Heritage: Documenting the Dye-Yielding Plants of Marathwada

Marathe V. R.
Department of Botany, N. E. S. Science College, Nanded-431605 (M.S.), India
And
Bharti A. S.
Department of Botany, N. E. S. Science College, Nanded-431605 (M.S.), India
And
Amrutwad B. B.
Department of Botany, N. E. S. Science College, Nanded-431605 (M.S.), India
And
S. K. Umate
Rajiv Gandhi Mahavidyalaya, Mudkhed Dist. Nanded

ABSTRACT

The Marathwada region of Maharashtra is rich in biodiversity, with a long history of traditional practices that utilize local flora for various purposes, including the extraction of natural dyes. This research, aims to explore and document the diverse array of plants in this region that have historically been used for dyeing textiles and other materials.The research and investigation of natural dye-yielding plants has received a lot of attention as there is an increasing demand for environmentally acceptable and sustainable alternatives to manufactured dyes. This study focuses on the recording of dye-yielding flora in the Marathwada area in the state of Maharashtra, India. The region is noted for its high biodiversity.The intention of this study is to identify and list the native species of plants that can be utilized as natural dye sources and investigate traditional knowledge about their use. A thorough list of dye-potential plants was developed through field surveys; contacts with local communities of Marathwada region. Natural dyes are aesthetically pleasing due to their diverse origins and unique colors. Non-toxic properties make them suitable for coloring textiles, cosmetics, pharmaceuticals, and dietary supplements. Although traditional systems of knowledge have been followed for many years, the utilization of natural colors has decreased. Furthermore, there's very little data available in databases concerning either dye-yielding species. Therefore, the goal of the current study is to document the dye generating plant species along with their knowledge from the research area.

Keywords: Dye-yielding plant, Natural Dyes, Marathwada

Introduction:

Natural dyes have played a crucial role in human history, serving as the primary source of color for textiles, food, and body adornment for thousands of years. Derived from plant, animal, and mineral origins, these dyes not only provided aesthetic value but also symbolized cultural, religious, and social significance in many societies. The industrial revolution, however, brought

about the development of synthetic dyes, which, due to their affordability, vibrant color range, and superior fastness, quickly overshadowed natural dyes. Today, synthetic dyes dominate the textile industry, but their environmental and health impacts have led to a renewed interest in natural dyes as sustainable alternatives (Cardon, 2007).

Natural dyes, particularly those derived from plants, are celebrated for their eco-friendly characteristics. They are biodegradable, renewable, and free from the toxic chemicals commonly found in synthetic dyes (Kaur & Bhattacharya, 2016). As awareness of environmental sustainability grows, industries and consumers alike are shifting towards greener alternatives. This shift has rekindled interest in plant-based dyes, especially in regions with rich biodiversity and traditional knowledge systems, such as Marathwada in Maharashtra, India. These plants have been traditionally used by local communities not only for textile dyeing but also for medicinal and ritualistic purposes. For centuries, communities in Marathwada have relied on the native plant diversity to create vibrant natural colors, utilizing parts such as roots, bark, leaves, flowers, and fruit. Despite the decline in natural dye usage following the widespread adoption of synthetic dyes, the knowledge of plant-based dyeing remains preserved among artisans and traditional practitioners (Ramaswamy & Jha, 2019).

The resurgence of interest in natural dyes is largely driven by the need for sustainable solutions in the textile industry. Synthetic dyes, although efficient, contribute significantly to environmental pollution, particularly water contamination. The dyeing process in conventional textile industries releases toxic chemicals, heavy metals, and non-biodegradable waste into water bodies, causing long-term ecological damage. In contrast, natural dyes offer a sustainable alternative with minimal environmental impact. They require fewer chemicals for dye fixation, produce less waste, and are generally non-toxic and biodegradable (Patel & Pandya, 2018).

This research paper seeks to document the dye-yielding plants of Marathwada, focusing on their cultural and medicinal significance. It will examine the types of dyes produced; the parts of the plants used as well as the medicinal properties associated with these plants. By doing so, it aims to contribute to the growing body of knowledge on sustainable alternatives to synthetic dyes, promote the conservation of biodiversity, and support the livelihoods of local communities engaged in traditional dyeing practices.

In summary, the importance of natural dyes goes beyond their aesthetic appeal. They represent a sustainable, environmentally friendly alternative to synthetic dyes while preserving cultural heritage and traditional knowledge. The documentation of dye-yielding plants in regions like Marathwada is not only a means of preserving biodiversity but also a step toward fostering sustainable development. As industries increasingly prioritize eco-friendly practices, the potential for natural dyes to re-enter mainstream markets is greater than ever. Through this research, the valuable botanical heritage of Marathwada's dye-yielding plants will be highlighted, offering insight into their role in sustainable practices for the future.

Study area and methodology:

Marathwada is important geographical area situated in the Maharashtra state of India with

around 64,590 square kilometers of land. It has eight districts Aurangabad, Beed, Jalna, Latur, Nanded, Osmanabad, Parbhani, and Hingoli. The area is distinguished by its semi-arid environment, heritage, and agricultural challenges. The region maintains a semi-arid environment with scorching summers (up to 45°C) and pleasant winters. The typical yearly rainfall ranges from 600 and 800 mm, with the majority occurring during the monsoon months (June to September). However, because of climate change, the area has seen irregular rainfall patterns & periodic droughts, harming agricultural and water supply. The region's ecology includes arid evergreen forests, scrublands, & grazing land, which are home to a range of natural dye-producing flora comprising *Butea monosperma* (Palash), *Wrightia tinctoria* (Dudhi), etc. These species of plants offer enormous possibilities for sustainable natural color manufacturing, which is beneficial for industries like textiles and the preservation of culture.

The study was carried out during December 2023 to March 2024. The technique has been categorized as questionnaires, conversations, and field walks. To investigate the research region, periodic trips are scheduled with other informed individuals from other villages in the study area. During field trips to the subject of research area, information about flora was collected. Plants were recognized using conventional literature. Plant identification is performed utilizing standard local flora (Naik, 1998). All collected information is presented in the table-1.

Results and discussion:

Table – 1: List of dye yielding plants

SN	Botanical Name & Family	Local Name	Part Used	Dye Colour Produced	Medicinal Use	References
1	*Achyranthes aspera* L. (Amaranthaceae)	Aghada	Whole Plant	Yellow	Antipyretic, anti-inflammatory, diuretic	Kaur & Bhattacharya (2016), Sundari et al. (2020)
2	*Aloe vera* (L.) Burm. f. (Asphodelaceae)	Korphad	Leaves (Gel)	Yellow	Skin healing, antioxidant, anti-inflammatory	Sundari et al. (2020), Patel & Pandya (2018)
3	*Amaranthus viridis* L. (Amaranthaceae)	Chaulai	Leaves	Green	Anti-inflammatory, diuretic, digestive aid	Cardon (2007), Ramaswamy & Jha (2019)
4	*Annona reticulata* L. (Annonaceae)	Ramphal	Leaves, Bark	Yellow	Antimalarial, astringent, digestive aid	Bala & Dhawan (2015), Kaur & Bhattacharya (2016)
5	*Azadirachta indica* A. Juss (Meliaceae)	Neem	Leaves, Bark	Yellow, Brown	Antifungal, antibacterial, anti-inflammatory	Sundari et al. (2020), Patel & Pandya (2018)
6	*Barleria prionitis* L. (Acanthaceae)	Kate koranti	Leaves, Roots	Yellow	Anti-inflammatory, anti-arthritic, pain relief	Jain (1991), Sundari et al. (2020)
7	*Basella alba* L. (Basellaceae)	Mayalu	Leaves, Stems	Green, Red	Laxative, anti-inflammatory, skin infections	Cardon (2007), Patel & Pandya (2018)
8	*Bauhinia variegata* L. (Fabaceae)	Kanchan	Bark, Flowers	Yellow	Antidiabetic, antimicrobial, digestive aid	Bala & Dhawan (2015), Patel & Pandya (2018)

9	*Bombax ceiba* L. (Malvaceae)	Katesawar	Flowers, Bark	Yellow, Orange	Anti-inflammatory, wound healing, skin infections	Jain (1991), Patel & Pandya (2018)
10	*Brassica oleracea* L. (Brassicaceae)	Patta Gobhi	Leaves	Green	Antioxidant, anticancer, anti-inflammatory	Ramaswamy & Jha (2019), Cardon (2007)
11	*Butea monosperma* (Lam.) Kutze (Fabaceae)	Palas	Flowers	Orange	Antidiarrheal, anti-inflammatory, antifungal	Jain (1991), Sundari et al. (2020)
12	*Caesalpinia pulcherrima* (L.) Sw. (Fabaceae)	Gulmohar	Flowers, Bark	Yellow, Red	Antipyretic, antimicrobial, anti-inflammatory	Patel & Pandya (2018), Ramaswamy & Jha (2019)
13	*Cassia fistula* L. (Fabaceae)	Amaltas	Pods, Bark	Brown, Black	Laxative, anti-inflammatory, skin diseases	Kaur & Bhattacharya (2016), Bala & Dhawan (2015)
14	*Cocos nucifera* L. (Arecaceae)	Nariyal	Root	Brown	Antiviral, antifungal, wound healing	Sundari et al. (2020), Bala & Dhawan (2015)
15	*Curcuma longa* L. (Zingiberaceae)	Halad	Rhizome	Yellow	Anti-inflammatory, antioxidant, digestive aid	Kaur & Bhattacharya (2016), Patel & Pandya (2018)
16	*Cuscuta cassytoides* Nees ex Engelm. (Convolvulaceae)	Amarvel	Whole Plant	Yellow	Antiviral, antimicrobial, liver protection	Kaur & Bhattacharya (2016), Bala & Dhawan (2015)
17	*Delonix regia* (Bojer ex Hook.) Raf. (Fabaceae)	Gulmohar	Flowers	Yellow, Red	Antimicrobial, anti-diarrheal	Patel & Pandya (2018), Ramaswamy & Jha (2019)
18	*Duranta repens* L. (Verbenaceae)	Duranta	Leaves, Flowers	Yellow	Antimicrobial, anti-inflammatory, wound healing	Jain (1991), Ramaswamy & Jha (2019)
19	*Eclipta alba* (L.) L (Asteraceae)	Bhringraj	Leaves	Black, Dark Green	Hair growth promoter, liver tonic, antimicrobial	Sundari et al. (2020), Patel & Pandya (2018)
20	*Erythrina variegata* L. (Fabaceae)	Pangara	Flowers, Bark	Red	Antibacterial, anti-inflammatory, wound healing	Sundari et al. (2020), Patel & Pandya (2018)
21	*Euphorbia tirucalli* L. (Euphorbiaceae)	Saptarangi	Latex, Branches	Yellow	Treats asthma, skin diseases, joint pain	Sundari et al. (2020), Jain (1991)
22	*Heliotropium indicum* L. (Boraginaceae)	Bhurundi	Flowers, Leaves	Yellow	Anti-inflammatory, wound healing, skin infections	Patel & Pandya (2018), Jain (1991)
23	*Hibiscus rosa-sinensis* L. (Malvaceae)	Jaswand	Flowers	Red, Pink	Antioxidant, skin healing, hair tonic	Bala & Dhawan (2015), Ramaswamy & Jha (2019)
24	*Holarrhena pubescens* Wall. ex G. Don (Apocynaceae)	Pandhara Kuda	Bark	Yellow	Treats diarrhea, dysentery, fever	Cardon (2007), Ramaswamy & Jha (2019)
25	*Impatiens balsamina* L. (Balsaminaceae)	Gulmehndi	Flowers, Leaves	Orange, Red	Antibacterial, wound healing, anti-inflammatory	Jain et al. (2015), Kaur & Bhattacharya (2016)
26	*Indigofera tinctoria* L. (Fabaceae)	Neel	Leaves	Blue	Anti-inflammatory, antifungal, skin healing	Cardon (2007), Jain et al. (2015)
27	*Justicia adhatoda* L. (Acanthaceae)	Adulsa	Leaves	Green	Expectorant, treats cough and asthma	Bala & Dhawan (2015), Patel & Pandya (2018)

28	*Kigelia africana* (Lam.) Benth. (Bignoniaceae)	Sausage Tree	Fruits, Bark	Yellow, Brown	Antimicrobial, anti-inflammatory, wound healing	Bala & Dhawan (2015), Ramaswamy & Jha (2019)
29	*Lannea coromandelica* (Houtt.)Merr. (Anacardiaceae)	Moi	Bark	Red, Brown	Antibacterial, anti-inflammatory, skin diseases	Sundari et al. (2020), Jain (1991)
30	*Lawsonia inermis* L. (Lythraceae)	Mehandi	Leaves, Bark	Red, Orange	Antibacterial, anti-inflammatory, skin diseases	Kaur & Bhattacharya (2016), Jain (1991)
31	*Manilkara hexandra* (Roxb.) Dubard. (Sapotaceae)	Khirni	Bark, Fruit	Brown	Antidiabetic, antioxidant, antimicrobial	Patel & Pandya (2018), Sundari et al. (2020)
32	*Mirabilis jalapa* L. (Nyctaginaceae)	Gulbakshi	Flowers	Yellow, Red	Antibacterial, antifungal, anti-inflammatory	Bala & Dhawan (2015), Cardon (2007)
33	*Morinda citrifolia* L. (Rubiaceae)	Noni	Fruits, Leaves	Yellow, Brown	Antioxidant, anti-inflammatory, pain relief	Ramaswamy & Jha (2019), Kaur & Bhattacharya (2016)
34	*Musa paradisiaca* L. (Musaceae)	Kela	Peel, Stem	Brown	Antidiabetic, antioxidant, wound healing	Ramaswamy & Jha (2019), Kaur & Bhattacharya (2016)
35	*Nerium oleander* L. (Apocynaceae)	Kaner	Flowers, Bark	Yellow, Brown	Anticancer, cardioprotective, anti-inflammatory	Patel & Pandya (2018), Sundari et al. (2020)
36	*Punica granatum* L. (Lythraceae)	Dalimb	Rind, Bark	Yellow, Brown	Anti-inflammatory, antioxidant, digestive aid	Kaur & Bhattacharya (2016), Ramaswamy & Jha (2019)
37	*Semecarpus anacardium* L.f. (Anacardiaceae)	Biba	Fruits	Black	Antimicrobial, antitumor, analgesic	Jain et al. (2015), Ramaswamy & Jha (2019)
38	*Senna auriculata* (L.) Roxb. (Fabaceae)	Tarwad	Leaves, Flowers	Yellow	Antidiabetic, anti-inflammatory, antioxidant	Jain et al. (2015), Cardon (2007)
39	*Senna tora* (L.) Roxb. (Fabaceae)	Tarota	Seeds, Leaves	Brown	Antifungal, antimicrobial, laxative	Bala & Dhawan (2015), Patel & Pandya (2018)
40	*Spathodea campanulata* P. Beauv. (Bignoniaceae)	Fountain Tree	Flowers	Yellow, Orange	Anti-inflammatory, skin diseases, analgesic	Kaur & Bhattacharya (2016), Sundari et al. (2020)
41	*Tagetes erecta* L. (Asteraceae)	Zendu	Flowers	Yellow, Orange	Antibacterial, anti-inflammatory, insect repellent	Ramaswamy & Jha (2019), Bala & Dhawan (2015)
42	*Tectona grandis* L. f. (Lamiaceae)	Sagwan	Wood	Brown	Antidiarrheal, antimicrobial, wound healing	Ramaswamy & Jha (2019), Sundari et al. (2020)
43	*Terminalia arjuna* (Roxb. ex DC.) Wight & Arn. (Combretaceae)	Arjun	Bark	Brown, Grey	Cardioprotective, anti-hypertensive, antimicrobial	Bala & Dhawan (2015), Jain (1991)
44	*Terminalia chebula* Retz. (Combretaceae)	Hirada	Fruit	Yellow, Black	Laxative, anti-inflammatory, immune booster	Cardon (2007), Patel & Pandya (2018)
45	*Vachellia nilotica* (L.) P.J.H.Hurter & Mabb. (Fabaceae)	Babul	Bark, Pods	Brown, Dark Red	Treats diarrhea, cough, skin infections	Jain et al. (2015), Patel & Pandya (2018)

46	*Woodfordia fruticosa* (L.) Kurz. (Lythraceae)	Dhayati	Flowers	Red, Orange	Antioxidant, anti-inflammatory, skin healing	Patel & Pandya (2018), Sundari et al. (2020)
47	*Wrightia tinctoria* (Roxb.) R. Br. (Apocynaceae)	Kala kuda	Bark, Leaves	Blue	Anti-diabetic, skin healing, antimicrobial	Jain (1991), Cardon (2007)

Discussion:

This research paper includes the documentation of 47 species used as dye yielding plants of 45 genera belonging to 27 families. Many plants in the Marathwada region are notable for their ability to produce vibrant, long-lasting dyes. For instance, *Acacia nilotica* (Babul) produces brown and dark red dyes from its bark and pods, widely used in traditional dyeing processes in rural communities (Patel & Pandya, 2018). Similarly, *Punica granatum* (Anar) provides yellow and brown dyes from its rind and bark, making it valuable for textile applications (Kaur & Bhattacharya, 2016). *Indigofera tinctoria* (Neel), which is renowned for its production of natural blue dye, has been a cornerstone of traditional indigo dyeing practices for centuries (Cardon, 2007). Many other plants in the table, such as *Curcuma longa* (Haldi) and *Lawsonia inermis* (Mehndi) provide yellow and red-orange dyes, respectively. These are still widely used in modern cosmetics and cultural ceremonies, demonstrating their persistent relevance in the dye industry (Ramaswamy & Jha, 2019).

In contrast, plants like *Delonix regia* (Gulmohar) and *Butea monosperma* (Palash) yield bright yellow to red and orange hues from their flowers, contributing to sustainable dye alternatives to synthetic colors. These plants are being actively researched for their potential to replace harmful synthetic dyes in textiles, thus supporting environmentally-friendly practices (Patel & Pandya, 2018). In addition to their dye-yielding potential, the medicinal properties of these plants offer significant pharmacological benefits. *Terminalia arjuna* (Arjun) and *Terminalia chebula* (Harad) are two such plants with a long history of use in Ayurvedic medicine for their cardioprotective, antimicrobial, and immune-boosting properties (Bala & Dhawan, 2015). These plants demonstrate that the same plant resources that provide natural colors also have potent medicinal uses, aligning with the principle of holistic utilization of natural resources.

Similarly, *Curcuma longa* is one of the most well-known medicinal plants, with its rhizomes being used extensively for their anti-inflammatory, antioxidant and digestive benefits (Kaur & Bhattacharya, 2016). The yellow dye produced from turmeric is also a natural food colorant, further emphasizing its multifaceted applications in daily life (Sundari et al., 2020).

Lawsonia inermis (Mehndi), widely used as a natural hair dye and body art in various cultures, also holds antibacterial and antifungal properties, making it effective in treating wounds and skin diseases (Jain, 1991). This example illustrates the overlap between traditional cosmetic use and medicinal efficacy, which has been scientifically validated over time. Plants like *Cuscuta reflexa* (Amarbel), *Euphorbia tirucalli* (Saptarangi), and *Eclipta alba* (Bhringraj) also demonstrate significant pharmacological importance, being used in the treatment of conditions ranging from

asthma and liver ailments to promoting hair growth (Jain et al., 2015). The traditional uses of these plants have been validated by modern pharmacological research, suggesting they hold promising potential in the development of natural drugs and remedies.

Natural dye-yielding plants play an important role in the sustainability movement, as they provide eco-friendly alternatives to synthetic dyes, which often contain toxic chemicals that are harmful to the environment. Plants like *Tectona grandis* (Teak) and *Bauhinia variegata* (Kachnar) offer brown and yellow dyes from their wood and flowers, respectively. These natural dyes are biodegradable, renewable, and less harmful to aquatic ecosystems when compared to synthetic dyes (Ramaswamy & Jha, 2019). The resurgence of interest in natural dyeing processes supports local economies, reviving traditional craftsmanship and promoting environmentally conscious practices. Moreover, many of the plants mentioned, such as *Butea monosperma* (Palash) and *Indigofera tinctoria*, have deep cultural significance in India. Palash, for instance, is traditionally associated with the celebration of Holi, the festival of colors, due to its vibrant red-orange dye (Patel & Pandya, 2018). This intersection of cultural heritage and ecological sustainability underscores the importance of documenting and preserving these plants.

Despite the myriad benefits, there are several challenges to the widespread use of natural dyes. One key issue is the lower fastness properties of some natural dyes compared to synthetic counterparts. While advancements in mordanting techniques have improved the durability of plant-based dyes, further research is required to standardize these processes (Bala & Dhawan, 2015). Additionally, sustainable cultivation and conservation of dye-yielding plants are critical for their continued use. Several species like *Wrightia tinctoria* and *Semecarpus anacardium* are becoming rare due to habitat loss and over harvesting (Jain *et al*., 2015). Efforts should be made to cultivate these plants sustainably to ensure their availability for future generations. Research into agroforestry models and community-based conservation initiatives can help maintain the biodiversity of these valuable species.

Furthermore, there is a need for greater integration of natural dyes into commercial industries. While natural dyes are gaining traction in niche markets, especially among eco-conscious consumers, their higher cost and limited scalability hinder their widespread adoption (Sundari *et al*., 2020). Collaborative efforts between scientists, environmentalists, and artisans could foster innovation, improving the commercial viability of these plant-based dyes without compromising their environmental benefits.

Conclusion:

The documentation of dye-yielding plants from Marathwada reflects a rich botanical heritage that merges traditional knowledge with modern sustainable practices. These plants not only provide vibrant natural dyes but also offer significant medicinal properties, contributing to holistic health and wellness. However, challenges like lower dye fastness, unsustainable harvesting, and limited industrial adoption must be addressed through concerted research efforts. The future of these natural resources lies in sustainable cultivation, innovation in dyeing

techniques, and the promotion of eco-friendly alternatives to synthetic dyes, thus preserving both the environmental and cultural heritage of the region.

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Ethnomedicinal uses and preliminary phytochemical analysis of *Tribulus terrestris* L.

Parashar Preeti
And
Ray Sudip
Department of Botany,
P.M.B Gujarati Science College D.A.V.V. Indore (M.P.)

ABSTRACT:

A medicinal plant possesses curative properties mainly due to the presence of alkaloids, glycosides, saponin, carbohydrates, protein, phytosterols, flavonoids and tannin etc. They are naturally synthesized by the plants. The plants are important renewable source of raw materials for the production of variety of chemicals which can be utilized by mankind. It becomes necessary to find out the chemical constituents present in a particular medicinal plant which are used to cure the human and animal diseases. An attempt has been made to correlate the biological activity with the chemical constituents of the plants or part used in medicine. In the present study, simple phytochemical screening procedures were carried out to find the various constituents present in the extract of petroleum ether, benzene, chloroform, acetone, ethanol of Tribulus terrestris L.showing the presence of alkaloids, flavonoids, saponin, tannin and phenolic compound,protein carbohydrates and phytosteroides. The plant is used as ethnobotany and ethnoveterinary medicines.

Key words: *Tribulus terrestris* L, ethnobotany and ethnoveterinary.

Introduction:

Large population of developing countries of Asia, Africa used local medicinal plants in their healthcare practices. Medicinal plants provide health security and safety to peoples and act as alternative source for modern system of medicine (JAFICOAF, 2008). Nearabout 75-90% population of rural area still depends on traditional medicine due to its effectiveness over modern system (Fassil, 2001). According to WHO, most of the people in developing country still depends on natural plant products and traditional medicine for primary healthcare. Medicinal plants contain various types of phytoconstituents such as alkaloids, tannin, saponins, carbohydrates, amino acids, proteins, terpenoids, steroids, flavonoids (Vines, 2004).

Different types of phytochemical constituents such as alkaloids, carbohydrates, flavonoids, steroids, glycosides, tannin and flavonoids are present in medicinal plants with definite physiological activities on human beings (Edoga*et al*., 2005; Mann, 1978). Information about chemical constituents of medicinal plants is very essential as it is used for synthesis of complex substances (Mojab *et al*., 2003; Parekh *et al.,* 2007).

Tribulus terrestris L. is an annual herb, belongs to family Zygophyllaceae, mostly found in

tropical and moderate region of the world, Asia, Mexico, U.S. (Abeywickrama, 1991). In Ayurveda it is known as Gokshura, Gokharu, Trikanta and Trikantaka. From ancient time, *Tribulus terrestris* L.is used to cure human as well as animal ailments hence present study focus on qualitative phytochemical analysis of this plant. Therefore, present study focuses on preliminary phytochemical analysis of *Tribulus terrestris* L.

Material and Methods:

Plant material is collected during flowering and fruiting periods from different region of Nimar and represents entire aerial parts of plants. Plant parts were thoroughly washed shed driedand then grind to fine powder. About 25 gm. powder of plant material was subjected to successive soxhlet extraction with 250ml. of various solvent i.e. petroleum ether, benzene, chloroform, acetone and ethanol for 8 hours. Qualitative estimation of some major phytochemical constituents such as alkaloids, flavonoids, glycosides, saponin, tannin, protein, carbohydrates and physeteroides was carried out by using standard methods. Plant was identified by using various floras and voucher specimen was deposited in department of botany, P.M.B Gujarati Science College, Indore.

Detection of alkaloids:

To a few ml of filtrate, few drops of Wagner's reagent are added by the side of the test tube. Formation of reddish-brown precipitate indicates the presence of alkaloids. Test for glycosides about 3ml extract was mixed with dil.H_2SO_4, boiled and finally filtered. Equal volume of chloroform was added to cold filtrates. The organic solvent was separated and mixed ammonia solution. Ammonical layer turned pink or red indicates the presence of anthraquinone glycosides.

Test for carbohydrates:

Extract was mixed with equal volume of Benedict's reagent in test tube. Solution was heated in boiling water bath for 5 min. It was turned green, yellow or red, indicates the presence of carbohydrates.

Test for saponins:

Small amount of extract was shaken with little quantity of water. If foam produced persists for 10 minutes indicates the presence of saponins.

Test for tannin and phenols:

To 2-3ml extract mixed with few drops of 5% $FeCl_3$ solution. Formation of deep blue-black colour indicates the presence of tannin and phenols.

Test for flavonoids:

Extract was treated with few drops of sodium hydroxide solution intense yellow colored was formed It becomes colourless on addition of dilute acid, indicates the presence of flavonoids.

Test for Phytosteroids and terpenoids:

About 2ml extract was with mixed chloroform and then added 1-2ml acetic anhydride and 2 drops of conc. H_2SO_4 drawn from the side of test tube. Appearance of first red, then blue and finally green colour indicates the presence of steroids.

Test for protein:

About 3ml extract was treated with 4% sodium hydroxide and few drops of 1% copper sulphate solution. Formation of purplish violet or pink colour indicated the presence of proteins.

Result and Discussion:

Tribulis terrestris L. commonly known as Chotta gokhru belongs to familyZygophyllaceae. It is prostrate herbs, young parts silky, leaves opposite one from each pair is small. Flower yellow, axillary fruits globose, woody with 2pairs of sharp spines. Different part of plant such asroots, leaves, stem and fruit possess medicinal properties and are used to cure various ailments. Fruit is used as a diuretic.Leaf paste is applied in the treatment of corn.Fruit boiled and decoction is use in cough and in leucorrhoea.Fruit is used in backache, asthma and cough.The whole plant is used for treating impotency. Domestically fruit and leaves are used as fodder.Leaves is used as a vegetable and Fruits are eaten by some tribes.

In ethnoveterinary practices, leaves are crushed to make paste. It is applied on septic wounds of animals.250 gm stem mixed with fodder is given to animals for two days for removal of internal parasites.250 gm root paste and 25 gm paste of leaves of *Azadirachta indica* (neem)is applied locally for removal of external parasites. Fruits are mixed with fodder to cure diarrhoea in cattle.

The result of the preliminary phytochemical screening of *Tribulus terrestris* L. in table shows the presences of different phytochemicals prepared in different solvent extracts. Alkaloids, Flavonoids, saponin, tannin and phenolic compound, protein, carbohydrate, phytosteroides are present in the test. Due to this phytochemical compound the plant used against different human and animal ailments.

Table 1: Qualitative chemical examination of various extracts

Plant parts	Test	Reagent used	Petroleum ether extract	Benzene extract	Chloroform extract	Acetone extract	Ethanol extract
Leaves	Alkaloids	Mayer's Dragendorff 's Hager's Wagener's	+ve	+ve	- ve	+ve	+ve
	Glycosides	Borntrager's Legal Test	- ve	- ve	- ve	- ve	- ve
	Saponin	Foam Test Froth Test	+ve	+ve	+ve	- ve	+ve
	Tanin and Phenolic compound	5% Ferric chloride Bromine water Acetic acid Test	+ve	+ve	- ve	+ve	- ve

	Protein	Biuret's Xanthoproteic Test	+ve	- ve	- ve	- ve	+ve
	Carbohydrate	Fehling's Molisch's Benedict's Test	- ve	- ve	- ve	+ve	+ve
	Phytosterols	Libermann's Liberman-Burchard's Test	+ve	- ve	- ve	+ve	+ve
	Flavonoids	Alkaline reagent Lead acetate Shinoda Test	- ve	- ve	+ve	+ve	+ve

Conclusion:

Presence of various phytochemical strongly supports to medicinal properties of *Tribulus terrestris* L. Previous literature also reported medicinal use of *Tribulus terrestris* L. from ancient time. Present study documented information about its ethnomedicinal value and phytochemical constituents; help for future use.Further study is also required for standardization and characterization of crude drugs obtained from plant.

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Sustainable Coloration: Exploring the Potential of Natural Dyes

Marathe V. R.
PG Department of Botany, N. E. S. Science College, Nanded (Maharashtra), India
And
Amrutwad B. B.
PG Department of Botany, N. E. S. Science College, Nanded (Maharashtra), India
And
S. S. Mhasal
Department of Botany, Arts and Commerce College, Warvat Bakal, Dist. Buldhana

ABSTRACT

Natural dyes have been utilized for millennia, providing vibrant colors derived from plants, minerals, and animals. Plant-based dyes, in particular, have been an integral part of human culture, used in textiles, art, and even food. The shift towards synthetic dyes in the 19th century brought convenience and uniformity but also environmental and health concerns. The information about ancient Indian plants that produced dyes and their natural colors is the focus of the present article. Dyes are highly colored substances that are added to a variety of substrates, including fiber, cosmetics, paper, hair, and so on, to impart color. They can also be obtained from plant roots, berries, fruits, tree bark, leaves, and flowers wood/stems, fungus, lichens and by using different extraction techniques.Recently, consumers have begun to show interest in natural dyes again after synthetic colors overpowered them for the last sixty years. Currently, textile materials are dyed using only synthetic substances that are not good to the environment. They cause waste disposal issues, water pollution, carcinogenicity, and non-biodegradability. Natural coloring supplies offer a practical answer to these issues. Due to greater knowledge of natural dyes beneficial characteristics, the market for them has grown worldwide in recent times. Given this context, the current review aims to raise awareness about the use of natural dyes as an alternative to synthetic ones.

Keywords: Natural dyes, Plant based dyes, Sustainable coloration

Introduction:

An important class of non-wood forestry materials are natural coloring agents and dyestuffs, which are used in the production of paper, paint, ink, leather, desserts, and other food items besides textiles, skin care products, and pharmaceuticals (Hena, 2016), Given that they come from natural resources, all pigments and dyes made from plants, insects, and minerals are referred to as colorants that are natural. The usage of synthetic dyes has been steadily declining over the past few years as a result of growing environmental consciousness and negative consequences brought on by either their toxicity or their inability to biodegrade. Apart from the previously mentioned, there are several grave health risks such as hypersensitivity and the synthetic dyes have been known to cause cancer. Consequently, the use of certain synthetic dyes has been prohibited

worldwide, notably in the Germany, European Economic Community (EEC), the United States, and India. The benefits of employing natural colorants are numerous; they come from renewable resources, are safe for human contact, simple, harmonious with nature, and require less chance of chemical reactions during production (Brian, 1998). The colors produced by natural colorants and dyes are usually mild, dazzling, and visually soothing. Although natural dyes usually don't present a health crisis, sometimes they may have therapeutic benefits. Furthermore, employing natural dyes has no dumping problems. However, there are a number of disadvantages to natural dyes, including availability, color production, stability, and the challenge of accurately reproducing various tints and the dyeing procedure. Furthermore, natural colors have a place in the market, but they can't take the place of synthetic dyes entirely.

Historical context:

Ancient Origins:

The use of plant-based dyes dates back to ancient civilizations, where they were integral to cultural practices, art, and textiles. Some of the earliest evidence of plant dyes has been found in archaeological sites across the world, suggesting that dyeing practices were prevalent in ancient Egypt, Mesopotamia, and China. Egyptians used plant dyes for textiles, cosmetics, and art. Indigo (from *Indigofera tinctoria*) and madder (from *Rubia tinctorum*) were among the prominent dyes used (Cardon, 2007). Evidence suggests that Sumerians dyed wool with natural dyes, including those derived from plants like madder and saffron (*Crocus sativus*) (Barber, 1991). The Chinese have a long history of using plant dyes, such as the blue dye from woad (*Isatis tinctoria*) and red from madder. Silk, a significant textile, was often dyed using plant extracts (Goodwin, 1982).

Dyeing was one of the earliest techniques employed by the people of the ancient civilization. This is evident from the murals and wall paintings found in Ajanta, Ellora, Sithannavasal caves, and Mithila (Jha and Basak, 1994) and the Egyptian structures such as pyramids that were exclusively colored with natural colors.

Middle Ages:

During the middle Ages, the use of natural dyes flourished in Europe. The knowledge of dyeing techniques was often closely guarded by guilds, and the production of certain dyes, such as the famous Tyrian purple (though not plant-based, it was a significant dye of the period), was highly specialized. Woad became a crucial blue dye in Europe, especially in England and France. The cultivation of woad supported entire local economies. Madder was also widely used for red hues (Balfour-Paul, 2011). The Islamic world made significant advancements in the use and trade of natural dyes, with detailed knowledge of dyeing techniques and mordants (Allchinet al., 1968).

Renaissance and Early Modern Period

The Renaissance period saw a renewed interest in the arts, including the use of natural dyes. With the expansion of trade routes, exotic dyes from the New World and Asia became more accessible to European dyers. In the new World, discovery of cochineal (*Dactylopius coccus*), a vibrant red dye from the Americas, revolutionized the dyeing industry in Europe. Although

cochineal is derived from insects, many plant-based dyes from the New World, such as logwood (*Haematoxylum campechianum*), were also introduced (Greenfield, 2005). The global trade network established during this period allowed for the exchange of plant-based dyes, enhancing the variety and availability of dyes (Lee, 2005).

Industrial Revolution

The Industrial Revolution in the 18th and 19th centuries marked a turning point in the history of dyes. The development of synthetic dyes by chemists like William Henry Perkin, who discovered the first aniline dye (mauveine) in 1856, drastically changed the dyeing industry. Synthetic dyes quickly supplanted natural dyes due to their ease of production, consistent quality, and vibrant colors. This led to a decline in the use of plant-based dyes, as synthetic alternatives were more economical and reliable (Travis, 1993).

Artificial dyes gained acceptance more quickly as a result of their numerous uses in a variety of industries, including cosmetics, photodynamic healing, Food, nonlinear optical phenomena and most significantly, textiles industry (Prasad & Williams, 1991; Sinha et al., 1995; Savarino et al., 1999) as a result of the general cost issue and convenience of dying. However, over the past few decades, there has been a progressive decline in the use of synthetic dyes due to growing environmental consciousness and negative effects emanating either because of their toxicity or not sustainable quality. Natural dyes will have a better role in the replacement of synthetic dyes and can be utilized in contaminated environments in lieu of synthetic ones because of their eco-friendly nature, biodegradability, and safety.

Categorization of natural colorants:

Natural dyes are categorized to in three categories viz. plant-based, animal-based, and mineral-based according to the sources from which they are derived (Bhattacharya, 2010).

1. Plant Based Dyes:

When textiles were accidentally stained with fruit or plant juice, the very first dyes were found to be plant-based. There are several plant parts that are capable of being used for producing plant dyes, including leaves, flowers, fruits, pods, bark, etc (Table 1). These plant-based colors can be used without a mordant or in conjunction with various ones. India is home to a diverse range of plants, with over 450 of them producing pigments and dyes. (Reddy et.al, 2011)

Table – 1: Plant Based dyes

Plant Name	Family	Dye Color	Part Used	Example Use	Reference
Madder (*Rubia tinctorum*)	Rubiaceae	Red, Pink	Roots	Textile dyeing	Cardon (2007)
Indigo (*Indigofera tinctoria*)	Fabaceae	Blue	Leaves	Denim jeans	Balfour-Paul (2011)
Woad (*Isatis tinctoria*)	Brassicaceae	Blue	Leaves	Traditional European textiles	Lee (2005)
Saffron (*Crocus sativus*)	Iridaceae	Yellow, Orange	Stigmas	Food coloring, textiles	Barber (1991)

Turmeric (*Curcuma longa*)	Zingiberaceae	Yellow	Rhizomes	Food coloring, textiles	Shahid& Mohammad (2013)
Onion skins (*Allium cepa*)	Amaryllidaceae	Yellow, Brown	Skins	Textile dyeing	Samanta & Konar (2011)
Logwood (*Haematoxylum campechianum*)	Fabaceae	Black, Purple	Heartwood	Ink, textiles	Greenfield (2005)
Pomegranate (*Punica granatum)*	Lythraceae	Yellow, Brown	Rinds	Textile dyeing	Gupta & Jain (2015)
Weld (*Reseda luteola*)	Resedaceae	Yellow	Leaves, Stems	Textile dyeing	Cardon (2007)
Dyer's Chamomile (*Anthemis tinctoria*)	Asteraceae	Yellow	Flowers	Textile dyeing	Cristea & Vilarem (2006)
Henna (*Lawsonia inermis*)	Lythraceae	Orange, Red	Leaves	Hair dye, body art	Travis (1993)
Black Walnut (*Juglans nigra*)	Juglandaceae	Brown, Black	Husks	Wood staining, textiles	Goodwin (1982)
Oak (*Quercus spp.*)	Fagaceae	Brown, Black	Bark, Galls	Leather tanning, textiles	Allchin et al., (1968)
Cutch (*Acacia catechu*)	Fabaceae	Brown	Heartwood	Textile dyeing	Samanta & Konar (2011)
Brazilwood (*Caesalpinia echinata*)	Fabaceae	Red, Purple	Heartwood	Textile dyeing	Cardon (2007)

2. Animal Based Dyes:

Animal-based dyes have played a significant role in the history of textile dyeing and color production. These dyes, derived from various animals and their secretions, have been prized for their vibrant and long-lasting colors, often commanding high value in trade and cultural significance (Table 2). The use of animal-based dyes dates back to ancient times and has influenced art, fashion, and industry across different civilizations.

Table – 2: Animal Based dyes

Animal Name	Family	Dye Color	Part Used	Example Use	Reference
Cochineal (*Dactylopius coccus*)	Dactylopiidae	Red, Pink	Insect bodies	Food coloring, textiles	Greenfield (2005)
Kermes (*Kermes vermilio*)	Kermesidae	Red	Insect bodies	Historical textiles	Cardon (2007)

Lac (*Kerria lacca*)	Kerriidae	Red, Purple	Insect resin	Textile dyeing	Chakravorty (1972)
Tyrian purple (*Bolinus brandaris*)	Muricidae	Purple	Mollusk gland	Royal garments	Ball (2001)
Sepia (*Sepia officinalis*)	Sepiidae	Brown, Black	Ink sac	Drawing ink, textiles	Farndon (2007)
Murex (*Hexaplex trunculus*)	Muricidae	Purple, Blue	Mollusk gland	Historical textiles	Cardon (2007)
Indigo (*Phengodes laticollis*)	Phengodidae	Blue	Insect hemolymph	Textile dyeing	McCoy (1990)

3. Mineral Based Dyes:

Inorganic mineral salts and oxides of metals comprise a variety of pigments that are classified under this group of natural colors (Table 3). The most significant pigments made from minerals are red lead, ochre, cinnabar, and Realgar are a few instances of where red colors come from minerals.

Table – 3: Mineral Based dyes

Mineral Name	Chemical Composition	Dye Color	Part Used	Example Use	Reference
Ochre	Iron oxide	Yellow, Red, Brown	Earth	Pigments for paints and textiles	Cornell & Schwertmann (2003)
Malachite	Copper carbonate	Green	Mineral	Pigments for paints and cosmetics	Scott (2002)
Azurite	Copper carbonate	Blue	Mineral	Pigments for paints and art	Scott (2002)
Cinnabar	Mercury sulfide	Red	Mineral	Pigments for paints and art	Gettens & Stout (1966)
Realgar	Arsenic sulfide	Red, Orange	Mineral	Pigments for art	Eastaugh et al., (2008)
Lapis Lazuli	Lazurite (sodium aluminum silicate sulfate)	Blue	Mineral	Pigments for paints and cosmetics	FitzHugh. (1997)
Hematite	Iron oxide	Red, Brown	Earth	Pigments for paints and art	Cornell & Schwertmann (2003)
Charcoal	Carbon	Black	Burned wood	Pigments for art and textiles	Eastaugh et al., (2008)
Gypsum	Calcium sulfate	White	Mineral	Pigments for paints and cosmetics	Scott (2002)
Red Lead	Lead oxide	Red	Mineral	Pigments for paints and art	Eastaugh et al., (2008)

Advantages of natural dyes:

1. Natural colorants are environmentally friendly because they are made from natural materials. Natural colors are able to break down and their disposal does not cause pollution.
2. Colors are conveniently retrieved by boiling vegetation, fruits, leaves, flowers and bark.
3. Nil or minimal chemical interactions take place during color production.
4. Some colors that are natural, like the carmine utilized in shades of lipstick, are not harmful or cause ailments when consumed. So, Natural dyes are safe to use. (Choudhury et al., 2018).
5. Natural dyes are biodegradable, non-toxic, and allergen free.
6. In some situations, waste released during indigo dyeing can be utilized for biological fertilizers, eliminating the need for disposal.
7. Natural colorants are primarily plant-based and renewable, while synthetic colorants rely on non-renewable energy sources such as petroleum. Thus, the utilization of natural colors in place of burning fossil fuels (based on petroleum) Synthetic dyes have the ability to accumulate carbon credits.

Disadvantages of Natural dyes:

1. In comparison to synthetic colorants, a larger quantity of natural colors may be required to color a certain amount of cloth. For instance, 1 gram of cloth can be colored with 5 grams of artificial dye, but the same quantity of cloth requires 230 gm of naturally occurring dye. As a result, natural dyes cost greater than artificial colors.
2. Natural dyes might need the mordants during implementation. Whereas these substances assist the dye adhere to materials, they may also be harmful. Mordants in natural dyes include aluminum, iron, copper, & chrome as well. (Keycolour, 2016 and Choudhury, et al., 2018)
3. Due to low solubility in water, a time-consuming extraction technique may be required.
4. Long coloring processes.
5. Shade has poor repeatability.

Conclusion:

Plant natural dyes offer a viable and sustainable alternative to synthetic dyes, with significant environmental and health benefits. Despite some challenges, ongoing research and technological advancements hold the promise of overcoming these hurdles. Embracing plant-based dyes can contribute to a more sustainable future, preserving traditional practices while promoting innovation in various industries.

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Survey of Medicinal Plants from Gundegaon Area of Ahmednagar District (M.S) India

Mr. Sushilkumar S. Shinde
New Art's, Commerce and Science College, Shevgaon, Ahmednagar, MS, India
And
Mr. Rahul B. Kharat
Art's, Commerce and Science College, Shevgaon, Ahmednagar, MS, India

ABSTRACT

Since ancient time, human beings have been mostly depended on plant resources for their basic needs like food, medicine, fiber, fodder, shelter, etc. they were directly dependent on plants, but due to with advancement in science and technology dependence on plants as a direct source has been slightly reduced in recent years.Gundegaon is a large village located in Nagar Taluka of Ahmednagar district. The present study is deals with medicinal plant from Gundegaon area of Ahmednagar district with their local name, botanical name, family and uses done during June- August 2024. During the study ethnobotanical point of view of total 124 plants 45 families used for medicinal purpose have been recorded.

Keyword: Medicinal plants; Ethnobotany, Conservation, Diversity.

Introduction:

Ahmednagar is the largest district of Maharashtra, occupying a central position in the state. The district is located between 18°02' and 19°09' north latitude and 73°09' and 75°05' east longitude. It is bounded on the north by Nasik district, on the south by Solapur district, on the east by Beed and Osmanabad districts, on the west by Pune district, on the northeast by Aurangabad district, and on the northwest by Thane district. Ahmednagar district is divided into 14 revenue talukas. Major rivers such as Godavari, Bhima, Mula, and Pravara flow through the district, and there are two dams, Mula and Bhandardara. The forest covers an area of 1,904.84 sq km, which is 10.93% of the total geographical area of the district (District Survey Report, Part-A, Ahmednagar). In recent years, it has become necessary to promote traditional knowledge of plant-based drugs alongside modern medicinal systems. Medicinal plants are rich in therapeutic compounds, which are nature's gifts to human civilization. The present study investigates the wealth of angiospermic medicinal plants. Therefore, there is a need for scientific documentation of ethnobotanically important plants and to spread traditional knowledge regarding the uses of these plants, which is the focus of this work. Plants and information about their uses need to be conserved for future generations.

Study Area:

Gundegaon is a village in Nagar Taluka in Ahmednagar district of Maharashtra, India. It lies at an altitude between 19° 06' 3.7908" N latitude and 74°44' 26.4372" E longitude. The

village is located near the Shudhaleshwar River, which originates in the Panchtekadi hills to the west of the village. The area is covered by 40% forest.

Material and Method:

An ethnobotanical survey was carried out from July to August 2024 to collect traditional information from the aboriginal peoples regarding the ethnobotanical importance of forest resources in the Gundegaon village area. The present work involved a questionnaire survey and documentation of plants utilized by tribal/local peoples for treating various diseases. The methodology used for collecting information involved informal interviews with people. Simultaneously, plants were identified using botanical determination keys provided in regional floras (Pradhan & Singh 1999, Cooke 1901-1908).

The information collected was analyzed quantitatively to obtain the following data: the plants most used, the number of different uses, the parts of plants most frequently mentioned for medicinal uses, the most common preparations, and modes of application. The plants were listed alphabetically along with their family names, common names, and uses.

Result and Discussion:

In our survey of Gundegaon, we documented 124 plant species across 45 families, each exhibiting a range of medicinal properties. These plants are traditionally used by local communities, including Mahadev Koli, Thakar, Ramoshi, and Bhills, to treat conditions such as colds, coughs, asthma, fever, jaundice, cancer, snake and dog bites, piles, and infections. The study also highlights the modes of administration of these plants, reflecting their significance in both local and Ayurvedic medicinal practices. The region shows major vegetation from families such as Asteraceae, Apocynaceae, Fabaceae, Caesalpiniaceae, Convolvulaceae, and Solanaceae.

Conclusion:

These plants with medicinal properties are essential for human existence, and we should be aware that there are many more plants across the world that possesses rich medicinal properties. Some species are endangered, with many facing extinction. It is necessary to conserve these threatened or endangered species, not only for the conservation of biodiversity but also for the welfare of humanity.

Table No -1 Collected Plant and Its Medicinal Uses.

The table below consists of the botanical name, local name, habit, family, and medicinal importance of plants used by tribal communities for treating diseases. Parts used include tubers, roots, stems, leaves, flowers, and seeds. The secondary metabolites identified are phenolic compounds, flavonoids, alkaloids, and terpenes.

SR. NO	BOTANICAL NAME	LOCAL NAME	FAMILY	HABIT	MEDICINAL VALUE
1.	*Acacia catechu*	Khair	Fabaceae	Shrub	Piles, Headache, Cold, Dog bite, Snake bite, Skin Disease
2.	*Acalypha indica*	Kupi	Euphorbiaceae	Herb	Jaundice, Rat Bite, Asthma, Antibacterial, Earache, Anticancer, Anti diabetic
3.	*Acacia nilotica*	Babhul	Fabaceae	Tree	Antimicrobial, A, Anticancer, Anti-hypertensive
4.	*Achyranthus aspera*	Aghada	Amranthaceae	Herb	Migraine, Eye Swelling, Boils, Hernia,Asthma,Piles, Headache, Cold, Dog bite, Snake bite, Skin Disease, Bone Fracture
5.	*Adhatoda vasica*	Adulsa	Acanthaceae	Shrub	Cough,Jaundice,Nasalhaemoh arrage
6.	*Aegle marmelos*	Bel	Rutaceae	Tree	Fever, Tuberculosis, Anti-inflammatory, Anticancer, Diabetes
7.	*Agave americana*	Ghaypat	Asparagaceae	Shrub	Earache, Cooling,Swelling and Boils
8.	*Ageratum conyzoids*	Goatweed	Asteraceae	Herb	To Stop Itchinging Cattle
9.	*Aloe vera*	Korphad	Lilliaceae	Herb	Piles,DogBite, Jaundice, Body pain, Hair Treatments, Skin Treatments Cooling effect
10.	*Alternanthera sessilis*	Chimukata	Amranthaceae	Herb	Piles, Indigestion, Improvevision, Treat Hepatitis, Asthma, Lungs Disorders
11.	*Amaranthus tricolor*	Tandulcha	Amaranthaceae	Herb	Vomiting, Piles and External application on inflammation
12.	*Annona hexapetala*	Champa	Annonaceae	Shrub	Anti-microbial, DiarrheaFever, Anti-Fertility, Antioxidant
13.	*Argimone mexicana*	Bilayat	Papaveraceae	Herb	A Pain Killer, Diuretic, Anti-inflammatory Seeds and leaf oil for Cough.
14.	*Aristolochia bractata*	Kidmar	Aristolochiaceae	Herb	Asthma, Intestinal Worms, Arthritic Pain, ImmunityBooster,Start Menstruation
15.	*Asclepias curassavica*	HaladiKunku	Apocynaceae	Herb	Cough, Intestinal worms, Wound Healing
16.	*Asperagus recemosa*	Shatawari	Liliaceae	Climber	Blood, Dysentery, Skin Diseases, Lactation, Swelling, Stomach Pain

17.	*Azadirechta indica*	Kadunimb	Meliacceae	Tree	Antibacterial, Anti-fungal, Anthelmintis. Anticancer, Acne, Useful in Detoxification, Reducer Dandruff, Treat Wounds, Gastrointestinal diseases
18.	*Bacopa monnieri*	Bramhi	Plantaginaceae	Herb	Chest Pain, Arthritic, Leg Swelling, Bronchitis, Cough and Cold, Neurological disorders like Memory loss
19.	*Bambosa arundinacea*	Bamboo	Poaceae	Tree	Wound, Stomach Pain and Fever
20.	*Bauhinia purpurea*	Raktchandan	Caesalpiniaceae	Tree	Antibacterial,Anti-diabetic, Analgesic, Anti-inflammatory, Anti-cancerous, Thyroid 22Regulating Activity
21.	*Bauhinia racemosa*	Apata	Caesalpiniaceae	Tree	Headache, Fever, Ulcer, Skin Diseases, Blood Diseases,Dysentery and Diarrhea
22.	*Bidens biternata*	Chitta	Asteraceae	Herb	Cough, Fever, Throat Infection
23.	*Boerhhavia diffusa*	Punarnava	Nyctaginaceae	Herb	Arthritic Pain, Eye Itching, Fever, Jaundice and Wound Healing
24.	*Caesalpinea pulcherima*	Shankasur	Caesalpiniaceae	Tree	To treat minor injuries and wounds, Fever, Antioxidant, Anti-tumorous, Anti-ulcer
25.	*Caesalpinia pulchereama*	Shankasur	Caesalpiniaceae	Herb	Diabetes, Body Ache, Fever
26.	*Caesalpinia crista*	Sagargota	Caesalpiniaceae	Herb	Intestinal worms, Bone Fracture, Hernia, Paralysis, Fits
27.	*Caesulia axillaris*	Maka	Asteraceae	Tree	Antibacterial, Anti inflammator and Anti -fungal
28.	*Calatropis gigantea*	Rui	Apocynaceae	Shrub	Intestinal Worms, Headache, Fits, Stomach Pain, Swelling, Painful Menstruation.
29.	*Calatropis procera*	Rui	Apocynaceae	Shrub	Headache, Leprosy, Dogbite, Cough.
30.	*Canna indica*	Kardal	Cannaceae	Shrub	Itching and Jaundice
31.	*Carraluma adsendens*	Makdsinghi	Apocynaceae	Herb	Cooling Effect, Antioxidant,Anti-inflammatory, Antibiotic,Anti-ulcer, Antibacterial, Hypoglycemic Activity

32.	*Carrisa carrandus*	Karvand	Apocynaceae	Tree	Treat Acidity, Indigestion, Fresh and Infected Wounds,Stomach Pain , Urinary Disorder, Diabetic and Ulcer,
33.	*Cassia auriculata*	Tarvad	Fabaceae	Shrub	Cough, Diabetics,Scorpion Sting, Promoting Fertility
34.	*Cassia ocsidentalis*	Rantakala	Fabaceae	Shrub	Jaundice, Bone Fracture, Arthritic Pain.
35.	*Cassia tora*	Takala	Fabaceae	Shrub	As Laxative, Anti Asthmatic and Diuretic agent.Ringworm, Eye Pain
36.	*Cathranthus roseus*	Sadapuli	Apocynaceae	Herb	Immunity Booster Tonic & Diabetes
37.	*Celosia argentea*	Kombada	Amranthaceae	Shrub	Kidney Stone, Cooling Effect, Leucorrhoea, Reduce Liver Heat
38.	*Cestrum nocturnum*	Ratrani	Solanaceae	Shrub	Antioxidant, Hepatoprotective, Anti- HIV, Anticonvulsant, Anti-fungal, Analgesic
39.	*Chlorophytum tuberosus*	Musali	Asparagaceae	Herb	Cough, Body Swelling, Earache,
40.	*Chrysanthimum ssp.*	Shevanti	Asteraceae	Herb	Chest Pain, Blood Pressure, Fever, Cold, Headache, Dizziness, swelling
41.	*Clitoria ternata*	Gokarna	Fabaceae	Climber	Memory enhancer, Anti-depressant Anti-stress, Nootropic, Enziolytic
42.	*Coccinia indica*	Tondali	Cucurbitaceae		Diabetes, Kidney
43.	*Commelina benghalensis*	Cana	Commelinaceae	Herb	Wound Cuts Stomach Disorders, Fever
44.	*Convolvulus arvensis*	Chandvel	Convolvulaceae	Herb	Stomach Pain, Constipation& Purgative
45.	*Cordia dichotama*	Bhokar	Boraginaceae	Tree	Cough, Asthma, Fever, Diarrhea, Skin Diseases, Intestinal worms and Wounds
46.	*Cryptolepies buchananii*	Shevkavali	Apocynaceae	Climber	Wound Healing and Laxative
47.	*Cryptostegia grandifolia*	Rabarvel	Apocynaceae	Climber	Snake Bite, Wounds & Injuries
48.	*Cucumis trigonus*	Chimbuda	Cucurbitaceae	Climber	Liver Tonic,Leprosy,Jaundice,Diabetes, Bronchitis and Amentia
49.	*Cuscuta reflexa*	Amarvel	Convolvulaceae	Climber	Hepatic & Urinary Tract Disorder and Arthritic Pain,
50.	*Cynodon dactylon*	Durva-Harali	Poaceae	Herb	Cuts and Wounds, Urinary Tract Disorders, Kidney stone
51.	*Dhatura metal*	Dhotara	Solanaceae	Herb	Cough, Toothache, Arthritic Pain, Wound Healing

52.	*Echinops echinatus*	Kateri	Asteraceae	Herb	Spermatogenesis, Tonic for Weight Gain,Wound Healing, & Antidote to Poison
53.	*Eclepta prostrata*	Maka	Asteraceae	Herb	Dog bite, Swelling, Jaundice, Graying of Hairs & Hair Loss Problem
54.	*Emblica officinalis*	Chinch	Phyllanthaceae	Tree	Anti-inflammatory Anti-ulcer, Haepatoprotective Anticancer
55.	*Enicostema exillare*	Nai	Gentianaceae	Herb	Blood Pressure, Diabetes, Stomach Ulcer, Fever, Scorpion Sting
56.	*Feronia limonia*	Kauth	Rutaceae	Tree	Cough, Dysentery, Cardiac Disease, Vomiting, Fatigue, Tumors, Blood impurities, Asthm
57.	*Ficus benghalensis*	Vad	Moraceae	Tree	Astringent to bowels, Ulcer, Vaginal Complains, Fever, Inflammation, Leprosy, Syphilis
58.	*Ficus recemosa*	Umbar	Moraceae	Tree	Diarrhea, Diabetes, Respiratory and Urinary Diseases, Liver-disorder
59.	*Ficus religiosa*	Pimpal	Moraceae	Tree	Asthma, Diabetes, Diarrhea Epilepsy,GastricProblems, Inflammatory Disorders, Sexual disorders,
60.	*Glossocardia bosvallea*	Khadakshepu	Ateraceae	Herb	Chronic Fever, Leucorroea,
61.	*Grewia asiatica*	Phalsa	Malvaceae	Shrub	Treating Throats and Tuberculosis, Sexual Troubles, Asthama, , Fever and Diarrhea
62.	*Gymnesema sylvestre*	BedkichaPala		Lians	Anti-Diabetic, Jaundice, Eye Infection, Intestinal Worms
63.	*Hemidesmius indicus*	Anantmul	Apocynaceae	Climber	Diarrhea, Dysentery,Skin Diseases & Etching, Jaundice
64.	*Hibiscus rosa-sinensis*	Jaswandi	Malvaceae	Shrub	Hair treatments, Treating Wound, Inflammation, Fever and Cough, Diabetes, Antibacterial, Anti- fungal, Hair loss Treatments , Gastric Ulcer
65.	*Holarhena pubescence*	Pandharakuda	Apocynaceae	Tree	Treating Anemia, Jaundice, Stomach Pain, Epilepsy, Diarrhea
66.	*Impatien balsamina*	Terda	Balsaminaceae	Herb	Rheumatism, Burns, Snake Bites, Fractures, Ailments
67.	*Ipomoea cairica*	Garvel	Convolvulaceae	Climber	Stomach Pain, Stomach Ulcer, Constipation

68.	*Ipomoea carnea*	Besharam	Convolvulaceae	Shrub	Cuts and Wound Healing, Latex used in Skin Problems, Arthritic Pain
69.	*Ipomoea nill*	Nili Pungi	Convolvulaceae	Climber	Anthelmintic Diuretic and Laxative Anti tumour, Anti-cholinergic, Anti-fungal and Anti-tumour
70.	*Jasminum grandiflorum*	Jai	Oleaceae	Lians	Treatment of Wounds, Headache, Ulcer, Skin Diseases, Erectile Dysfunction Gingivitis
71.	*Jasminum malabaricum*	Jui	Oleaceae	Lians	Antibacterial, Anti-tumour Antioxidant Blood Purifier
72.	*Jasminum sambac*	Mogara	Oleaceae	Lians	Ringworms,Dysmenorrhoae , Leprosy, Skin Diseases, Antiseptic, Antidepressants
73.	*Jatropha gossypifolia*	Mogali Erand	Euphorbiaceae	Shrub	Antibacterial, Anti fertility Anti-inflammation, Antioxidant, Jaundice, Eczema
74.	*Justecia procumbance*	Pitttapapada	Acanthaceae	Herb	Fever,Cough, and Wound Healing
75.	*Lantana camara*	Ghaneri	Vebinaceae	Shrub	Paste on Injuries and Cuts, Wound Healing
76.	*Launea procumbance*	Pathari	Asteraceae	Herb	Fever & Jaundice
77.	*Lepidagathis cristata*	Bhuichendu	Acanthaceae	Herb	Paste on Cuts, Boils and Wounds
78.	*Lucas longifolia*	Thumba/Dudhani	Lamiaceae	Herb	Cough,Cold,Asthma, Antimicrobial,Headache,Digestive Disorder
79.	*Mangifera indica*	Amba	Anacardiaceae	Tree	Antiseptic, Astringent, Stomachic, Tonic Laxative, Diuretic, Treat to Diarrhea, Asthma, Cough, Hypertension , Piles
80.	*Mangolia champaca*	Sonchapha	Magnoliaceae	Tree	Diarrhea, Cough, Fever, Inflammation, Bronchitis, Cardio-tonic, Hypertension
81.	*Martynia annua*	Vinchavi	Martyniaceae	Herb	Sore Throat, Toothache,ScorpionStting, Cardiac Problems, Fever and Ulcer
82.	*Mimosa pudica*	Lajalu	Fabaceae	Herb	Urinary Tract Diseases, Body Ache, Kidney Disorder.
83.	*Mirabilis jalapa*	Gulbakshi	Nyctaginaceae	Herb	Cooling Effect, Boils and Burns Diuretic, Leucorrhea

84.	*Moringa concanensis*	Ran Shevga	Moringaceae	Tree	Ant cancerous, Antibacterial Antifungal, Anti-inflammatory Fertility in Women, Menstrual Pain, Intestinal worms
85.	*Nerium indicum*	Kanher	Apocynaceae	Tree	Cardiac Muscles, Relievepains and eliminate blood Stasis
86.	*Ocimum americanum*	Ran Tulsi	Lamiaceae	Herb	Indigestion, Eye Infection, Immunity Booster,
87.	*Ocimum santalum*	Tulsi	Lamiaceae	Herb	Cough, Cold, Fever, Jaundice, Earache, Headache,Asthma , Skin Problem, Immunity Booster, Dysentery etc.
88.	*Oldenlandia corymbosa*	Pittapapada	Rubiaceae	Herb	Active Blood Circulation, Clear Heat and Toxin, Hepatitis, Pneumonia, Urinary Infections, Snake Bite
89.	*Opuntia neriffollia*	Nivdunga	Cactaceae	Shrub	Jaundice and Nail Infection
90.	*Physalis minima*	Chirgoti	Solanaceae	Herb	Diarrhea, Stomach Pain, Earache
91.	*Plumbago zylanica*	Chitrak	Plumbagoginaceae	Shrub	Stomach Pain, Fever, Loose Motions, Scorpion Sting Bite, Jaundice
92.	*Polianthus tuberosa*	Nishigandha	Asparagaceae	Tree	Antipyrutic Agent, Antimicrobial, Cytotoxic function,Hypoglycemic activity,
93.	*Polyalthia longifolia*	Ashoka	Annonaceae	Tree	Fever Skin Diseases, Diabetes, Hypertension, Antibacterial, Antifungal, Antitumor.
94.	*Pongamia pinnata*	Karanj	Fabaceae	Tree	Pile, Skin Disease, Ulcer, Tumor, Cleaning Gums and Teeth
95.	*Ricinus communis*	Erand	Euphorbiaceae	Shrub	Eye Pain, Constipation, Mumps, Cooling Effect
96.	*Rugia repense*	Ghati	Acanthaceae	Herb	Swelling, Cough, Cold and Fever
97.	*Santalum album*	Chandan	Santalaceae	Tree	Skin Disorder,Bronchitis, Inflamation of Mouth, Common Cold and Weekness,
98.	*Senna siamea*	Kasud	Caesalpiniaceae	Tree	Jaundice, Typhoid Fever, Abdominal Pain, Menstrual Pain, Blood Cleaning Agent, Digestive and Urinary Tract Disorders
99.	*Shorea robusta*	Sal	Dipterocarpaceae	Tree	Constipation, Skin Infection, Wound burns, Piles, Arthritis, Anti-inflammatory and PainrelievingProperty

100.	*Sida acuta*	Chikana	Malvaceae	Herb	Common Cold, Headache, Nasal Congestion, Cough, Fluid Retention, Sore Mouth,
101.	*Solanum nigrum*	Kanguni	Solanaceae	Herb	Asthma, Ringworms, Liver Disease, Night blindness, Jaundice.
102.	*Sonchus oleraceae*	Mhatra	Asteraceae	Herb	Sores and used as Immunity Tonic
103.	*Striga angustica*		Scrophuliaceae	Herb	Plant improves Apitate and Taste.
104.	*Striga gesnerioides*		Scrophuliaceae	Herb	Extract to control Diabetes
105.	*Syzygium cumini L. Skeel*	Jambhul	Myrataceae	Tree	Sore Throat, Asthma, Blood Purifier, Dysentery, Ulcer,
106.	*Tabermontana divericata*	Swastik	Apocynaceae	Tree	Anti-epileptic, Brain Tonic, Anti-oxidant,
107.	*Tecoma stance*	Ghantiphul	Bignoniaceae	Tree	Diabetes, Digestive Problems, Fungal infection, Diuretic, Tonic, Vermifuge
108.	*Teprosia purpuria*	Unhali	Fabaceae	Herb	
109.	*Terminalia catappa*	Ran Badam	Combretaceae	Tree	Anti-diabetic, Wound healing, Anti-inflammatory, Anticancer, Antimicrobial
110.	*Terminalia arjuna*	Arjuna	Combretaceae	Tree	Fracture treatments, Ulcer, Anti-tumor, Antimicrobial, Antioxidants, Anti-fertility, Anti-HIV
111.	*Thespesia grandiflora*	Paras Bhendi	Malvaceae	Shrub	Skin Diseases, Dysentery, Ringworms, Tonic for regulate Blood Pressure
112.	*Tictona grandis*	Sag	Verbenaceae	Tree	Piles, Dysentery, Urinary disorders, Bronchitis, Leucoderma, Cooling, Laxative,
113.	*Tinospora cordifolia*	Gulvel	Menispermaceae	Climber	Fever, Jaundice, Chronic Diarrhea, Bone Fracture, Skin Disease, Poisonous Insect Bite, Snake Bite.
114.	*Tribulus terestris*	Godhadi	Zygophyllaceae	Herb	Kidney Disorders, Painful Urination, Male Sexual Problem, Skin Diseases
115.	*Tricodesma indica*	Ghol	Boraginiaceae	Herb	Swelling, Jaundice, Fever,
116.	*Tridax procumbance*	Ekdandi	Asteraceae	Herb	Jaundice, Apply on Cuts & Wounds,
117.	*Urginea indica*	Rankanda	Lilliaceae	Herb	Cure Dropsy, Regulate heartbeat and Strength to weak Cardiac Muscles, Kidney Disorder, Skin Diseases

118.	*Utricularia reticulata*	Nili Papani	Lentibulariaceae	Herb	Kidney Stone and Urinary Tract Disorders, Promote Weight Loss, To Stimulate Gallbladder Secretion.
119.	*Vernonia cinerea*	Sahadevi	Asteraceae	Herb	Treating Wounds and Earache
120.	*Vitex negundo*	Nirgudi	Verbenaceae	Shrub	Fever, Bodyache,Rheumatism, Ringworm, Wound Healing
121.	*Withania somnifera*	Ashwagandha	Solanaceae	Shrub	Loss Motion, Excess bleeding during Menses, Tuberculosis, Tonic for Immunity
122.	*Woodfordia fruticosa*	Dhayati	Lythraceae	Herb	Jaundice, Snake Bite, Piles.
123.	*Xanthium strumarium*	Landaga	Asteraceae	Shrub	Mouth Ulcer, applyon Boils Wound Healing
124.	*Zizuphus jujubae*	Bor	Rhamnaceae	Tree	Enhance Liver Health, Increases, Skin and Wound Healing Property

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Optimizing Seedling Growth in Fenugreek Using Epsom Salt

T. S. Jagadale
P.G. Department of Botany & Research Centre,
New Arts, Commerce and Science College Ahmednagar, 414001
And
D. D. Ahire
P.G. Department of Botany & Research Centre,
New Arts, Commerce and Science College Ahmednagar, 414001
And
S. B. Palve
P.G. Department of Botany & Research Centre,
New Arts, Commerce and Science College Ahmednagar, 414001

ABSTRACT

Fenugreek (Trigonella foenum-graceum Linn) is annual, forage, dicotyledonous leguminous crop commonly used as a spice and herb. This study explores the impact of magnesium sulphate (Epsom salt) on the germination and early growth of fenugreek seeds. Seeds were treated with five concentrations of magnesium sulphate (22 mM, 45 mM, 90 mM, 180 mM and 270 mM) along with a control group. Key parameters, including electrical conductivity, germination percentage, seed vigor, relative injury rate, mean germination time, germination index, seedling length reduction, and seed moisture content, were carefully observed. Results showed that seeds exhibited increased tolerance and better germination performance up to 90 mM magnesium sulphate, with significant improvements in seed vigor and reduced seedling length reduction. However, higher concentrations led to increased mean germination time and a rise in relative injury rate, especially at concentrations of 180 mM and above. Complete inhibition of seed germination occurred at 270 mM. The study suggests that moderate magnesium sulphate treatment, particularly up to 90 mM, can be beneficial for seed germination and seedling growth in fenugreek, while higher concentrations may be detrimental.

Keywords: Fenugreek, Magnesium sulphate, Seed germination, Seedling growth, Nutrient

Introduction:

Fenugreek (*Trigonella foenum-graceum* Linn.) is a prominent annual herb belonging to the Fabaceae family, which is home to approximately 19,000 species across 750 genera. The name *Trigonella* is derived from Latin, meaning "little triangle," a reference to the plant's characteristic triangular flowers. Native to Southeastern Europe and Western Asia, fenugreek is now widely cultivated in countries including India, Egypt, and various Mediterranean regions. This herb is renowned for its versatility, being used as a spice, herb, and vegetable. Beyond its culinary applications, fenugreek holds significant value in traditional medicine, where it has been employed to manage conditions such as diabetes, gastrointestinal disorders, and inflammatory diseases

(Verma *et al.,* 2024).

The seeds and leaves of fenugreek are particularly valued for their high medicinal and nutritional content. Fenugreek seeds are known to contain a wealth of bioactive compounds, including alkaloids, saponins, flavonoids, and sterols, which contribute to their therapeutic effects (Faisal *et al.,* 2024). These compounds give fenugreek with notable antibacterial, antioxidant, antimicrobial, anti-inflammatory, and hypoglycaemic properties. In Iran, fenugreek leaves are consumed fresh or dried, and the seeds are used in various culinary and medicinal preparations. The plant's high nutritional profile includes essential nutrients such as calcium, phosphorus, carotene, vitamin C, and protein, making it a staple in traditional diets and health practices (Ahmad *et al.,* 2016).

In addition to its medicinal benefits, optimizing fenugreek cultivation is essential for maximizing its growth and productivity. One critical factor influencing plant health is the use of magnesium sulphate, commonly known as Epsom salt. Magnesium plays a vital role in several physiological processes, including photosynthesis, enzyme activation, and protein synthesis. Epsom salt helps to enhance seed germination by strengthening cell walls and improving the absorption of essential nutrients such as nitrogen, phosphorus, and sulphur (Chalker 2018).

The application of magnesium sulphate can significantly impact plant development.When used in combination with compost, Epsom salt has been shown to boost plant productivity by improving soil fertility and supporting various physiological mechanisms. Research has demonstrated that magnesium sulphate affects key parameters such as germination rates, seedling vigor, and overall plant health by providing readily available magnesium ions that facilitate growth and resilience.

Given fenugreek's importance as both a food and medicinal plant, understanding how different concentrations of magnesium sulphate influence its growth can offer valuable insights. This study aims to investigate the effects of varying levels of magnesium sulphate on fenugreek seed germination and seedling development. By exploring these effects, the study seeks to optimize cultivation practices and enhance the plant's growth potential, ultimately contributing to more effective and sustainable use of this valuable herb.

Research specifically focusing on fenugreek has provided valuable insights into the effects of magnesium sulphate. Hooda & Jood (2007) found that fenugreek seeds treated with magnesium sulphate up to 90 mM showed improved germination rates and seedling growth, whereas higher concentrations resulted in reduced germination and increased seedling injury.Similarly, Shuai *et al.,* (2023) reported that magnesium sulphate positively impacted crop yield and quality under various stress conditions by enhancing nutrient uptake and stress tolerance.

Material and methods:

The pilot experiment was conducted earlier to select Epsom salt concentration for the further research.The following Epsom Salt (Magnesium Sulphate) treatmentswere used: 22mM, 45mM, 90mM, 180mM and 270mM.

Plant material- Seeds of Fenugreek (Variety: *Rajendra Kanti*) were got from a "Navsanjeevani Seed Company" from Pune, Maharashtra.

Methods:

Seeds were soaked in different concentrations of Epsom salt to investigate its effect on fenugreek seed germination. Seeds were soaked in various concentrations of Epsom salt (20 to 270 mM) along with a control for 24 hours. The Petri plate method was used for seed germination. Soaked seeds were spread on blotting paper, which was moistened with the respective concentrations of Epsom salt solution, and then allowed to grow for 7 days.The numbers of germinated seeds was observed and counted daily up to 7 days. Germination percentage, germination index, seed vigor, fresh weight, and dry weight were studied.Statistical analysis was conducted using Microsoft Excel to calculate standard deviation.

Parameters studied:

Germination Indices: During its early stage, which is up to **07 days**, seedling development was studied.

a) Germination Percentage (GP): Bewley and Black (2012).

$$\textit{Germination (\%)} = \frac{\textit{Number of germinated seeds}}{\textit{Total number of seeds}} \times 100$$

b) Germination Index (GI): Li (2008).

$$GI = \sum Gt / Dt$$

Where, Gt is the number of the germinated seed on day t and Dt is time corresponding to Gt in days.

c) Relative Injury Rate (RIR): Li (2008).

$$RIR = \frac{\textit{Germination (\%) in control - Germination (\%) in salt treated seeds}}{\textit{Germination (\%) in control}}$$

d) *Seed vigor:* Abdul-Baki and Anderson (1973).

$$\textit{Seed Vigor} = \frac{\textit{(Length of hypocotyl + length of radical)} \times \textit{Germination (\%)}}{100}$$

e) *Mean germination time (MGT):* Ellis and Roberts (1981).

$$\mathbf{MGT} = \sum (n \times d) / N$$

Where n is number of seeds germinated on each day, d = number of days from the beginning of the test, and N is total number of seeds germinated at the termination of the experiment.

f) *Salt tolerance (ST):* Tsegay and Gebreslassie (2014).

$$ST = \frac{\text{Seedling dry weight of salt treatment}}{\text{Seedling dry weight in control}} \times 100$$

g) Seedling Height Reduction (SHR): Islam & Karim (2010).

$$SHR = \frac{\text{Seedling height at control - Seedling height at saline condition}}{\text{Seedling height at control}}$$

h) Fresh weight and dry weight: On the day of harvest, the fresh weight of seedlings for each treatment was recorded. Later, seedlings were dried at 78°C for 48 hours to record dry weight.

Result and discussion:

The results of this study elucidate the effects of Epsom salt (magnesium sulphate) on fenugreek seed germination and early seedling growth.

Magnesium is a crucial element for plant health, integral to processes such as photosynthesis, enzyme activation, and nucleic acid synthesis (Marschner, 2012). As the central component of chlorophyll, magnesium facilitates the absorption of light energy, which drives photosynthesis (Ishfaq*et al.,* 2022). Magnesium deficiencies can lead to symptoms such as chlorosis, reduced growth, and impaired nutrient uptake (Marschner, 2012). Adequate magnesium levels are essential for maintaining optimal plant function and productivity (Ahmed, 2023).

Magnesium sulphate has been shown to positively affect seed germination and seedling development. Moderate applications can enhance these processes by improving nutrient availability and cellular structure. The moderate concentrations of magnesium sulphate (up to 90 mM) significantly enhanced seed germination and seedling vigor. The study attributed these improvements to better nutrient uptake and improved cell wall integrity (Kailiu *et al.,* 2021).
Conversely, high concentrations of magnesium sulphate can have detrimental effects. Elevated levels have been linked to reduced germination rates and delayed seedling emergence (Abid *et al*., 2008). This is because excessive magnesium can lead to nutrient imbalances and osmotic stress, negatively impacting seedling growth and development.

The data reveal a clear relationship between Epsom salt concentration and fenugreek seed germination. Lower concentrations (0.4 mM to 8.0 mM) consistently yield high germination percentages, reaching up to 100% in several cases. This indicates that these concentrations are optimal for enhancing seed germination, which is consistent with findings that moderate magnesium sulphate levels can stimulate seed growth and improve germination rates (Gerendas and Fuhrs 2021). Conversely, at higher concentrations (e.g., 180 mM and above), the germination percentage declines, with complete inhibition observed at 270 mM. This decline is likely due to increased osmotic pressure and ion toxicity, which impair seed germination and development (Tavakkoli *et al*., 2024).

The influence of magnesium sulphate extends to broader aspects of plant stress tolerance and nutrient management. Magnesium facilitates the uptake and utilization of other essential nutrients, such as nitrogen and phosphorus, which are crucial for plant growth (Rengel, 2007). This interaction underscores the importance of balanced nutrient applications for optimal plant performance.

Recent studies have explored magnesium sulphate's role in enhancing plant resilience under stress conditions. Santos *et al*. (2023) found that magnesium sulphate application improved drought resistance and overall plant resilience in fenugreek. Bardees *et al*. (2019) also noted improved fenugreek growth and yield under saline conditions with magnesium sulphate application. Additional research highlights the role of magnesium sulphate in diverse environmental contexts. Wang *et al*. (2020) reported that magnesium sulphate improved fenugreek growth and yield under low soil fertility conditions. The further demonstrated that magnesium sulphate enhanced growth and yield in fenugreek under both normal and stressed conditions, including drought and salinity.

Electrical Conductivity:

The increase in electrical conductivity (EC) with higher Epsom salt concentrations reflects a rise in ionic stress. At 270 mM, EC exceeds 20.0, suggesting severe osmotic stress. High EC values are known to negatively affect seed germination by creating a hypertonic environment that hinders water absorption and seedling development (Munns & Tester, 2008). This observation aligns with previous studies showing that elevated EC levels can impair seed germination and early growth stages (Zelm *et al*., 2020).

Table 1.2: Electrical Conductivity of Each Epsom Salt Treatment.

Epsom Salt Concentrations (mM)	Electrical Conductivity
Control	0.45
22	3.64
45	6.3
90	10.27
180	17.25
270	> 20.0

Germination Index and Relative Injury Rate:

The germination index (GI), reflecting the speed of germination, was highest in the control and lower Epsom salt concentrations (22 mM and 45 mM). However, at higher concentrations (90 mM and above), the GI decreased significantly, indicating delayed germination. This delay is attributed to increased osmotic stress and ion toxicity at higher Epsom salt concentrations, consistent with findings by Li (2008) and Ellis and Roberts (1981). The relative injury rate (RIR) also increased at higher concentrations, with a marked rise at 180 mM and complete inhibition at 270 mM, corroborating the notion that excessive Epsom salt causes significant seed stress (Munns & Tester, 2008).

Table 1.3: Effect of Epsom Salt on Germination Index, Relative Injury Rate, Seed vigor and Mean Germination Time in fenugreek.

Epsom Salt Concentration (mM)	Mean Germination (%)	Germination Index	Relative Injury Rate	Seed Vigor
Control	100 ± 0.0	96 ± 8.8	0.0 ± 0.0	9.0 ± 1.1
22	100 ± 0.0	89 ± 2.8	0.0 ± 0.0	7.4 ± 2.2
45	100 ± 0.0	87 ± 2.1#	0.0 ± 0.0	2.5 ± 0.9
90	100 ± 0.0	64 ± 2.3#	0.0 ± 0.0	2.2 ± 0.4
180	32 ± 9.2#	08 ± 2.2#	68.0 ± 9.8*	0.3 ± 0.5
270	0.0 ± 0.0#	-	100.0 ± 0.0*	-

*Significantly higher than control at probabilities of 0.05. # Significantly lower than control at probabilities of 0.05
*Values given in mean ± S.D

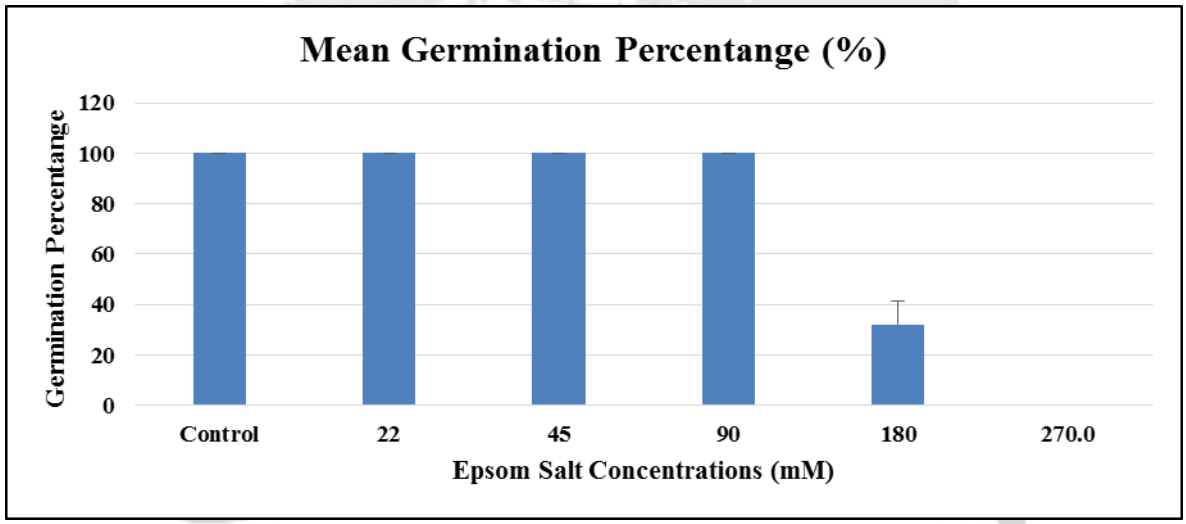

Fig. 1.1: Effect of Epsom Salt on Germination Percentage.

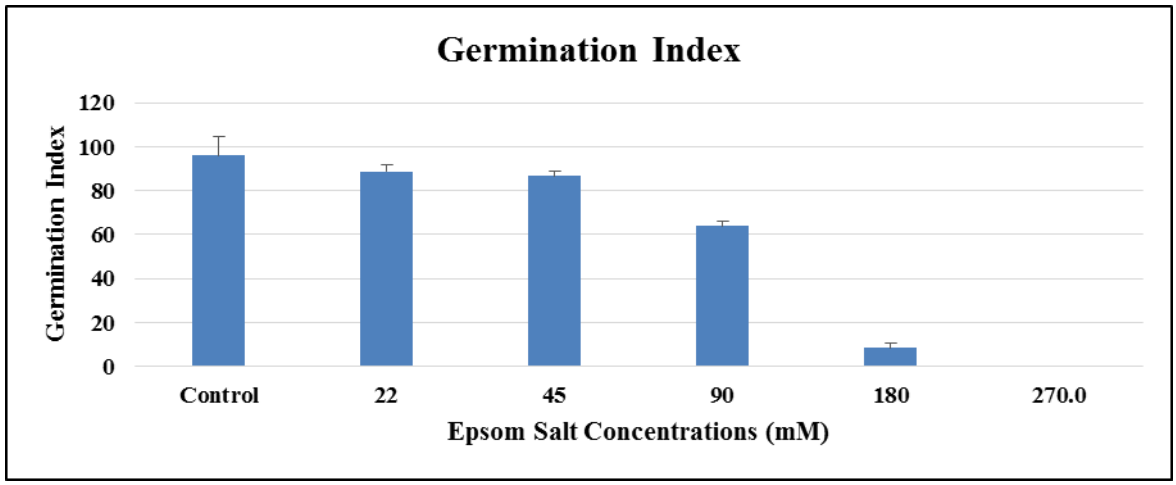

Fig. 1.2: Effect of Epsom Salt on Germination Index.

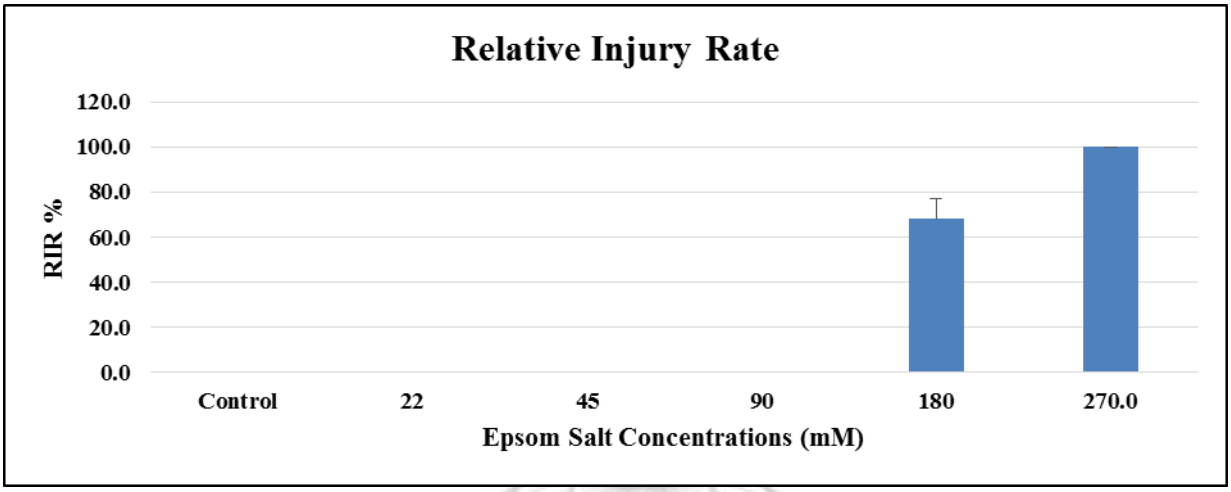

Fig. 1.3: Effect of Epsom Salt on Relative Injury Rate.

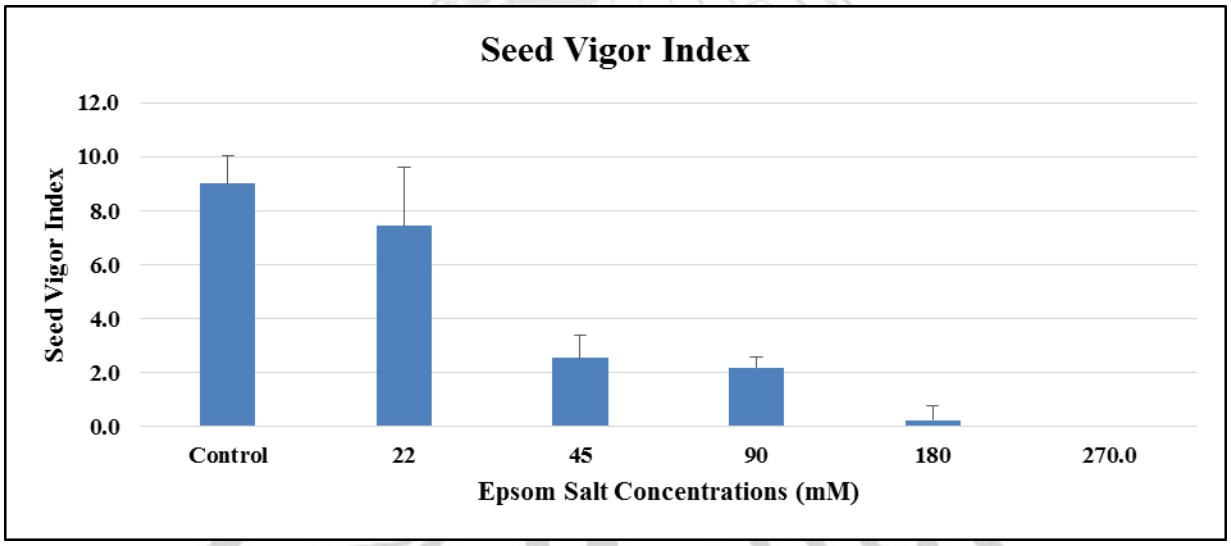

Fig. 1.4: Effect of Epsom Salt on Seed Vigor Index.

Seed Vigor and Mean Germination Time:

Seed vigorwhich integrates seedling growth and overall health, was highest at lower concentrations (control and 22 mM) and decreased with increasing Epsom salt concentrations. This decline is indicative of the stress imposed by higher salt levels, which adversely affect seedling vigor (Islam & Karim, 2010). Mean germination time (MGT) was shortest at 180 mM, suggesting that this concentration may offer a balance between promoting germination and minimizing stress. However, higher concentrations delayed germination, reinforcing theneed for optimal salt concentration to avoid growth inhibition (Tsegay & Gebreslassie, 2014; Siddiqui *et al.,* 2016).

Seedling Height Reduction and Salt Tolerance:

Seedling height reduction was most pronounced at 180 mM Epsom salt, with a complete inhibition of growth at 270 mM. This reduction highlights the detrimental effects of high Epsom salt concentrations on seedling growth, likely due to osmotic stress and ion toxicity (Raza *et al.,* 2019). The observed trend in salt tolerance, with reduced seedling height and increased mean germination time at higher concentrations, underscores the importance of maintaining appropriate

Epsom salt levels to balance growth benefits and potential stress effects (Marschner, 2011; Khan *et al.,* 2014).

Table 1.4: Effect of Epsom Salt onSalt Tolerance (%), Height Reduction (cm), Fresh weight (gms), Dry weight (gms) in fenugreek.

Epsom Salt Concentration (mM)	Mean Germination Time (Days)	Height Reduction (%)	Seedling Height (cm)	Seed Moisture (%)
Control	4.32 ± 0.09	0.0 ± 1.1	9.01 ± 1.05	6%
22	4.39 ± 0.03	17.5 ± 2.2	7.43 ± 2.18	
45	4.42 ± 0.04	71.8 ± 0.9	2.54 ± 0.85	
90	4.74 ± 0.04*	75.7 ± 0.4	2.19 ± 0.39	
180	5.78 ± 0.06*	91.3 ± 0.5*	0.78 ± 0.51	
270	-	-	-	

*Significantly higher than control at probabilities of 0.05. # Significantly lower than control at probabilities of 0.05
*Values given in mean ± S.D

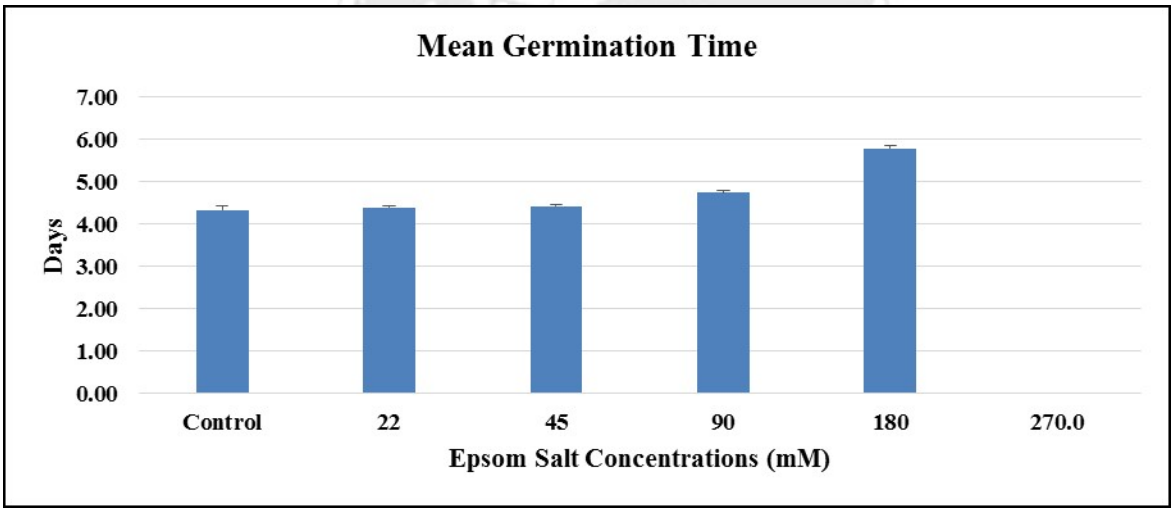

Fig. 1.5: Effect of Epsom Salt on Mean Germination Time (Days).

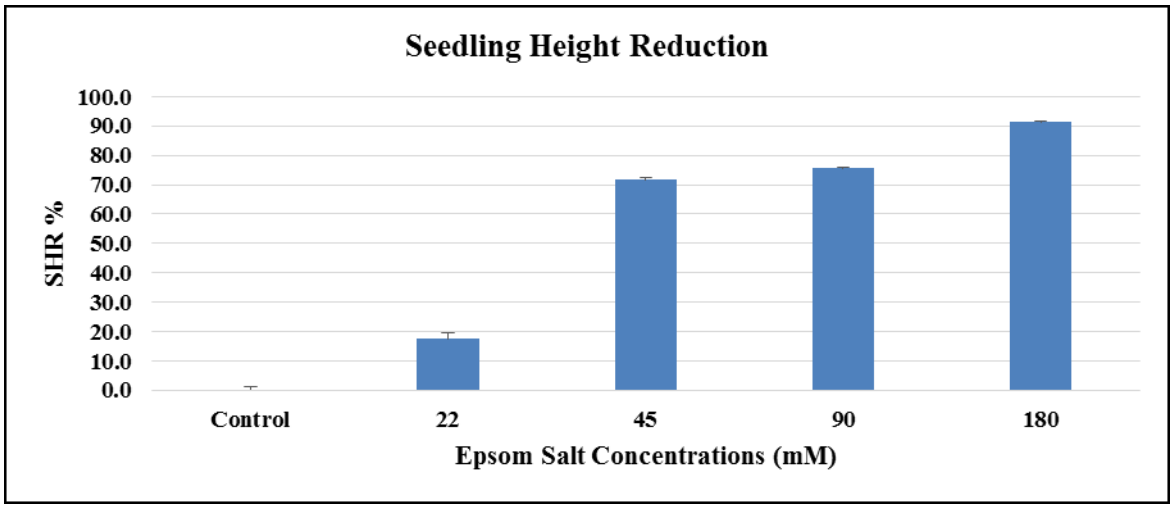

Fig. 1.5: Effect of Epsom Salt onSeedling Height Reduction.

Conclusion:

Based on the study, Epsom salt treatment significantly affects fenugreek seed germination and seedling growth. Lower concentrations of Epsom salt (up to 90 mM) positively influence germination percentages, germination index, seed vigor, and reduce mean germination time, making it an effective method for enhancing seedling establishment. However, higher concentrations lead to increased osmotic stress and reduced germination and seedling vigor, with total inhibition observed at 270 mM. Therefore, Epsom salt concentrations below 180 mM are recommended to optimize germination and growth while minimizing adverse effects. These findings suggest that controlled Epsom salt application can improve fenugreek cultivation by speeding up germination and supporting early seedling development.

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Some important wild medicinal plants from Shegaon tehsil of Buldhana district

K. B. Theng
Arts & Commerce College Warwat Bakal, Dist. Buldhana.
And
A. N. Korpenwar
Rajiv Science and Commerce College Zari Jamni, Dist. Yavatmal.

ABSTRACT

The present investigation is carried out on some important wild medicinal plants from Shegaon region of Buldhana district. The study was conducted during June 2022 to December 2023 and it focused on medicinal plants and their uses. A total 40 plants belong to 30 different families were documented from study area. Out of 40 listed plants, most dominant families found highest for Fabaceae, Moraceae, Verbenaceae, Asclepidaceae, Caesalpinaceae and Combretaceae, etc.

Local people and traditional healers used various plant parts mostly leave, roots, flower and fruits in health care practices. Documentation of wild medicinal plants helps to conserve traditional knowledge and future generation also access information regarding plant resources in healthcare practices. Study revealed that all documented plants are effective against various diseases. Therefore, present study focuses on the medicinal properties and documentation of wild medicinal plants for the greater benefits of mankind.

Keywords: Wild, Medicinal, Shegaon, Traditional system, Buldhana.

Introduction:

Floral diversity has a critical role in the survival of life on the earth. Large scale population of India depends on plants for primary healthcare practices. Knowledge of native traditional practitioners and local experts, their beliefs, skill and cultural practice has important role in using medicinal plants in herbal medicine and folk remedies for human health. Various system of medicine such as Ayurveda, Unani, Allopathy, and Homeopathy utilized plants and plants part as a medicine (Kumar *et al*., 2015).

Medicinal plant helps to provide health security to rural people throughout the world. Nearabout 70% population of developing country depends on plants medicine for primary healthcare (Jeelani *et al*., 2018). Asian medicinal plants contribute about 50% of total export quantity and 45% of world profits from traditional medicine. Asian countries including India, China, Nepal, Myanmar, Bangladesh, Pakistan and Indonesia start to cultivate and extract medicinal plants for healthcare purpose (Rashid *et al*., 2014).Tropical and subtropical regions consist of most of the wild medicinal plant of world. Traditionaland modern systems of medicine used near about 50,000 species of plant in different part of the world (Jain, 1991).

In India 65% population depends on traditional system of medicine and there are around

eight thousand manufacturing units of traditional system of medicine supporting rural people as a source of income (Astutik *et al*., 2019). Tribal communities collect locally available wild as well as cultivated plant species from different part of country and used to treat different diseases.

Millions of rural people in India used medicinal plants in healthcare practices (Anonymous, 2019). In India, traditional medicines are used for cultural, historical and ecological purpose (Kunwar *et al*., 2010).Utilization of plants for medicinal purpose continue to increase eveninadequate information is available about it trends (Ramawat *et al*., 2008).

Materials and methods:

Present study was conducted in Shegaon tahsil of Buldhana district, Maharashtra. Geographical location of Shegaon is represented by coordinates as $20^0$47'40" N- $76^0$41'40" E. The subsequent field visits were organised in study area during June 2022 to December 2023. The data collection was done by interviewing personal interview, questionnaire and group discussion with local people and traditional healers.

Plants specimens were collected in proper vegetative and blooming periods. Identification of Plants was confirmed with the help of relevant scientific literature (Singh and Karthikeyan, 2000; Naik, 1998 and Diwakar and Sharma, 2000). The plant specimens were brought to laboratory and processed for herbarium preparation. The voucher specimens were deposited in department of Botany, Arts and Commerce College Warwat Bakal, Dist. Buldhana (M.S.).

Resultand Discussion:

Present study documented different vegetations from study sites. A total 40 plant species belong to 30 different families were recorded from study area (Table no. 1). Most of the species belongs to Fabaceae (4), Moraceae (3), 2 species belong to Verbenaceae, Asclepidaceae, Caesalpinaceae and Combretaceae while remaining families such as Amaranthaceae, Rutaceae, Papaveraceae, Mimosaceae, Acanthaceae, Aristolochiaceae, Bombacaceae, Balanitaceae, Capparaceae, Umbeliferaceae, Araceae, Boraginaceae, Bignoniaceae, Dioscoreaceae, Convolvulaceae, Myrtaceae, Sterculiaceae, Lamiaceae, Sapotaceae, Euphorbiaceae, Santalaceae, Anacardiaceae, Monispermaceae and Asteraceae including one species each.

Tribal and rural people of study area depend on plant-based drug for their healthcare practices. They utilised different parts of plant such as leaves, roots, fruits, flowers in different ailments and disorders. Ethnomedicinal information obtained from tribal people, traditional healers and forest dwellers is used for the standardization of crude drugs. Patil *et al*, (2011) reported that people of Buldhana district have rich heritage of knowledge of medicinal plants. He also revealed the necessity of further study for development of new drugs in future.

The recorded medicinal plants used to treat different ailments includingdysentery, skin diseases, cough, indigestion,diarrhea, fever, headache,burn injuries,snake bites, wound healing, worms, stomach pain, cold, constipation, urinary problems, ear ache, backaches, muscular and joint pain, rheumatism, diabetes, leucorrhea, asthma and ulcer. Korpenwar, (2007) reported that tribal communities commonly used medicinal plants. He noticed the importance of documentation

of such plants for understanding indigenous knowledge system.

Table: 1 List of medicinal plants from Shegaon tehasil of Buldhana district (M.S.)

Sr. No.	Botanical Name	Local Name	Family	Medicinal Uses
1.	*Achyranthes aspera* L.	Aghada	Amaranthaceae	Indigestion, dysentery, skin diseases, cough.
2.	*Aegle marmelos* Corr.	Bel	Rutaceae	To treat Fever, dysentery, blood sugar control, Control of high blood pressure.
3.	*Argemone Mexicana* L.	Pivladhotra	Papaveraceae	To treat jaundice, itching problems, skin diseases.
4.	*Acacia nilotica* L.	Babhul	Mimosaceae	To treat diarrhea, fever, headache, joints problem, burn injuries.
5.	*Andrographis paniculata* Burm. f.	Kalmegh	Acanthaceae	To treat fever, inflammation, skin problems, snake bites.
6.	*Aristolochia bracteolate* Lamk.	Gindiyan	Aristolochiaceae	Wound healing, Tonic for immunity system.
7.	*Butea monosperma* Lamk.	Palas	Fabaceae	Stomach ache, skin ailments, piles, diarrhea, and dysentery.
8.	*Bombax ceiba* L.	Kate sawar	Bombacaceae	Wound healing, constipation, urinary problems. Stimulant, antidysentric.
9.	*Balanites aegyptica* L.	Hinganbet	Balanitaceae	To treat worms, stomach pain, cold.
10.	*Barleria prinotis* L.	Katekoranti	Acanthaceae	Joints pain, bleeding gum, swelling.
11.	*Bauhinia racemosa* Lamk.	Apta	Fabaceae	It has anti-inflammatory, analgesic, antimicrobial activity. Used to treat asthma, malaria, heachache, fever.

12.	*Clerodendrum serratum* Spreng.	Bharangi	Verbenaceae	To treat cough, cold, fever, inflammation, pain.
13.	*Calotropis procera* Ait.	Rui	Asclepiadaceae	To treat skin disease, ear ache, stomach ache, backaches, muscular and joint pain.
14.	*Clitoria ternatea* L.	Gokarna	Fabaceae	It has anti-inflammatory, antioxidant, sedative properties. Used in liver and indigestion problem.
15.	*Crateva adansonii* DC	Varun	Capparaceae	To treat old wound healing, asthma, snakebite.
16.	*Centella asiatica* L.	mandukparni	Umbeliferaceae	Wound healing, burn, brain tonic.
17.	*Colocasia esculanta* Schott.	Alu	Araceae	Immunity enhancer, treat swelling and pain, diarrhea.
18.	*Ceropegia bulbosa* Roxb.	Gayala	Asclepiadaceae	To treat stomach-aches, ulcer, indigestion.
19.	*Cordia dichotoma* Forst.	Bhokar, Gondani	Boraginaceae	Stomach pain, fever, diarrhea, headache.
20.	*Dolichandrone falcate* Wall. ex. DC.	Medshing	Bignoniaceae	It has anti-allergic, anti-cancer, anti-inflammatory, antiviral and anti-fungal property. Used in fractures and diabetes.
21.	*Dioscorea bulbifera* L.	Dukarkand	Dioscoreaceae	To treat sore throat, dysentery, diabetes, piles, skin diseases, leprosy.
22.	*Evolvulus alsinoides* L.	Shankhavel	Convolvulaceae	Asthma, pile treatment, brain tonic.
23.	*Eugenia jambolana* L.	Jambhul	Myrtaceae	Diabetes, constipation, stomach-aches.

24.	*Ficus religiosa* L.	Pimpal	Moraceae	Toothache, vomiting, wound healing and skin problems.
25.	*Ficus glomerata* Roxb.	Umbar	Moraceae	wound healing, swelling, asthma, dysentery.
26.	*Ficus benghalensis* L.	Vad	Moraceae	To treat rheumatism, diabetes, cough, skin disorders.
27.	*Helicteres isora* L.	Muradsheng	Sterculiaceae	To treat diarrhoea, wound healing, constipation in new born babies.
28.	*Hardwickia binata Roxb.*	Anjan	Caesalpiniaceae	Headache, leucorrhea, indigestion.
29.	*Leucus aspera* Willd.	Bahuphul	Lamiaceae	Used to treat asthma, cold and cough, fever.
30.	*Madhuca longfolia* Koen.	Moha	Sapotaceae	To treat diabetes, headache, skin disease, Increase milk production in lactating women.
31.	*Mucuna pruriens* L.	Khaj-khuiri	Fabaceae	To treat constipation, inflammation, cough, pain.
32.	*Ricinus communis* Linn.	Erand	Euphorbiaceae	To treat diarrhea, dysentery, fever, headache, antidiabetic.
33.	*Santalum album* L.	Chandan	Santalaceae	To treat common cold, relief stress, skin infections, chest pain.
34.	*Semecarpus anacardium* L.	Biba	Anacardiaceae	It has antibacterial, antioxidant, anti-inflammatory properties, memory enhancer.
35.	*Tamarindus indica* L.	Chinch	Caesalpinaceae	To treat wound healing, dysentery, stomach-ache, inflammation.

36.	*Tinospora cordifolia* Willd.	Gulvel	Menispermaceae	To treat bacterial and fungal infection, diabetes, fever.
37.	*Tectona grandis* L.	Sag	Verbenaceae	Used to treat skin infection, urinary problems.
38.	*Terminalia arjuna* Roxb.	Arjun	Combretaceae	To treat asthma, heart diseases. It has antioxidant, antimicrobial properties also.
39.	*Terminalia belerica* Gaertn.	Behda	Combretaceae	To treat diabetes,cough, throat infection. Used as immunity booster.
40.	*Xanthium strumarium* L.	Gohkru	Asteraceae	To get relief in toothache, ear infection, headache, diarrhea.

Conclusion:

Present study reported that ethnomedicinal plants are utilised in healthcare practices by the local people. Scientific and authenticate validation of traditional knowledge is necessary for safety use in herbal practices. Documentation of traditional knowledge and conservation of wild medicinal plants is very essential. Study also suggests further investigation for screening of crude drugs for their chemical composition and activities.

Acknowledgement:

Authors are grateful to local people, traditional healers and folk medicine practitioners from Shegaon regions for sharing their detail valuable knowledge and cooperation during data collection of wild medicinal plants.

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Investigation of Aerospora and Its Impact on Indoor Environment of Nagbhid.

Dr. Aruna N. Shende
D. K. Mahila Mahavidyalaya, Kurkheda, Gadchiroli.
And
Dr. A. N. Korpenwar
Rajiv vidyan Va Vanijya Mahavidyalaya, Zari-Jamni, Yavtmal.
And
Dr. R. R. Dahegaonkar
Dr. Ambedkar College of Arts, Commerce & Science, Chadrapur.

ABSTRACT:

Aerobiology has great concern about the presence of allergens in the atmospheric dust. Environmental air pollution is caused due to road dust and other half due to aerospora including fungal spore, pollen grains, dust mites etc. The present study on investigation of aerospora in the indoor environment of Nagbhid region. Air sampling was carried out by using Volumetric Tilak Air Sampler during two consecutive years 2016 to 2018. Sixty-nine types of fungal spores belonging to class Phycomycotina, Ascomycotina, Basideomycotina, Deuteromycotina and six other types including pollen grains, cellulose fiber, epidermal hairs, algal filament, insect wings/ scales, mites have been revealed. Fungal spores i.e. Aspergillus sp. (42.3%), Cladosporium (40.9%), Nigrospora (11.52%) to be dominant followed by Alternaria (9.32%), Heterosporium (5.31%), Hypoxylon (3.2%) to be less have been recorded in the air of poultry farm which increase mortality rate in poultry birds by causing allergy, nasobronchial diseases. In intramural environment of library, Chaetomium (9.04%) play a vital role in deterioration of valuable literature, books, novels and journals. Fungal spores released in indoor environment & become pollutant and allergens. Similarly, indoor air monitoring for human & animal health, bio-deterioration of ancient literatures and cultural heritage and their protection has been carried out. It has great scope further. Hence this study has been selected for the public awareness, recognition of health hazards due to aerobiological aerospora and their management for health conservation.

Keywords: - Aerospora, Intramural environment, Allergy, Biodeterioration, Mites.

Introduction:

Aerobiology is a scientific and multidisciplinary approach focusing on the source, release, up-lift, transport, deposition and impact of organisms and biologically significant materials which affect plants, animals and human beings (Tilak, 1987). The airborne fungal spores are adapted to transfer by means of air in greater extents comparatively to any other biological components which are transferred by wind such as pollen, insect, bacteria etc. Dust particles including variety of

microorganisms i.e. fungi producing spores, pollen grains get airborne are called Aeromicrobiota or aerospora. Aerospora implicating with changing environment and lifestyle act as significant cause of allergy. With the alarming increase in allergic disorders, such as allergic rhinitis, bronchial asthma and atopic dermatitis covering as high as 30% of the population world over, there is an increasing interest in the study of incidence, concentration and movements of bioparticulate matter in the earth atmosphere and their impact on human health. Air monitoring for knowing the diversity, abundance and variation of airborne mycoflora according to seasonal changes. The continuous air sampling is needed and estimation of qualitative and quantitative of aerospora.

Material and Methods: -

- The 'Volumetric Tilak air sampler' (Tilak and Kulkarni, 1970) is an electrically operated device was fixed in the various indoor environment of Nagbhid.
- The air sampler installed at height of 1.5 meter from ground level and runs continuously for the period of two consecutive academic years from June 2016 to May 2018.
- The glycerine jelly mounted 14 slides were prepared from Vaseline coated cello tape on drum by impingement process, cello tape removed from rotating drum of the sampler at the end of 7th day respectively.
- The mounted slides were scanned by using binocular research microscope and microphotographs were captured by using micro-camera which directly attached to the microscope.
- The Spores per cubic meter were calculated by the following formula: Spores/m3 = No. of same type of spore X 14 (Where 14 is the conversion factor for Tilak Air Sampler).

Results and Discussion:

Sixty-nine spore types belonging to class Phycomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina and other types have been encountered. 62 Fungal spores were identified and others were separated from fungal spore which includes Cellulose fibers, epidermal hairs, hyphal fragments, Insect parts, Pollen grains, airborne mites and some unidentified spores. A clear variation was seen among the fungal spores with respect to changing environmental conditions. Some spores were observed throughout the half year like *Aspergillus, Alternaria, Ascospores, Basidiospores, Bitrimonospora, Bispora, Cladosporium Curvularia, Cheatomium, Didymosporium, Diplodia, Ganoderma, Helminthosporium, Hytridium, Haplosporella,* and Smut spores. Twenty-one types of ascospores have been observed from which some ascospores are found only in rainy months and they provide specialize information as a bioindicator for rain fall. In July month rain fall is about 164mm in this particular month spore count Ascomycotina (21588spores/m3) to be highest followed by August (21350spores/m3), September (20763spores/m3), November (19521spores/m3) and lowest at late summer i.e. in June month (16324spores/m3) respectively. The study was also carried out to find out cause of biodeterioration of stacked books, newspapers, journals, periodicals, paper materials and wooden book racks, due to airborne microbes, which cause health hazards among the students, readers, workers and book

handlers due to inhalation of airborne microbes from the book materials. In present study *Aspergillus sp. (*42.09%), *Cladosporium* (40.55%), *smut spores* (3.76%) were dominant. According to Takahashi (1997), Sen and Asan (2001) and El-Morsy (2006) *Cladosporium* spores dominate theaerospora in hot climates.

These results coincide with our findings. According to Shaheen (1992) the abundance of *Cladosporium* throughout the year may be attributed to the structural features of the spores such as small size, thin exine and smooth wall which favour and facilitated the transport of aerospora.

Fig. 1: Class wise Percentage contribution of aerospora to the total aerospora during study period

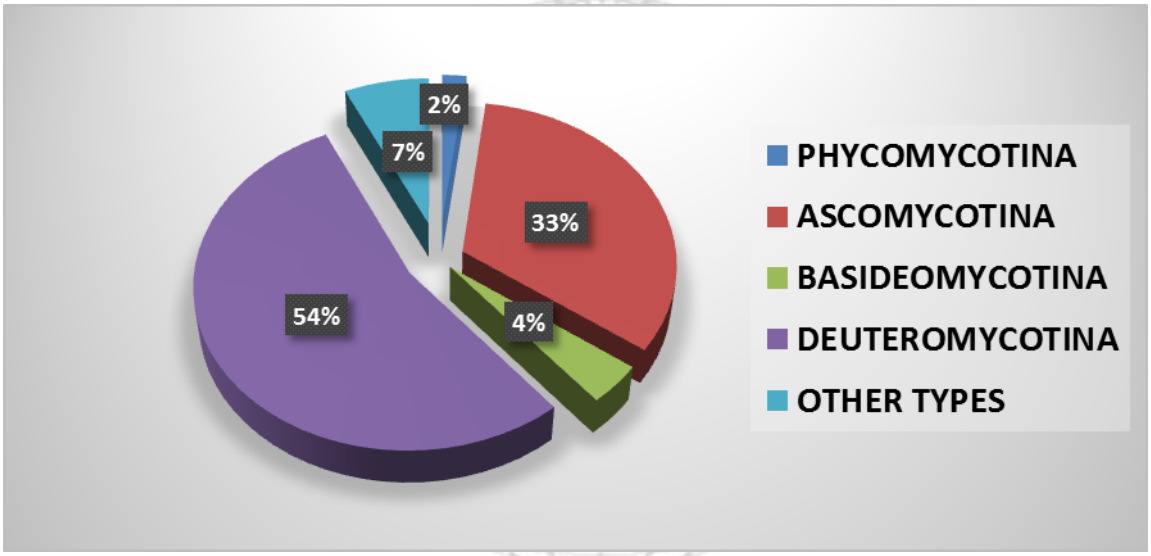
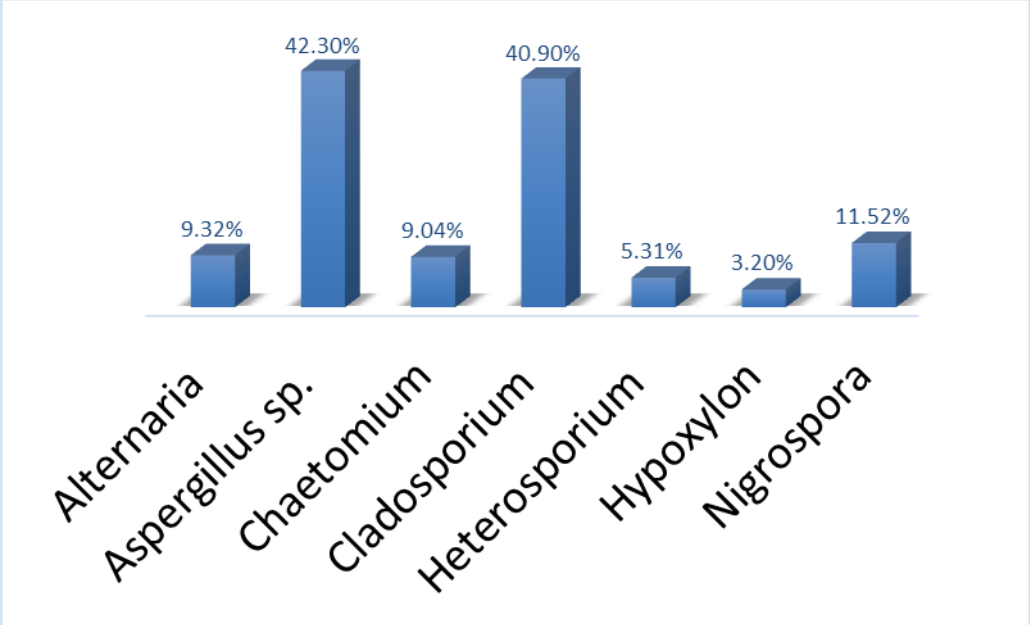


Fig2: Percentage contribution of some dominant aerospora to the total aerospora during study period

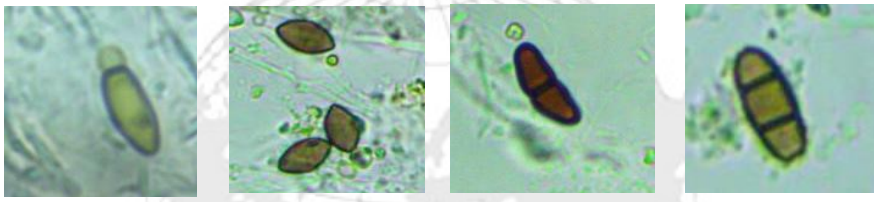


Conclusion:

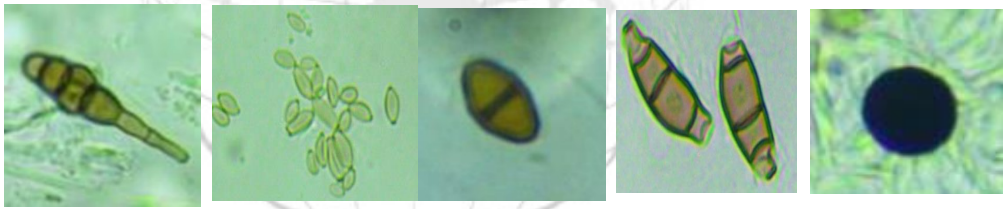
Findings revealed 69 types of aerobiocomponents causing biodeterioration of library materials as evidenced by damaged valuable ancient literature major biodeteriogens recorded are *Cladosporium, Aspergillus, Chaetomium, Alternaria, curvularia etc.* The visitors have been found suffering from various health disorders like itching, sneezing, cough, fever etc. due to these airborne microbes leading to allergic manifestations.

Hence, this work is significant for protection of valuable ancient literature, management of biodeteriogens and health conservation of visitors.

Table 1: Microphotographs of some airborne fungal spores obtained during study period from two consecutive academic years. (From June 2016 to May 2018)



Ascomycotina:-A-*Apioryncostoma,* B-*Cheatomium,*C-*Didymospheria,* D- *Hystidium,*



Deuteromycotina:-G- *Alternaria,* H- *Cladosporium,* I- *Cordana,* J- *Curvularia, ,* L- *Nigrospora.*

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Plants and Kingdoms of Life with Emphasis on Taxonomy and Systematics

S. W. Dighe
Shri Pundlik Maharaj Mahavidyalaya, Nandura Rly, Dist. Buldana

ABSTRACT

Basic components of systematics various systematic activities are directed towards the singular goal of constructing an ideal system of classification that necessitates the procedures of identification, description, nomenclature and constructing affinities. This enables a better management of information to be utilized by different workers, investigating different aspects, structure and functioning of different species of plant. Identification or determination is recognizing an unknown specimen with an already plants, taxonomy and systematics 9 known taxon, and assigning a correct rank and position in an extant classification. In practice, it involves finding a name for an unknown specimen. This may be achieved by visiting a herbarium and comparing unknown specimen with duly identified specimens stored in the herbarium. Alternately, the specimen may also be sent to an expert in the field who can help in the identification. Identification can also be achieved using various types of literature such as Floras, Monographs or Manuals and making use of identification keys provided in these sources of literature. After the unknown specimen has been provisionally identified with the help of a key, the identification can be further confirmed by comparison with the detailed description of the taxon provided in the literature source. A method that is becoming popular over the recent years involves taking a photograph of the plant and its parts, uploading this picture on the website and informing the members of appropriate electronic lists or Newsgroups, who can see the photograph at the website and send their comments to the enquirer. Members of the fraternity could thus help each other in identification in a much efficient manner.

Keywords: Taxonomy, Nomenclature, Identification, Classification, systematic position

Introduction:

The basis of contemporary taxonomy is the similarity of organisms, which reflects descent from a recent common ancestor. As a result, two plants are taxonomically related if they share characteristics like the ability to store carbohydrates in a specific sort of molecule.

Plant taxonomy can be defined as the branch of botany which deals with characterisation, identification, classification and nomenclature of plants based on their similarities and differences.

Objectives for plant taxonomy are:

1. **Identification:** identify the unknown species based on its characteristics and by comparing with already existing species. Identification is the process of recognising an organism's essential characteristics.
2. **Characterisation:** to describe all the characteristics of the newly identified species
3. **Classification:** placing and arranging the known species into different groups or taxa according to similarities and dissimilarities

4. **Nomenclature:** giving the scientific name according to the convention

Methods to know Taxonomy and Systematics:

The word systematics comes from the word '*systema*', meaning the systematic arrangement of the organisms. It takes into consideration the evolutionary relationship of the organisms. Plant systematics deals with interrelation between plants and their evolutionary descent. Systematics studies biological diversity and organises the information into a classification.

Organisms are classified on the basis of similarities, closeness or relationship between them. It shows the phylogenetic taxonomy relationship between different organisms and shows their line of descent. The similarities among individuals show that they might have developed from the common ancestor. It shows the evolutionary pathway of modern living organisms. Closely related organisms are included in a group, which share a common gene pool.

Organisms are categorized into different taxonomic categories according to the similarities and specific features. The different taxonomic categories in their hierarchical order are:

- Kingdom
- Phylum
- Class
- Order
- Family
- Genus
- Species

The number of common characteristics decreases as we move from species to the kingdom, where species having fundamental similarities and organisms in the same kingdom having least common features.

List of Systems of Plant Taxonomy

The earliest system of classification considered only a few vegetative characters. Modern taxonomic studies have been more elaborate and taken into consideration various morphological, cellular and molecular characteristics, e.g. cellular and reproductive features, mode of nutrition, habitat, evolutionary relationships, etc. along with morphological features.

There are three main types of systems for plant classification. Here is the list of systems of plant taxonomy:

1. Artificial system of Classification
2. Natural system of Classification
3. Phylogenetic system of Classification

1. Artificial systems: Artificial systems were the earliest systems, which attempted to classify organisms based on a few superficial characters.

These were important in the history of biological classification as this was a novel attempt to organise living organisms. The demerit was that it didn't consider morphological details and the evolutionary relationship. They gave equal importance to vegetative and sexual characters but it is

not true. Vegetative characters are greatly influenced by the environment. As a result, the closely related species were kept apart.

Aristotle classified plants more than 2000 years ago on the basis of simple morphological characters into herb, shrub and trees**.**

Theophrastus in his book "Historia Plantarum or Enquiry into plants" attempted to arrange plants in various groups based on how plants reproduce and its uses. He is called "Father of Botany".

Carl Linnaeus is known as the "Father of Modern Taxonomy". In his book "Systema Naturae" (1735), he gave the hierarchical system of classification of the natural world into the plant kingdom, the animal kingdom and mineral kingdom.

He understood the importance of floral characters and classified plants based on the number of stamens present in them. It is also known as the sexual system of classification.

Linnaeus kept on adding new work to his publications. In "Species Plantarum" (1753), he gave a brief description of all the species known to him. He described around 7,300 plant species in it. He divided the plant kingdom into 24 classes based on the structure, union, length and the number of stamens. E.g. Monoandria (1 stamen), Diandria (2 stamens), Polyandria (more than 12 stamens), Monoadelphia (stamens united in a single bundle), Monoecia, Dioecia, Polygamia (polygamous plants), Cryptogamia (flowerless plants), etc.

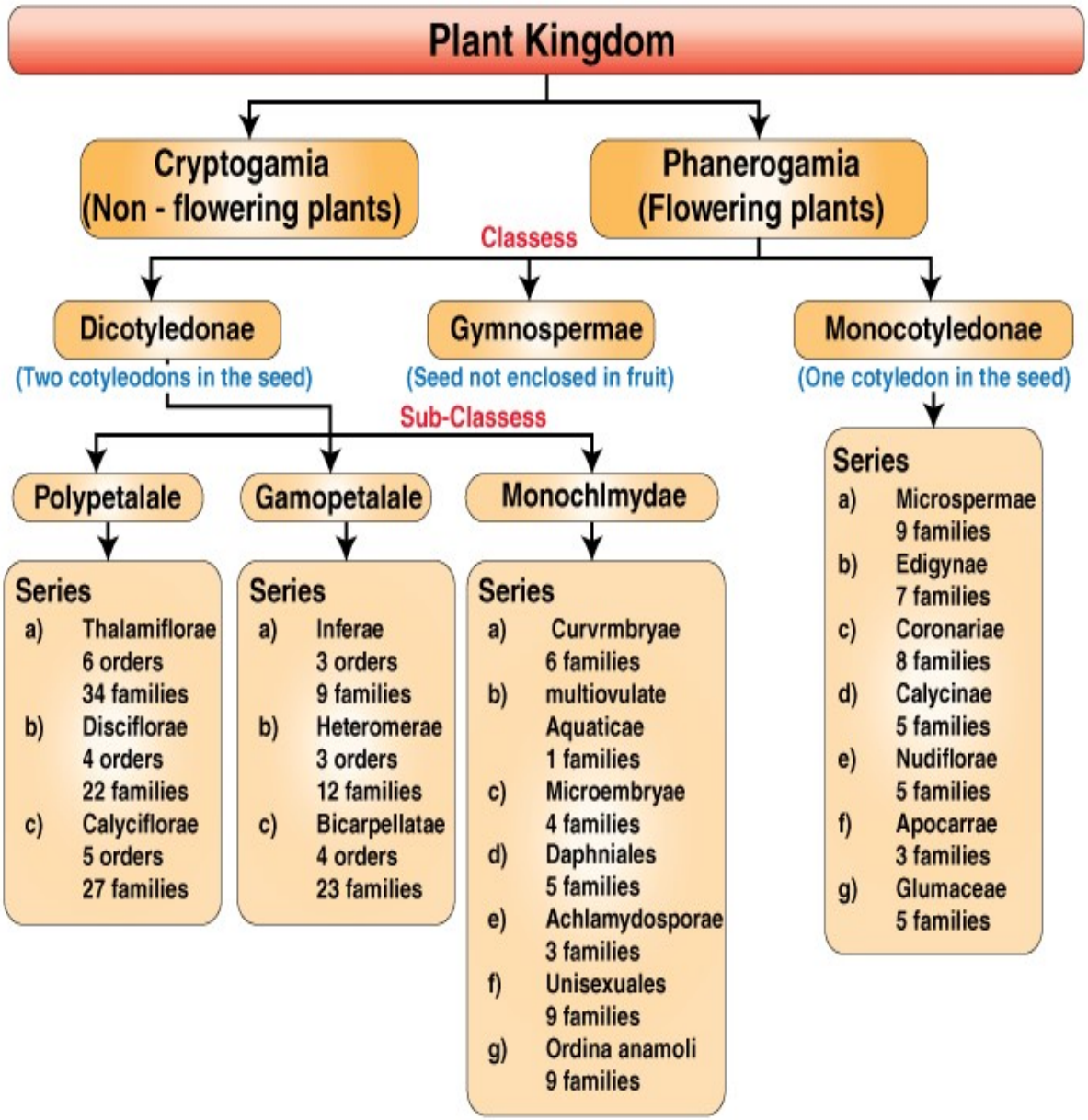
He gave the Binomial nomenclature system. In "Philosophia Botanica", he had given rules for naming every species. It is called binomial because each name has two components, genus name and species name, e.g. *Solanum melongena* (brinjal), *Solanum tuberosum* (potato) having the same genus but different species name.

2. Natural systems: In this system of classification, more characters were considered while classifying. It was based on the natural similarities of vegetative and floral characters among the organisms. It took into consideration various external and internal features like the anatomy of a cell, types of embryos and phytochemistry.

Bentham and Hooker system of classification was the most important natural system of classification of flowering plants. They classified plants into Cryptogams (non-flowering plants) and Phanerogams (flowering plants).

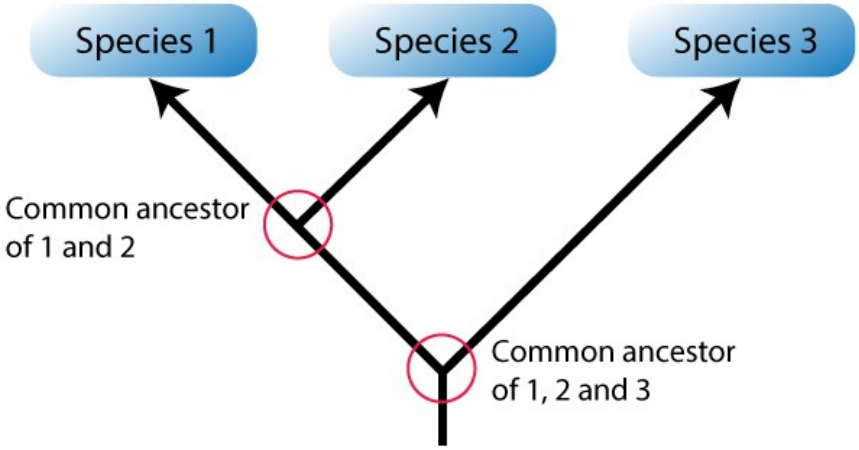
In the Bentham and Hooker classification system, 97,205 species of seed plants were classified into 7569 genera and 202 families. The flowering plants were further classified into three classes namely Dicotyledon, Gymnosperm and Monocotyledon.

The Bentham and Hooker system of classification was published in the book "Genera Plantarum" in three issues over the years 1862 to 1883.



It helped to determine relationships between the various groups of plants but failed to identify phylogenetic relationships among different groups of plants. It wrongly placed gymnosperms between monocotyledons and dicotyledons.

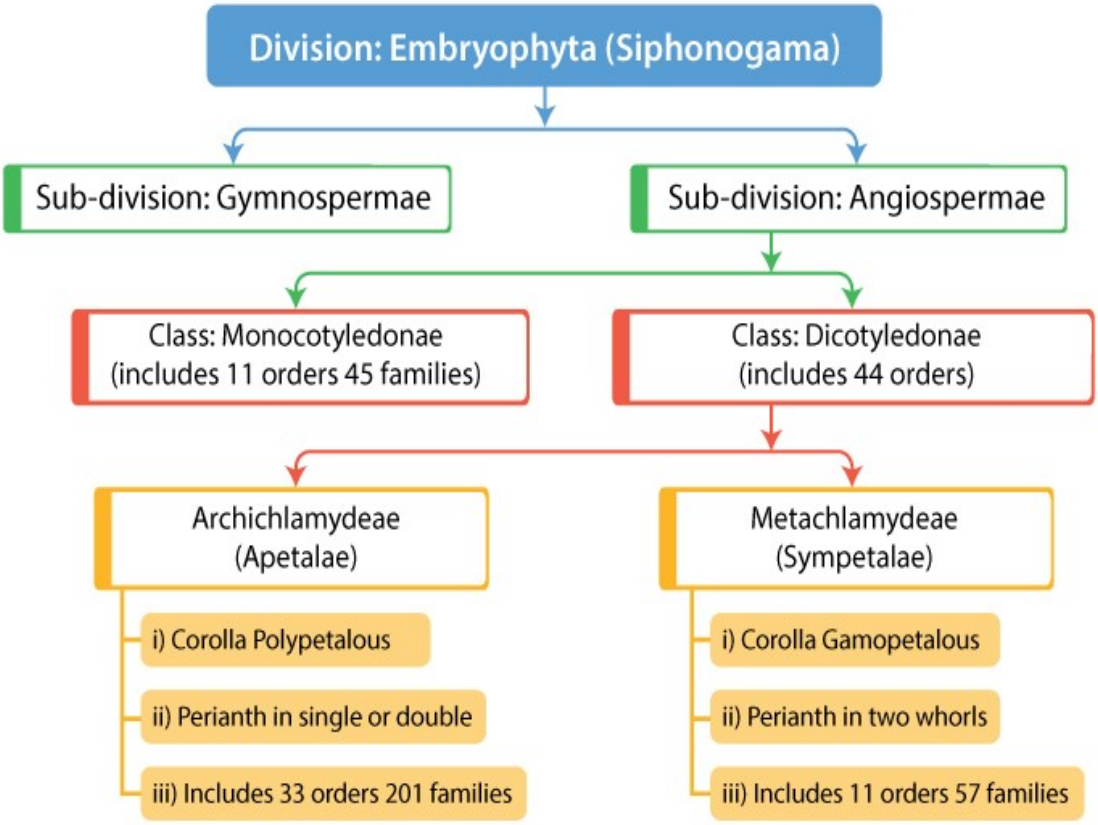
The Phylogenetic system of classification: This system is based on evolutionary sequence and genetic relationship. The phylogenetic system of classification was developed after the publication of Darwin's theory of evolution. Apart from the morphological characteristics found from fossil records, genetic constituents were also considered. It has been widely accepted by biologists all over the world. According to this system, all the organisms belonging to the same taxa originated from the common ancestor.



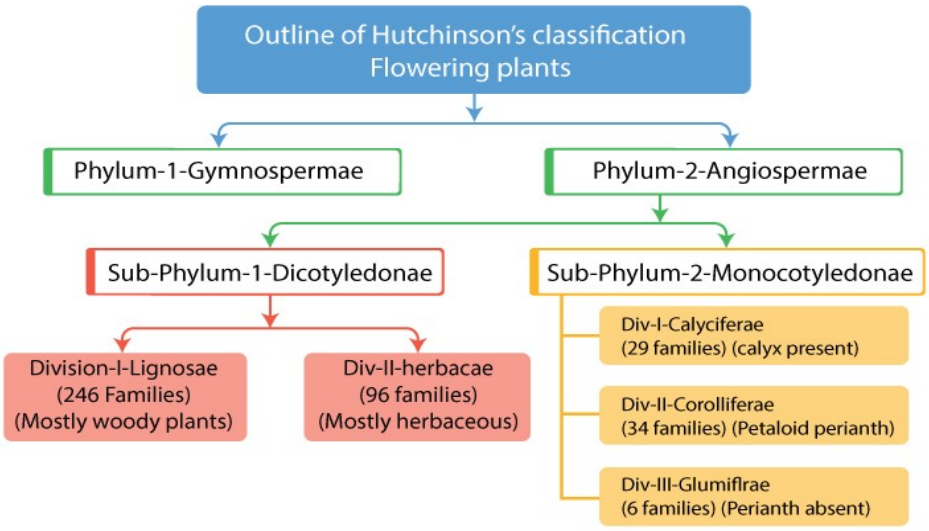
Various scientists namely Engler and Prantl, Hutchinson, Takhtajan, Cronquist, Rolf Dahlgren and Robert F Thorne contributed to the phylogenetic system of classification.

The two main phylogenetic systems of classification are:

- **Engler and Prantl system of classification:** In this type of phylogenetic system of classification, floral characters like single whorl or no perianth, unisexual flowers pollinated by wind were considered primitive characters as compared to two whorls in the perianth and bisexual flowers pollinated by insects. They arranged plants based on the increasing complexity of the flower morphology.



- The plant kingdom was divided into 13 divisions:
  - 11 are Thallophytes
  - 12th EmbryophytaAsiphonogama**,** i.e. plants having embryos but pollen tubes are absent (bryophytes and pteridophytes)
  - 13th EmbryophytaSiphonogama**,** i.e. plants with embryo and pollen tubes (seed plants)
- Hutchinson's classification: John Hutchinson, a British botanist gave the phylogenetic system of classification in his book named "The Families of Flowering Plants" in two volumes in 1926 and 1934. In his classification, Hutchinson divided angiosperms into monocotyledons and dicotyledons.
  - Dicotyledons were further divided into two divisions, namely, Lignosae (woody plants) and Herbaoae (herbaceous plants)
  - Monocots were divided into 3 divisions on the basis of flower morphology, namely, Calyciflerae (calyx present), Corolliferae (petaloid perianth) and Glumiflorae (perianth absent)



Modern Taxonomic advancements

With the advent of molecular biology, many techniques to identify genetic materials have been developed. This has equipped us to compare individuals at different taxonomic levels and resolve the difficulties of classifying them even if there is no fossil evidence.

1. **Numerical taxonomy:** It is done by using computers and all the observable characters are taken into consideration. Each character is assigned with a code and a number. Hundreds of characters can be considered together and given equal importance.
2. **Cytotaxonomy:** It utilises cytological information like chromosome number, shape size, etc. to understand the taxonomy.
3. **Chemotaxonomy:** Use of chemical constituents of plants for taxonomic studies is known as chemotaxonomy. Proteins, amino acids, nucleic acids and peptides, starch grains, wax,

fat, oil, phenols are studied in chemotaxonomy.

Importance of Plant Taxonomy

- It gives a detailed overview of various morphological and anatomical structures of a plant species
- It organises all the information of plants into an orderly fashion
- It indicates the phylogenetic relationship between species and its ancestry
- Plant taxonomy enables to identify any unknown species and its place in the classification by comparing with known species
- Analysis of genetic constituents can be done on the basis of systematics
- It is used to scientifically name any species, which helps in the uniformity of the name around the world and avoids confusion
- It helps to understand the biodiversity present at a place
- It helps in recording all the living species known until now
- Taxonomy is widely used in agriculture, medicine and forestry

Resultand Discussion:

Plant taxonomy and plant systematics are inextricably linked, and there is no clear distinction between the two fields. In practise, “plant systematics” is concerned with the links between plants and their evolution, particularly at the higher levels of classification, whereas “plant taxonomy” is concerned with the practical handling of plant specimens. Nevertheless, the precise link between taxonomy and systematics has evolved over time, changing in tandem with the goals and methodologies used.

Plant taxonomy is well-known for being unstable, and for historically failing to reach a consensus on the circumscription and placement of taxa within a species.

Classification systems serve the function of classifying organisms based on features that are shared by all of their members. There are several characteristics that distinguish plants from animals, including the presence of cellulose cell walls, polyploidy, and the presence of sedentary growth. Whereas animals must consume organic molecules, plants, through the process of photosynthesis, are able to convert light energy into organic energy without the need for food. The basic unit of categorization is the species, which is a collection of organisms that are capable of reproducing amongst themselves and that are genetically related; a broader classification is the genus, which is a group of organisms that are not genetically related.

The identification, classification, and description of plants are the three main objectives of plant taxonomy. The contrast between these three objectives is critical, yet it is frequently missed.

Conclusion:

Plant taxonomy aids in the determination of evolutionary relationships and also an organised grouping of morphologic traits provides a complete understanding of these qualities. It also aids in the identification of recently found species.The identification, classification, and descriptions of plants are the three main objectives of plant taxonomy. The contrast between these

three objectives is critical, yet it is frequently missed.The categorization of plants has enabled it to make it simpler for humans to research the numerous kinds of plants species that live on the planet, as well as the development of those species. Monocots and dicots, as well as Angiosperms as well as gymnosperms, are among the classifications used to classify plant groups. A large number of groupings or categories are found within the kingdom Plantae.

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Exploration of pollen sources and bee floral calendar of SPM campus Nandura (Rly), Dist. Buldhana

Katgaye A.M.
Shri Pundlik Maharaj Mahavidyalaya Nandura Dist. Buldhana (M.S.)

ABSTRACT

Honeybees are one of the most important pollinators in nature. The present study was conducted for conservation of beeflora from SPM college campus District Buldhana, Maharashtra. Total 40 bee foraging plants recognize from study area. Among the explored bee forage sources were 20 trees, 08 herbs, 10 shrubs and 02 climbers. Pollen sources were observed in pollen loads belonged to different families. Honeybees visited number of different flowers in a one day. The observed flora was further divided into pollen, nectar and both pollen and nectar yielding plants. During the year 2022 January-June and September- December is the highest honey flow periods except mid June-August were critical dearth periods was observed. Pollen taxa found in honey and pollen loads are helpful in recognizing bee forage plant. This type of bee flora was acted as food source of honeybees throughout the year.

Key Words- Pollen sources, bee flora, pollen calendar, exploration

Introduction:

Pollen is a reproductive part of male flower. Pollen forms the important primary, secondary metabolites and rich energy source for honey bees. Pollen taxa found in honey and pollen loads are helpful in recognizing bee forage plant. Beeflora is important for sustaining beekeeping industry. Honeybees are the most important and superior pollinator of the natural ecosystem, as they store pollen and nectar for future purposes. To fulfil their requirement honey bees, pollinate wide variety of flower in mutualistic form right from cultivated to wild species and ornamental crops (Abrol 1997, Pande *et al*., 2016). However flowering plants of several plant families are blossoming at different time intervals of the year (Free 1970). Honeybees pollinate 16% of flowering plant species in the world and nearly 400 species of agricultural plants (Crane and Walker1984). Every region has its own honey flow and dearth periods of short and long duration. Such knowledge on bee flora will help in the effective management of bee colonies during such periods. Many researchers studied the various aspects of botanical sciences, with special emphasis on floral biology, taxonomy, and palynology (Ramchandran 1936, Deodikar 1961). The present study was carried out to prepare an inventory of existing polleniferous bee flora and develop floral calendar in SPM campus Dist. Buldhana MH (India).

Material and Methods:

(a) Study sites:

Nandura taluka is located in the North- Eastern side of the district of Buldhana. It is situated between 20° 50′ 0″ N, 76° 27′ 35″ E. It has become bigger city with Jigaon Project as one

of the bigger dam so around 20 villages which are affected by this project totally depend upon this city and making it as bigger trade hub. City get expanded towards Nimgaon in North,Wadi in west, Aamsari in east and Kolamba in South.Nandura has oil mills, dal mills, and joining & pressing industry along with handlooms.Nandura also acts an important trade centre in the region. Prominent goods traded include wheat, jowar, pulses, cotton, onion, chili, lemon and several vegetables like Brinjal.People economically backward and the income source of people is farming.

b) Identification of bee-flora from pollen loads:

Available honey comb near to campus were studied during the year 2022 (Figure 1). During these visits collection of local flora, study their habits and their utility to honey bees as forage sources were nectar or pollen. The observation of pollen source was based on collection of pollen loads. Polleniferous material of all the identified plants was collected and references slides were prepared using acetolysis method Erdtman (1960). Enlisting of the plants in the region was made and identified with the help of various flora like Flora of Presidency of Bombay (Cooke, 1958) , Flora of Maharashtra (Singh 2001, Almeida 1998) and relevant research papers and reports.

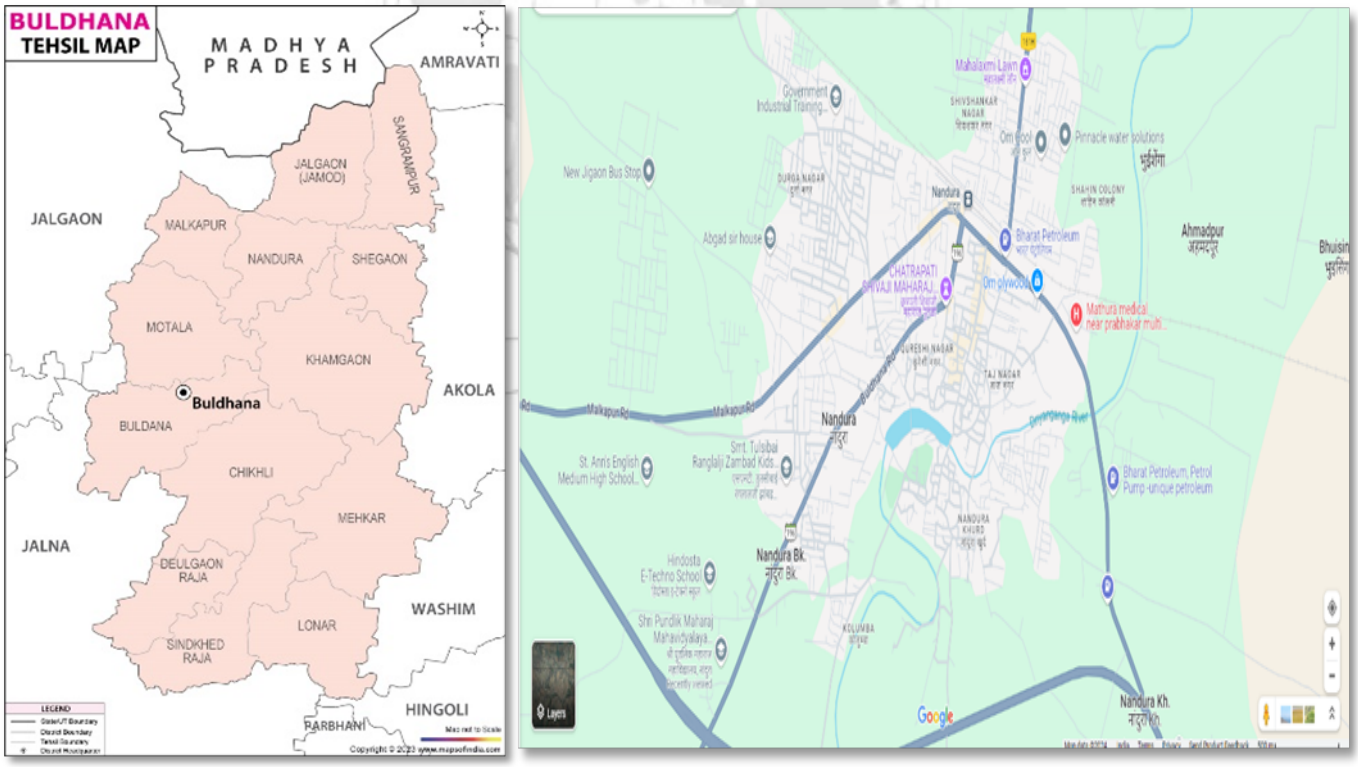

Fig.1 Map of Study site

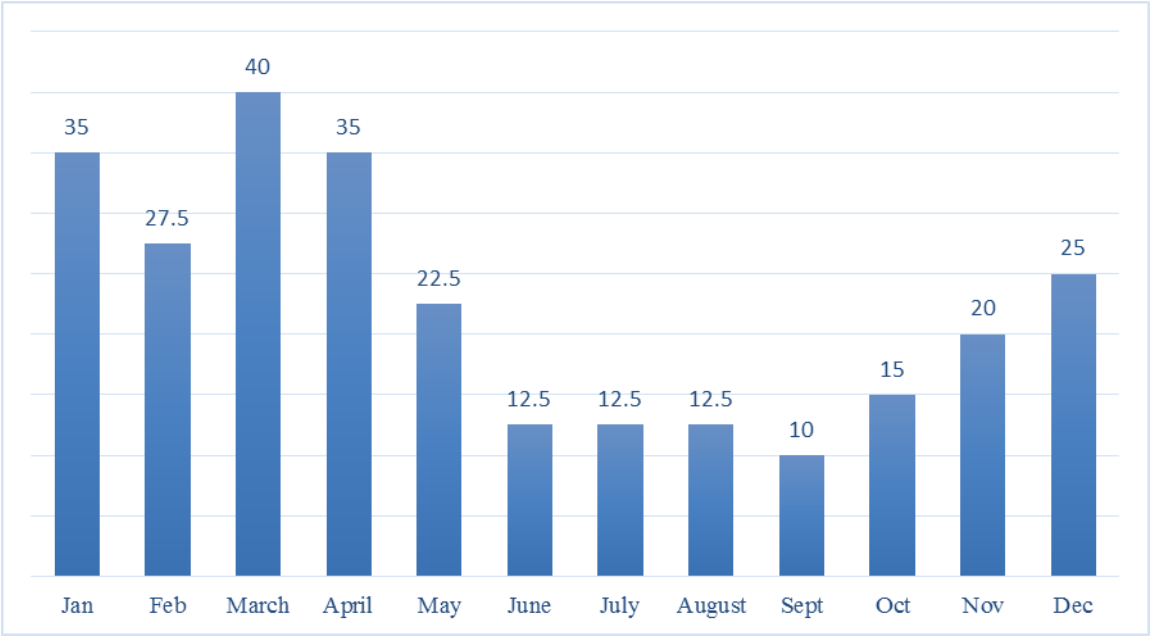

Fig.2 Percent abundance of Total Bee Flora during 2022

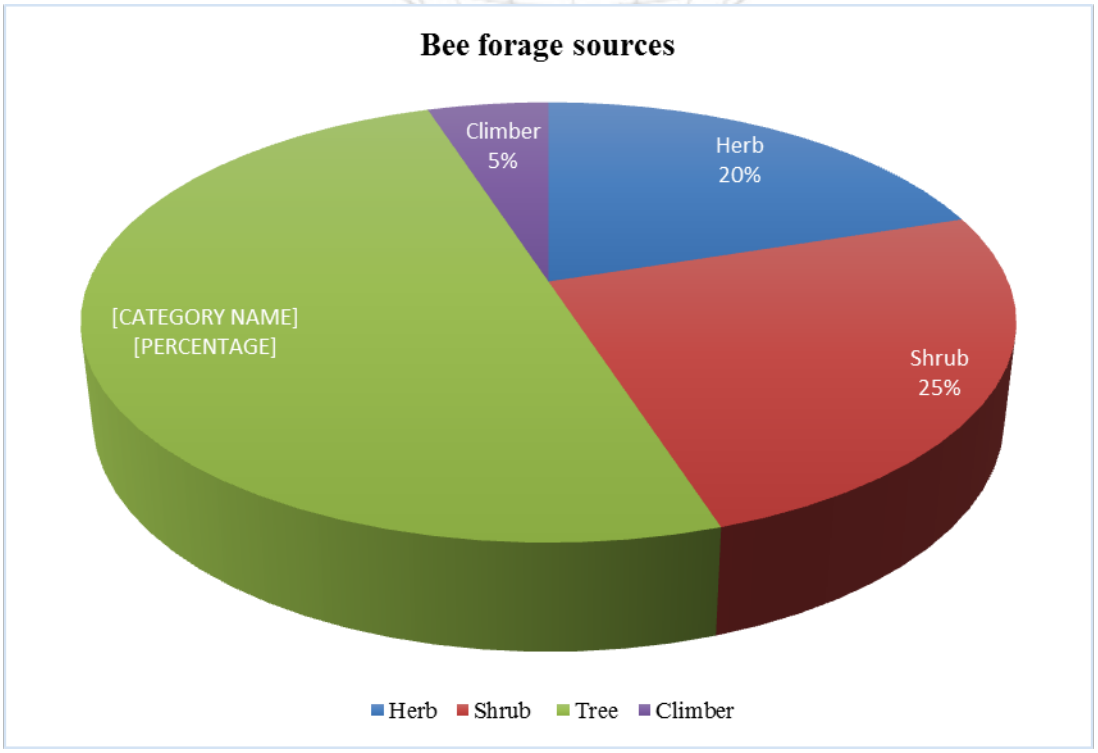

Fig. 3. Bee forage sources

Table. 1 Bee floral Calendar of study area

Sr. No.	Botanical Name	Local name/ Common name	Family	Flowering period	Plant type
1.	*Achyranthus aspera L.*	Aghada	Amranthaceae	Oct-Feb	Herb
2.	*Adhatoda vasica* Nees	Adulsa	Acanthaceae	Oct-Apr	Shrub
3.	*Aegle marmelos* (L.) Corr.	Bel	Rutaceae	Jan-Apr	Tree
4.	*Altarnanthera sessilis R.Br* -	-	Amranthaceae	Around year	Herb
5.	*Azadirachta indica* A. Juss	Neem	Meliaceae	Jan-March	Tree
6.	*Barleria prionitis L.*	Katekorati	Acanthaceae	Feb-Jul	Shrub
7.	*Butea monosperma (Lam.) Taub.*	Palas	Fabaceae	Jan-Apr	Tree
8.	*Cajanus cajan (L.) Millsp*	Tur	Fabaceae	Oct-Jan	Shrub
9.	*Canna indica* L	Indian shot	Cannaceae	-	Shrub
10.	*Cassia siamea* Lam.	Kashida	Mimosaceae	March-May	Tree
11.	*Cassia fistula L.*	Amaltas	Caesalpiniaceae	Mar-May	Tree
12.	*Cassia tora L.*	Tarota	Caesalpiniaceae	July-Nov	Herb
13.	*Catharanthus roseus* (L.)	Periwinkle	Apocynaceae	-	Herb
14.	*Cestrum nocturnum* L.	Night-blooming jasmine	Solanaceae	April-June	Climber
15.	*Chrysanthemum indicum* L.	Indian Chrysanthemum	Asteraceae	Nov-Jan	Shrub
16.	*Citrus aurantifolia* christm	Citrus lime	Rutaceae	-	Tree
17.	*Cordia dichotoma* G. Frost.	Indian cherry	Boraginaceae	Jan-May	Tree
18.	*Dalbergia sissoo* Roxb.	Shisham	Fabaceae	March-April	Tree
19.	*Duranta erecta* L.	golden dewdrop	Verbenaceae	June-August	Shrub
20.	*Gliricidia sepium* (Jacq) walp	Mouse killer	Fabaceae	April - May	Tree
21.	*Gmelina arborea* Roxb.	Gamhar	Lamiaceae	Feb-March	Tree
22.	*Hamelia patens* Jacq	hummingbird bush	Rubeaceae	-	Shrub
23.	*Hibiscus rosa-sinensis* L.	China rose	Malvaceae	-	Shrub
24.	*Impatiens balsamina* L.,	Garden balsam	Balsaminaceae	Sept-Oct	Herb
25.	*Lagerstroemia speciosa* (L.) Pers.	Pride of India, Queens flower	Lythraceae	March-April	Tree
26.	*Lantana camera* L.	Hadadh Kunku	Verbanaceae	Jan-Dec	Shrub
27.	*Mangifera indica* L.	Amba	Anacardeceae	Nov-Jan	Tree
28.	*Murrayakoenigii* (L.) spreng.	Curry tree	Rutaceae	Jan-March	Tree
29.	*Ocimum sanctum* Linn.	Tulsi	Lamiaceae	-	Herb
30.	*Pithocellobium dulce* (Roxb) Benth	Manila tamarind	Fabaceae	Nov-Dec	Tree
31.	*Pongamia pinnata* (L.)	Beech tree, karanj	Fabaceae	March-April	Tree
32.	*Portulaca grandiflora* Hook.	Eleven o'clock, mexican rose	Fabaceae	-	Herb
33.	*Psidium guajava* L.	Peru, jamb	Myrtaceae	March-May	Tree
34.	*Punicagranatum* L.	Pomegranate	Lythraceae	-	Tree
35.	*Rosa indica* L.	Gulab	Rosaceae	-	Shrub
36.	*Syzygium cumini* (L) Skeels	Jambul	Myrataceae	April-May	Tree
37.	*Tectona grandis* L.	Sag	Lamiaceae	July-Sept	Tree
38.	*Tinospora cordifolia* (Willd.) Miers.	Guduchi, giloy	Menispermaceae	June-August	Climber
39.	*Tridax procumbens S.L.*	Kambarmodi	Asteraceae	Jan-Dec	Herb
40.	*Ziziphus jujuba* Mill.	Red date, Ber	Rhamnaceae	Oct-Dec	Tree

Results & Discussion:

The present research work was recorded on different polleniferous honeybees foraging plants during January -December 2022. The result revealed that total 40 bee foraging plant species were useful to honeybees (Table-1).Among the explored bee forage sources were 20 trees, 08 herbs,10 shrubs and 02 climbers (Fig.3).Pollen sources were observed in pollen loads belonged to different families like Mimosaceae, Amranthaceae, Acanthaceae, Rutaceae, Asteraceae, Fabaceae, Apocynaceae, Caesalpiniaceae, Myrataceae, Lythraceae, Anacadiaceae, Verbanaceae, Solanceae, Lamiaceae, Rhamnaceae, Malvaceae, Balsaminaceae, Rubeaceae, Meliaceae, Cannaceae, Boroginaceae, Rosaceae, Menispermaceae. During the year 2022 January-June and September-December is the highest honey flow periods except mid-June-August were critical dearth periods was observed (Figure 2). From Western Ghats of Karnataka studied morphology of Sixty-eight bee forage plants (Shubharani *et al.,* 2013). Total 83 pollen sources were procured from Gadchiroli Dist. Maharashtra (Katgaye and Kalkar 2021).

Total 50 medicinal plants species were analysed fromVidya Pratishthan campus, Baramati, Pune district Maharashtra. Some of the common and important medicinal bee forage plants were studied like *Azadirachta indica*, *Mangifera indica*, *Cassia fistula*, *Cassia occidentalis*, *Albizzia* spp., *Bauhinia* spp. and *Prosopis juliflora.* (Harugade *et al*., 2016). The study of Anjaneri and Dugarwadi hills, Nashik revealed that 52 plant species were useful to honeybees, out of which 29 were agricultural crops and 23 wild plants. The identified flora was further grouped into pollen, nectar and both pollen and nectar yielding plants. Mid-December to February and mid- July to September were identified as honey flow periods and mid- April to mid-June were the critical dearth periods during the year. It was observed that the bee-flora consist of mostly ornamentals, timber, medicinal, fruits, vegetables and other commercially important plants like spices, pulses, cereals, oilseed yielding, fiber, and fodder crops (Bhalchandra *et al*., 2014).From Nagaland total 69 foraging plants of *A. cerana* and 64 foraging plants of stingless bees in foot hill. The bee flora was observed mostly wild, timbers, ornamentals, medicinal, fruits, vegetables, and other agricultural important plants like pulses, cereals, oil yielding, fiber and fodder crops etc. these plant species served as the good sources of pollen and nectar in the study area. In dearth period when agricultural crops are not in blooming then weeds and wild flowering plants were observed as alternative food sources for honey bees. Wild flora is providing nectar and pollen sources all around the years (Singh *et al.,* 2016).

Conclusion:

The present work was done on 40 plants species useful for bee keeping. As per the observation recorded different fruit, vegetables, cereals, pulses, oil yielding, ornamental, fibers and wild plants species were the provider of nectar and pollen for honey bees. There is a variation on seasonal availability of honeybee forages. Most important trees flowered in March and May. The results also shows that the study area has large number of pollen yielding sources were available. To maintain the existing bee flora and growing more plants or to conserve all bee forage plants in the study area.

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Assessment of floral diversity of Shri Shivaji Arts, Commerce and Science College Motala, Dist. Buldhana. (M.S.)

Theng P. A.
Shri Shivaji Arts, Commerce and Science College, Motala, Dist. Buldana (M.S.)
And
Sakhare S. S.
Mahatma Fule Arts Commerce and Sitaramji Chaudhary Science College,Warud, Dist. Amravati. (M.S.)

ABSTRACT

This study aims to assess the floral diversity of Shri Shivaji Arts Commerce and Science College, Motala, Dist. Buldhana (M.S.) focusing on the variety, distribution and ecological significance of plant species present in the campus. Floral diversity plays a crucial role in maintaining ecosystem balance, supporting various ecological functions and contributing to environmental sustainability.

A systematic survey of the campus flora was conducted, identifying species richness, abundance and habitat types. Field work included the collection of data through direct observation and sampling methods. The findings reveal a diverse range of species, including native, ornamentaland medicinal plants. Assessment of floral diversity gives account of 145 genera and 172 species belongs from 62 families. In the present assessment20 climber species, 26 shrubs, 36 herbs species and 90 trees are reported this study provides baseline data for future ecological research and helps in formulating strategies for sustainable campus management. The assessment also underscores the role of educational institutions in preserving biodiversity and promoting ecological awareness among students and staff.

Keyword: Floral diversity, Biodiversity assessment, Campus flora, Sustainable campus management

Introduction:

Natural resources play a vibrant role in supporting life and maintaining of ecosystem. The biodiversity found on the earth nowadays which includes many tens of millions of wonderful organic species that's the manufactured from almost 3.5 billion years of evolution and came into existence, flourished and vanished because of numerous reasons (Sainkhediya *et al*., 2022). The variation among the species is extremely helpful in the growth of the agriculture industry, medicine industry and for future research purposes (Gauswami *et al.*, 2022).

Biodiversity reflects total variety and variability within and among the flora and fauna and these studies are ecologically very important in the face of encroachment, habitat loss and extinction rates. The taxonomic assessment of flora is very crucial to the richness of biodiversity. This goal can be achieved by carrying out floristic studies and it is the main pillar of assessing

plant diversity conservation management and sustainable utilization (Krishnakumar and Ramesh, 2022).

Plant diversity deals with the account of plant species growing in a particular region at a specific time. Its assessments are considered as the basic requirement to understand the current status of plant diversity (Savina *et al.,* 2018).

The total number of species existing on the earth is not determined yet however, it is estimated that the total number of animal and plant species could be between 13 and 14 million (Heywood, 1995).Understanding species diversity and dispersal patterns is important to evaluate the complexity and resources of these forests (Kumar *et al*., 2006).Floristic account and diversity valuations are necessary to understand the standing diversity status and conservation of forest biodiversity (Jayakumar *et al*., 2011).

Flora is the simplest list of plants occurring within a given region and they are the living organisms lacking power of locomotion which resides its whole life in any circumstances at a single spot (Ramachandran *et al*., 1988).The word Flora derives from the Latin, Flora- the goddess of plants (Floris means flower). Flora refers to the brief taxonomic treatment of all plants occurring in a geographical location which generates a comprehensive account (Chhetri *et al*., 2019).

Floristic diversity within a specific area is referred to as the variety of plant species scattered in a particular area, which is based on climate conditions, the appearance of vegetation and biotic influences (Gaston and Spicer, 2013).A floristic study documents of all the plant species found within a specific geographical area. Some passionate and largescale floristic projects include development of keys, descriptions, and interpretation of the plants, although some may produce a simple list of plant species (Bhagat *et al*., 2021).

The floristic evaluations are considered as the backbone of the assessment of phytodiversity, conservation management and sustainable utilization of bioresearches of a region. They are helpful in providing signs of changing floristic pattern, new invasions, current status, rare, endemic and threatenedtaxa in a phytogeographical area (Ravi *et al*., 2016).

Material and Method:

The study was conducted at Shri Shivaji Arts, Commerce and Science College, Motala, Dist. Buldhana (M.S.), covering various habitats, including landscaped gardens, natural vegetation, and playground over 3.98 acres of land area. A systematic sampling method was used, dividing the campus into 4 zones based on vegetation types and land use. Random quadrats (10m x 10m) were laid out in each zone for detailed observation of plant species. Data were collected during the flowering season, recording plant species and their abundance in each quadrat, and specimens were identified using taxonomic keys and herbarium references. The un-identified plants were collected and identified with the help of local floras (Sharma *et al*., 1996; Singh and Karthikeyan, 2000; Diwakar and Sharma, 2000). Finally, plants were documented by following their botanical name, family and local nameof the individual plants.

Result and Discussion:

During the floristic assessment, atotal of 172 plant species, representing 63 different

families and exhibiting various growth forms, were identified. The botanical names, common names, habitatand familiesof the observed species are mentioned in Table 1. The present assessment provides detailed insights into the plant species present in the campus area, showing a rich diversity that includes 92 tree species (53.48%), 31 shrub species (18.02%), 28 herb species (16.27%), and 19 climber species (11.04%). Additionally, two hydrophytic and climbing vine species (1.06%) are also found.The family Fabaceae had the highest number of plant species. The distribution of trees, shrubs, herbs, and climbers in the study area was found to beirregular, indicating a varied plant composition across the campus. The diversity of trees provides resources and habitat for nearly all other life forms of forest. The tree species diversity varies significantly with the variation in biogeography and habitat disturbance (Ali *et al.,* 2018).

Trees dominate the landscape, accounting for more than half of the plant population, while shrubs, herbs, and climbers contribute significantly but to a lesser extent. The dominance of trees highlights their importance in the ecosystem, providing shade, habitat, and contributing to the microclimate of the campus. Shrubs and herbs, though smaller in number, play key roles in soil stabilization, biodiversity, and ecological support. Climbers, while the least represented, are important for vertical space utilization and add to the structural complexity of the vegetation.

Table 1. Floral Diversity in The CampusArea.

S.N.	Botanical Name	Common Name	Habit	Family
1	*Abrus precatorius* L.	Gunj	Climber	Fabaceae
2	*Abutilon indicum* (L.) Sweet	Dabla	Shrub	Malvaceae
3	*Acorus calamus* L.	Vekhand	Herb	Acoraceae
4	*Adhatoda vasica* Nees	Adulsa	Small tree	Acanthaceae
5	*Aegle marmelos*L.	Bel	Tree	Rutaceae
6	*Agave americana* L.	Peru	Tree	Asparagaceae
7	*Albizia lebbeck (L.) Benth*	Siras	Tree	Fabaceae
8	*Aloe vera* Miller.	Korphad	Herb	Liliaceae
9	*Alstonia scholaris* (L.) R.Br.	Saptaparni	Tree	Apocynaceae
10	*Ampelocissus latifolia* Wall.	Ran Draksha	Climber	Vitaceae
11	*Anacardium occidentale* L.	Kaju	Tree	Anacardiaceae
12	*Androgarphis paniculate* (Burm. f.)	Kalmegh	Herb	Acanthaceae
13	*Annona reticulata* L.	Ramphal	Tree	Annonaceae
14	*Annona squamosa* L.	Sitaphal	Tree	Annonaceae
15	*Araucaria heterophylla* (Salisb.)	Christmas Tree	Tree	Araucariaceae
16	*Argyreia nervosa* (Linn. F)	Samudrasok	Climber	Convolvulaceae
17	*Artemisia annua* L.	Artemisia	Herb	Asteraceae
18	*Artocarpus heterophyllus* (Lam.)	Phanas	Tree	Moraceae

19	Asparagus racemosus Willd.	Shatawari	Climber	Liliaceae
20	*Azadirachta indica* A. Juss.	Kadu Neem	Tree	Meliaceae
21	*Azolla microphylla*Kaulf.	Mosquito Fern	Aquatic Fern	Salviniaceae
22	*Bambosa bamboo* (L.) Voss	Welu	Herb	Poaceae
23	*Barleria lupulina* Lindl.	Kali Kate Koranti	Herb	Acanthaceae
24	*Barleria prionitis* L.	Kante Koranti	Shrub	Acanthaceae
25	*Bauhinia purpurea* L.	Kanchan	Tree	Fabaceae
26	*Bauhinia racemosa* Lam.	Abhata	Tree	Fabaceae
27	*Bixa orellana* L.	Shendri	Shrub	Bixaceae
28	*Bombax ceiba* L.	Katesanwar	Tree	Malvaceae
29	*Bougainvillea glabra* Choisy	Bogan vel	Climber	Nyctaginaceae
30	*Bryophyllum pinnatum* (Lam.)	Panfuti	Herb	Crassulaceae
31	*Butea monosperma* (Lam.) Taub.	Palas	Tree	Fabaceae
32	*Calotropis procera* (Aiton)	Rui	Shrub	Asclepidiaceae
33	*Calotropis gigantea* (L.)	Rui	Shrub	Asclepiadaceae
34	*Canna indica* L.	Kardal	Herb	Cannaceae
35	*Capparis zeylanica* L.	Waghati	Climber	Capparaceae
36	*Carica papaya* L.	Papaya	Tree	Caricaceae
37	*Carissa carandas* L.	Karwand	Shrub	Apocynaceae
38	*Cassia fistula* L	Amaltash	Tree	Fabaceae
39	*Catharanthus roseus* (L.) G. Don	Sadaphuli	Herb	Apocynaceae
40	*Ceiba pentandra* (L.) Gaertn.	Kapok	Tree	Malvaceae
41	*Centella asiatica* L.	Mandupkarni	Herb	Apiaceae
42	*Ceropegia bulbosa* Roxb.	Haman	Climber	Asclepidiaceae
43	*Chlorophytum borivilianum* Sant.	Safed Musali	Herb	Liliaceae
44	*Cinnamomum tamala* (Buch-Ham.)	Tejpatta	Tree	Lauraceae
45	*Cinnamomum verum* J. Presl.	Dalchini	Tree	Lauraceae
46	*Cissus quadragularis* L.	Hadjodi	Climber	Vitaceae
47	*Citrus aurantifolia* (Christm.)	Nimbu	Tree	Rutaceae
48	*Clerodendrum paniculatum*L.	Samai	Tree	Lamiaceae
49	*Clerodendrum phlomidis* L.f.	Agnimantha	Tree	Lamiaceae
50	*Clerodendrum serratum* L.	Bharangi	Shrub	Verbenaceae
51	*Clitoria ternateavar albiflora* L.	PandharaGokaran	Climber	Fabaceae

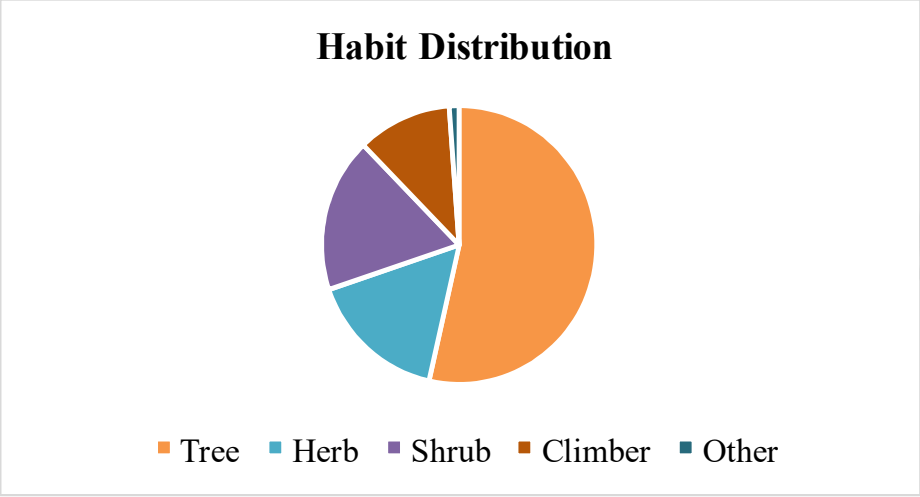
52	*Clitoria ternatea* L.	Nila Gokaran	Climber	Fabaceae
53	*Cocos nucifera* L.	Naral	Tree	Arecaceae
54	*Commiphora caudata* (Wight &Arn)	Gugul	Tree	Burseraceae
55	*Commiphora mukul* (Hook.)	Gugul	Tree	Burseraceae
56	*Costus igneus* N.E.Br.	Insulin Plant	Herb	Costaceae
57	*Costus speciosus* (Koen.) Sm.	Ran Adrak	Herb	Costaceae
58	*Crinum latifolium*L.	Ran Kanda	Herb	Amaryllidaceae
59	*Curculigo orchioides* Gaertn.	Kali Musali	Herb	Amaryllidaceae
60	*Curcuma longa* L.	Haldi	Herb	Zingiberaceae
61	*Cymbopogan nardus* (L.) Rendle	Gavati Chaha	Herb	Poaceae
62	*Dalbergia sisoo* (Roxb.) Wight	Sisoo	Tree	Fabaceae
63	*Datura metal* L.	Kala Dhotra	Shrub	Solanaceae
64	*Datura stramonium* L.	Dhotra	Shrub	Solanaceae
65	*Delonix regia* (Bojer ex Hook.)	Gulmohar	Tree	Fabaceae
66	*Dioscorea hispida* Dennst.	Manjar Kand	Climber	Dioscoreaceae
67	*Dolichandrone falcata* (Wall.)	Medshige	Tree	Bignoniaceae
68	*Dracaena trifasciata* (Prain)	Snake Plant	Herb	Asparagaceae
69	*Duranta erecta* L.	Mehendi	Shrub	Verbenaceae
70	*Eclipta alba* L.	Brungraj	Herb	Asteraceae
71	*Ehretia aspera* Forssk.	AjaanVruksha	Tree	Boraginaceae
72	*Elettaria cardamomum* (L.)	Vilaichi	Herb	Zingiberaceae
73	*Emblica officinalis* gaertn	Awala	Tree	Euphorbiaceae
74	*Euphorbia trigona* Haw	Cathedral Cactus	Tree	Euphorbiaceae
75	*Evolvulusal sinoides* L.	Shankhpushpi	Herb	Convolvulaceae
76	*Ficus benghalensis* L.	Wad	Tree	Moraceae
77	*Ficus benjamina* L.	Rubber Ficus	Tree	Moraceae
78	*Ficus carica* L.	Anjir	Tree	Moraceae
79	*Ficus elastic* Roxb. ex Hornem	Rubber Palm	Tree	Moraceae
80	*Ficus racemosa* L.	Umber	Tree	Moraceae
81	*Ficus religiosa* L.	Pimpal	Tree	Moraceae
82	*Gardenia resinifera* Roth	Dekemali	Tree	Rubiaceae
83	*Geodorum laxiflorum* (Lam.)	Hargathi	Herb	Orchidaceae
84	*Gliricidia sepium* (Jacq.) Kunth	Undirmari	Tree	Fabaceae
85	*Gloriosa suerba* L.	Kal Lavi	Climber	Colchicaceae
86	*Gmelina arborea* Roxb. Ex Sm.	Shivani	Tree	Verbenaceae

87	*Hardwickia binate* Roxb.	Anjan	Tree	Caesalpinaceae
88	*Heliconia rostrata* Ruiz & Pav	Heliconia	Shrub	Heliconiaceae
89	*Helicteres isora* L.	Murud Sheng	Tree	Malvaceae
90	*Hemidesmus indicus* (L.) R. Br.	Kawali	Climber	Apocynaceae
91	*Hibiscus rosa sinensis* L.	Jaswand	Shrub	Malvaceae
91	*Piper nigrum* L.	Mire	Climbing vine	Piperaceae
92	*Holarrhena antidysenterica* (L.)	Kutaj	Tree	Apocynaceae
93	*Ixora coccinea* L.	Ixora	Shrub	Rubiaceae
94	*Jasminum grandiflorum* L.	Ratrani	Climber	Oleaceae
95	*Jatropha integerrima* Jacq.	Jatroph	Tree	Euphorbiaceae
96	*Justica adhatoda* (L.) Nees	Lal Adulsa	Tree	Acanthaceae
97	*Justicia adhatoda* Nees	Kala Adulsa	Tree	Acanthaceae
98	*Kigelia pinnata* (Jacq.) DC	Ghanta Patra	Tree	Bignonoaceae
99	*Lagerstroemia speciosa* L.	Tamhan	Tree	Apocynaceae
100	*Lannea coromandelica* (Houtt.)	Mohi	Tree	Anacardiaceae
101	*Lantana camara* L.	Katekorati	Shrub	Verbenaceae
102	*Leucaena leucocephala* (Lam.)	Subabhul	Tree	Fabaceae
103	*Limonia acidissima*	Kawat	Tree	Rutaceae
104	*Madhuca indica* J.F. Gmel.	Moh	Tree	Sapotaceae
105	*Mangifera indica* L.	Amba	Tree	Anacardiaceae
106	*Manilkara zapota* (L.) P. Royen	Chiku	Tree	Sapotaceae
107	*Melia azedarach* L.	Bakanya Neem	Tree	Meliaceae
108	*Mentha piperita* L.	Pudina	Herb	Lamiaceae
109	*Mesua ferrea* L.	Nagkesar	Tree	Calophyllaceae
110	*Murraya koenigii* (L.) Spreng	Kadhipatta	Tree	Rutaceae
111	*Nerium indicam* L.	Kanher	Tree	Apocynaceae
112	*Nelumbo nucifera* Gaertn.	Kamal	Herb	Nelumbonaceae
113	*Neolamarckia cadamba*(Roxb.)	Kadamb	Tree	Rubiaceae
114	*Nyctanthes arbor-tristis* L.	Ratrani	Climber	Oleaceae
115	*Ocimum kilimandscharicum* L.	Kapuri tulasi	Herb	Lamiaceae
116	*Ocimum sanctum* L.	Krishna tulsi	Herb	Lamiaceae
117	*Oroxylum indicum* (L.) Kurz	Tetu	Tree	Bignoniaceae
118	*Pandanus amaryllifolius* Roxb.	Basmati	Herb	Pandanaceae
119	*Pandanus odoratissimus* L.f.	Kewada	Shrub	Pandanaceae
120	*Passiflora incarnata* L.	Krishna Kamal	Climber	Passifloraceae

121	*Peltophorum pterocarpum* (DC.)	Sonmohar	Tree	Fabaceae
122	*Pergularia daemia* (Forssk.)	Utran Vel	Climber	Apocynaceae
123	*Phoenix dactylifera* L.	Kharik	Tree	Arecaceae
124	*Phyllanthus acidus* L. Skeels	Rai Amla	Tree	Phyllanthaceae
125	*Phyllanthus niruri*L.	Bui Awala	Herb	Phyllanthaceae
126	*Pimenta dioica* (L.) Merr.	All Spice	Tree	Myrtaceae
127	*Piper betle* L.	Vidyache Pan	Climber	Piperaceae
128	*Piper longum* L.	Pimpli	Shrub	Piperaceae
130	*Platycladus orientalis* (L.)	Morpankhi	Tree	Cupressaceae
131	*Plectranthus amboinicus* (Lour.)	Pan Ova	Herb	Lamiaceae
132	*Plectranthus barbatus* Andrews	Coleus	Herb	Lamiaceae
133	*Plumeria pudica* Jacq.	Khairchampha	Tree	Apocynaceae
134	*Plumeria rubra* L.	Chafa	Tree	Apocynaceae
135	*Polianthes tuberosa* L.	Nishigandha	Herb	Amaryllidaceae
136	*Psidium guajava* L.	Peru	Tree	Myrtaceae
137	*Pterocarpus santalinus* L. f.	Rakta Chandan	Tree	Fabaceae
138	*Putranjiva roxburghii* Wall.	Putranjiva	Tree	Putranjivaceae
139	*Rauvolfia serpentina* (L.) Benth.	Sarpagandha	Shrub	Apocynaceae
140	*Rauvolfia tetraphylla* L.	KhotiSarpagandha	Shrub	Apocynaceae
141	*Redermachera xylocarpa* (Roxb.)	Khadsing	Tree	Bignoniaceae
142	*Ricinus communis* L.	Erand	Shrub	Euphorbiaceae
143	*Rosa indica* L.	Gulab	Shrub	Rosaceae
144	*Roystonea regia* (Kunth)	Royal palm	Tree	Arecaceae
145	*Santalum album* L.	Chandan	Tree	Santalaceae
146	*Sapindus emarginatus* Vahl.	Ritha	Tree	Sapindaceae
147	*Saraca asoca* (Roxb.) Willd	Sita Ashok	Tree	Fabaceae
148	*Schleichera oleosa* (Lour.) Merr.	Kusum	Tree	Sapindaceae
149	*Senna siamea* (Lam.) Irwin	Kasod	Tree	Fabaceae
150	*Simarouba glauca DC.*	Laxmi-Taru	Tree	Simaroubaceae
151	*Spathodea campanulata* Beauv.	Pichkari	Tree	Bignoniaceae
152	*Sterulia urens* Roxb.	Bhutya	Tree	Sterculiaceae
153	*Syzygium aromaticum* L.	Lawang	Tree	Myrtaceae
154	*Syzygium cumini L.*	Jambhul	Tree	Myrtaceae
155	*Tabernaemonta nadivaricata* (L.)	Tagar	Tree	Apocynaceae
156	*Tamarindus indica* L.	Chich	Tree	Fabaceae

157	*Tecoma stans* (L.) Juss. ex Kunth	Ghanti Ful	Tree	Bignoniaceae
158	*Tecomella undulata* G. Don	Raktarohida	Tree	Bignoniaceae
159	*Terminalia arjuna* (Roxb.)	Arjun	Tree	Combretaceae
160	*Terminalia catappa* L.	Deshi Badam	Tree	Combretaceae
161	*Terminalia chebula* Retz	Hirda	Tree	Combretaceae
162	*Tinospora cordifolia* (Willd.)	Gul Vel	Shrub	Menispermaceae
163	*Tridax procumbens* L	Kadimodi	Herb	Asteraceae
164	*Tylophora asthmatica* (Burm. f.)	Dam Vel	Climber	Asclepiadaceae
165	*Uraria picta* (Jacq.) DC	Prishniparni	Herb	Fabaceae
166	*Vitex negundo* L.	Nirgudi	Shrub	Lamiaceae
167	*Vitex negundo* L.	Kali Nirgudi	Shrub	Lamiaceae
169	*Withaniasomnifera*(L.) Dunal	Ashwagandha	Shrub	Solanaceae
170	*Woodfordia fruticose* L.	Dowari	Shrub	Lythraceae
171	*Zingiber officinale* Roscoe	Adrak	Herb	Zingiberaceae
172	*Ziziphus jujuba* Mill.	Bor	Tree	Rhamnaceae

Diagram 1: Distribution of plant according to their Habitat.



This data emphasizes that the campus supports a diverse range of plant life, all thriving due to favourable environmental conditions. The predominance of certain tree species, such as *Azadirachta indica*, *Dalbergia sissoo*, *Butea monosperma, Spathodea campanulata*, and *Delonix regia* suggests that they are particularly well-suited to the local climate and soil. A smaller number of exotic species present at the study site. The area was covered by the highest percent of mature woody tree species is more as compared to saplings followed by shrub, herbs, climbers and grasses. The area comprises endangered species *Terminalia arjuna, Celastrus paniculatus, Tinospora cordifolia* with higher medicinal importance and traditional use.

Conclusion:

The campus area boasts a rich diversity of plant species. Floristic diversity and its structural composition are very much important for campus beautification and in creating a serene and visually appealing landscape that fosters a conducive atmosphere for learning and recreation.The presence of diverse plant species not only adds to the aesthetic value of the campus but also plays a vital role in soil conservation, carbon sequestration, and the reduction of air pollution. Furthermore, such diversity helps mitigate the impacts of climate change and provides educational opportunities for students and researchers to study native flora and ecosystems. In essence, the floristic diversity and its structural composition are fundamental to both the environmental sustainability and the visual charm of the campus.The diversity is a vital asset, but the study also stresses the need for conservation strategies to protect these species and ensure the long-term sustainability of the campus ecosystem.

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Isolation and Identification of phytopathogenic fungi from Potato (*Solanum tuberosum* L.)

D. L. Gavande
Department of Botany,
Shri Shivaji Science and Arts College, Chikhli Dist. Buldana.
And
Dr. V. U. Pochhi
Department of Botany,
Shri Shivaji Science and Arts College, Chikhli Dist. Buldana.
And
M. D. Kolte
Department of Botany,
Shri Shivaji Science and Arts College, Chikhli Dist. Buldana.

ABSTRACT

The aim of the present study was to isolate and identify phytopathogenic fungi from Potato. The infected plant materials (i.e. Tuber, Root, and Stem & Leaves) were collected from potato field and the fungal species were isolated on potato dextrose agar (PDA) medium. Isolation yielded four fungal isolates belonging to four different genera. Identification is based on macroscopic and microscopic examination on the basis of their morphological character/fungal colony and their mycelium and conidia respectively. Pathogenicity tests were conducted on potato. The inoculations on Solanum tuberosum revealed that Alternaria solani induced early blight on leaves while Fusarium oxysporium induced wilting symptoms on the roots, Rhizoctonia solani produced black scurf on tubers and Fusarium spp. produced dry rot of tubers.

Keyword: Phytopathogenic fungi, PDA, Mycelium, Conidia, Wilting, Black Scurf, Early blight, Dry rot.

Introduction:

Potato (*Solanum tuberosum* L.) is the most important non-cereal food crop for human consumption and has the potential to significantly improve food security in poor countries (FAOSTAT 2019). Its diversified distribution pattern and widespread cultivation as a cash crop in regions with high levels of hunger and malnutrition make it a worldwide crop for sustainable food availability (Haverkort*et al*., 2013; Devaux *et al*., 2020; Lal *et al*., 2020a). The Food and Agriculture Organization (FAO) declared 2008 as the International Year of the Potato (FAOSTAT 2019). Potatoes are currently grown on 19 million hectares, with a global yield of 388 million tons per year.Fresh potatoes are consumed as a staple food by around 1.3 billion people in India and China (50 kilograms per person per year). Potato production in the developing world has consistently increased faster than in

affluent countries, indicating its importance as a source of food, income, and employment, particularly in Asia, Africa, and Latin America (Devaux *et al*., 2020). Potato breeders' primary goal is to increase productivity and improve nutrient quality, while also minimizing field losses due to pests, diseases, and severe environmental conditions, as well as improving post-harvest management.Poor crop and post-harvest management, field and storage diseases, frost, and severe rainfall are among the most significant causes of production loss and nutritional profile deterioration in potatoes (Delgado *et al*., 2017; Lal *et al.*, 2020b; Tiwari *et al*., 2020a). More than 40 diseases, including viruses, fungi, nematodes, insects, and bacteria, cause harm to potatoes' foliar portions and tubers (Fiers*et al*., 2012; Kumar *et al.*, 2019, 2020).

The present study designed to isolate and identify the fungal pathogens associated with *Solanum tuberosum* L. Specific objectives include: (1) to isolate and identify fungal species associated with Potato crops using different methods and morphological characters and (2) to test pathogenicity of the fungal species.

Materials and methods

The diseased materials were collected in sterile polythene bags from several potato crop fields in the Jalna district's Bhokardan region. After treating the infected potato tubers, leaf and roots with 70% (V/v) ethanol for 2-3 seconds and a 0.1% (w/v) mercuric chloride solution for 3-5 minutes, the tubers and infected sections were chopped into small pieces and rinsed 3-4 times with neutral distilled water. The fungi were allowed to develop on the diseased portions of the leaves and tuber by placing them in a moisture chamber for 2-3 days. The mycelium of the fungus was transferred to PDA plates and incubated for 3-5 days to allow for full sporulation growth. Each plate was grown in triplicate to ensure complete isolation and purification of the plant pathogenic fungi from microscopic photo plates. (Pawar D. S. Nasreen Sahera 2016).

Preparation of media:

Composition of PDA:

Potato	200gm
Dextrose	20gm
Agar-agar	20gm
Distilled water	1000ml
PH	6-7

Preparation of media

Potatoes were peeled and sliced and then weigh 200g, add it to a beaker with the water and bring it to a boil until the water turns whitish. Next, strain the mixture through muslin cloth, add 20g of dextrose, and stir well before heating it. Finally, add 20g of agar-agar and stir well to make a volume of 1000ml, sterilize it, and use it for pouring and isolating fungi.

Isolation and identification of fungi

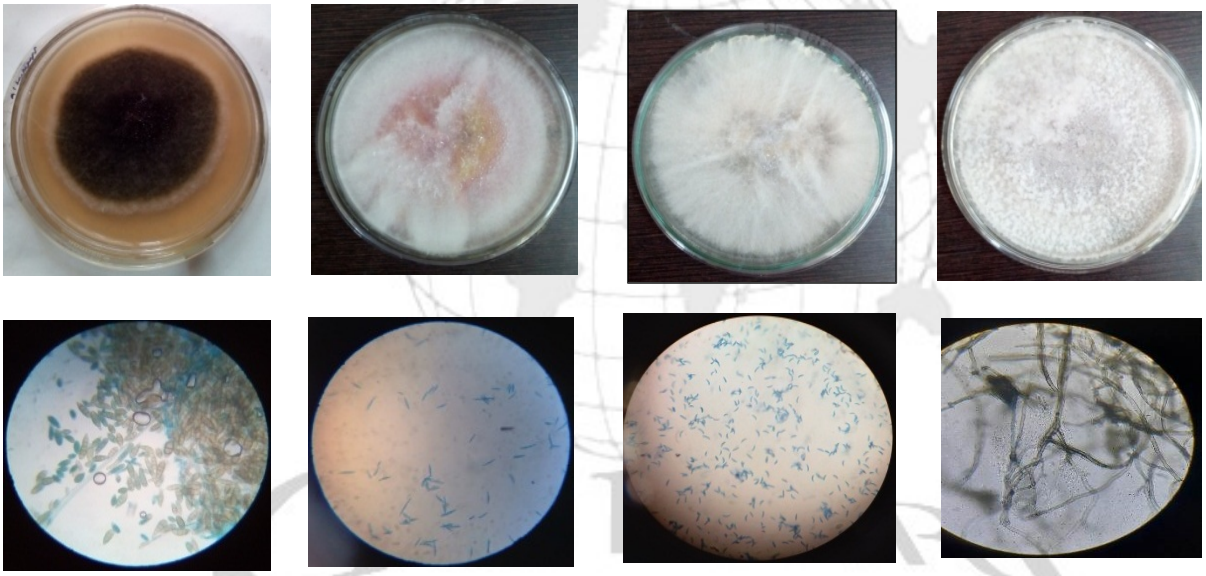
Isolation of fungi on PDA medium and identified by slide culture method in which directly

inoculating micro-fungi on a small square of agar medium and by using most recent identification keys. (Pawar D. S. Nasreen Sahera 2016).

Observation

Following Fungal species were identified by lacto phenol cotton blue technique using the manual of fungi:

Sr.No.	Name of Fungal Pathogen	Isolation from (Plant Part)	Disease Name
1.	*Alternaria solani*	Leaf	Early blight
2.	*Rhizoctonia solani*	Tuber	Rhizoctonia Canker/ black scurf
3.	*Fusarium oxysporum*	Roots	Fusarium wilt
4.	*Fusarium Spp.*	Tuber	Fusarium dry rot



Alternaria *Fusarium* *Fusarium oxysporum* *Rhizoctonia solani*

Photo plate: - Isolation of Fungi on PDA media and microscopic examination

Result and Discussion:

The result of this study is four Fungal pathogens were isolated and identified that are *Alternaria solani, Rhizoctonia solani, Fusarium oxysporum* and *Fusarium Spp.*In Pathogenicity test revealed that these fungi are responsible for, Early blight, Rhizoctonia canker/Rhizoctonia black scurf, Fusarium wilt, and Fusarium dry rot diseases respectively.Which is similar to other workers finding like, Fusarium is the source of potato dry rot, a deadly fungal disease that occurs all over the world. Soil and seed-borne inoculum can harm plants in the field, but the most significant damage occurs during storage. Dry rot affects the crop stand by preventing the formation of potato sprouts and causing losses of up to 25%, with infection reaching 60% during storage (Wharton *et al*., 2007).Potato wilt also produced by *Fusarium* species such as *F. oxysporum f. sp. tuberosi, F. solani, and F. sambucinum* is a vascular disease (Nelson *et al*., 1981; Daami-Remadi and El Mahjoub 2004). This pathogen enters potatoes by the roots and then settles in the xylem arteries of the stems, resulting in unilateral leaf

Yellowing, chlorosis, vascular discoloration, stunting, wilting and finally death. It also causes necrosis at the lower leaves (Hwang and Evans 1985; Kucharek *etal*., 2000). *Rhizoctonia solani* (Teleomorph; *Thanatephorus cucumeris*) is the most damaging potato pathogen among all soil-borne fungus (Ahmad *et al*., 1995), causing black scurf, root rot, stem canker, and damping-off disease complexes in the potato crop (Bains *et al*., 2002). *Alternaria solani* is a filamentous fungus that causes the early blight disease and leads to significant yield losses in potato crops (Suganthi *et al*., 2020; Meno *et al*., 2021, 2022).

Conclusion

The four funguses which were isolated from potato plants were very effective in destruction of the plant and found that the production of the potatoes was reduced due to the infection.

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Phytochemical Analysis of Opuntia Plant Leaf and Use on Herpes zoster Disease.

S. D. Shelke
Shri Shivaji Science and Art's college, Chikhli
And
P. S. Deshmane
Shri Shivaji Science and Art's college, Chikhli
And
Prof. Dr. V. U. Pochhi
Shri Shivaji Science and Art's college, Chikhli
And
Prof. D. L. Gavande
Shri Shivaji Science and Art's college, Chikhli
And
Prof. M. D. Kolte
Shri Shivaji Science and Art's college, Chikhli

ABSTRACT

Opuntia plant leaf also known as a prickly pear cacti are modified into spines to protect the plant from grazing animals and excessive transpiration. These spines are difficult to remove from human skin. In opuntia, the stem is modified into a flattened green structure to perform the function of leaves. Opuntia plant is used to treat chronic disease such as diabetes, obesity, cardiovascular diseases and cancer. In the present work phytochemical studies were performed. Phytochemical analysis recorded positive result for alkaloids, flavonoids, Tannins, Phenolic compound, saponins and foam. The result of these studies revealed most valuable information and also supports the continued sustainable use of plants in traditional systems of medicine.

Keywords: *Opuntia* Plant leaf, Phytochemical analysis, Herpes zoster disease.

Introduction:

Opuntia plant commonly known as prickly pear cactus, belong to the Cactaceae family. It is widely distributed in Mexico and Africa as well as in all American hemispheres and in the Mediterranean basin (Zorgui*et al*., 2009). *Opuntia* plant has a fresh pod, which is the stem and is also known as cladodes. The property of cladodes exhibits on interesting growth with its resistance to extreme droughts and climate. (Pareek *et al*., 2006). Cactus plant of the Cactaceae family has been used since of many years as a source of food. This plant is mainly known for its edible, nutritionally rich sweet fruit, but cladodes are also consumed, as fresh green vegetable & Salad (Pareek *et al*, 2006). The *opuntia* plant (*Opuntia ficus-indica*) has been used as a source of vegetal nutriments & traditional medicine in many countries. (Abd El-Razeket*et al.*, 2018).It has been

reported that the extract of stems and fruits of cactus exhibits antioxidant properties (Utkarsh at al., 2010). Foral on period of time, plants have been a valuable source of natural products for maintaining animal health & human health. The use of plant compounds for pharmaceutical purposes has gradually increased in India. According to world health organization medicinal plant may be considered as the richest bio sources of drugs and widely used for traditional systems of medicine.

Material and Method:

Collection of Plant Material:

The leaf of *Opuntia* plant was collected from local areas of Buldhana district. The *Opuntia* plant leaf are washed thoroughly with tap water and dried in sunlight and form powder of opuntia leaf. The extractions of plant material by using various organic solvents were used for the extraction of bioactive compound. The *Opuntia* plant leaf powder extracted with petroleum ether, benzene, acetone and water.

Preparation of solvent extract:

For the extraction of *Opuntia* plant leaf: 10 gm of opuntia leaf dried powder were added in different 100ml of solvent that are solvent is petroleum ether, acetone benzeneand water for 24 hours, then extract was filtered through the filter paper.

Qualitative Analysis of *Opuntia* Plant Leaf

The concentrated extracts were subjected to Qualitative test for the identification of various phytochemical constituents.

Test for Alkaloids:

Mayer's test: Few mL filtrate + 1-2 drops of Mayer's reagent along the side of test tube. They occur a creamy white / yellow precipitate then indicating positive test

Test for Flavonoids: -

Alkaline reagent Test: 1 ml extract and 2 ml of 2% NAOH solution and Few drops of dil. HCL. An intense yellow color, becomes colorless an addition of diluted acid then indicating positive test.

Test for Tannins:

10% NaOH test: 0.4 mL plant extract and 4mL 10% NaOH then had shaken well. Formation of emulsion than indicating positive test.

Test for Phenolic compound:

Ferric chloride test: - Extract aqueous solution and few drops 5% Ferric chloride solution. Dark green/bluish black color indicating positive test.

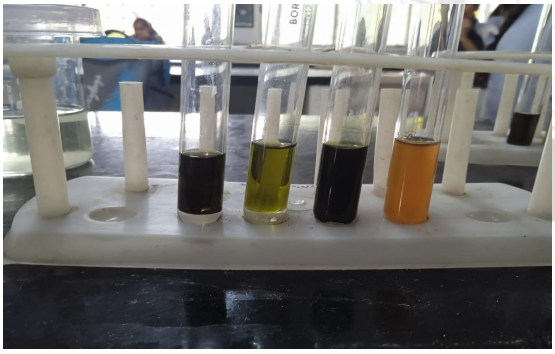
Test for Saponins:

Foam test: Shaken well this test tube. The foam is forming them indicating positive test.

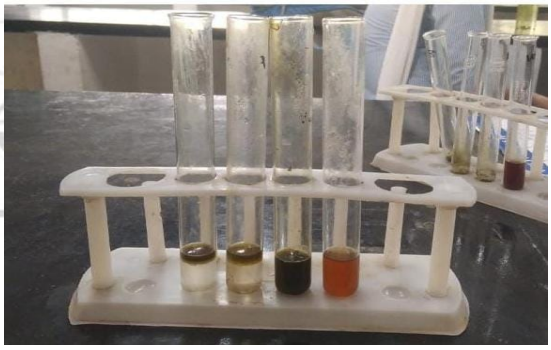
Observation

Qualitative chemical examination of various extracts. (Obtained by successive solvent extraction of plant material) *Opuntia* plant leaf (+ve = Present and -ve = absent)

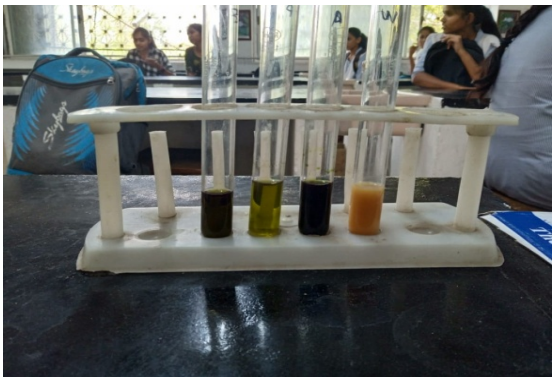
Plant parts	Test	Reagent used	Petroleum Ether	Benzene	Acetone	Water
Leaf of *Opuntia* plant	Alkaloids	Mayer's Reagent	+ve	+ve	-ve	-ve
	Flavonoids	Alkaline Reagent	+ve	+ve	-ve	+ve
	Tannins	10% NaOH Test	+ve	+ve	-ve	-ve
	Phenolic compound	Ferric Chloride solution Test	+ve	+ve	+ve	-ve
	Saponins	Foam Test	+ve	+ve	-ve	-ve



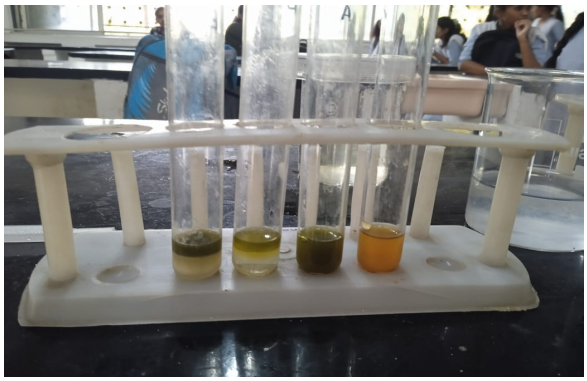
Alkaloids test



Tannins test



Phenolic compound test



Flavonoids test

Result and Discussion:

Alkaloids: It is found that concentration of alkaloids has been extracted in petroleum ether and benzene extract andthis is evident from the positive test with Mayer's Reagent. Acetone and water extract has shown negative test for Alkaloids.

Flavonoids: It is found that concentration of flavonoids have been extracted in petroleum ether, Benzene and water extract and this is evident from the positive test with Alkaline Reagent. Acetone extract has shown negative test for flavonoids.

Tannins: It is found that concentration of tannins have been extracted in petroleum ether and benzene extract and this is evident from the positive test with 10% NaOH test.Acetone and water extract has shown negative test for tannins .

Phenolic compound: It is found that concentration of phenolic compounds has been extractedin petroleum ether, Benzene and Acetone extract and this is evident from the positive test with ferric chloride solution test. Water extract has shown negative test for phenolic compounds.

Saponins:

Saponins have been extracted in petroleum ether and Benzene extract and this is evident from the positive test with foam test. Acetone and water extract has shown positive test for saponins.

Alkaloids, Tannins and Saponins are found in a petroleum ether and benzene extract. Flavonoids are found in Petroleum ether, Benzene and Water extract. Phenolic compounds occur in Petroleum ether, Benzene and Acetone extract. It is similar to other workers finding like the presence of the primary antioxidants, flavonoids, tannins and phenols in abundance may indicate strong radical scavenging properties against free radicals. (Mayer, R., & Shandro, A., 1997).

Conclusion:

We conclude that, *Opuntia* plant leaf has found alkaloids, tannins, flavonoids, saponins and phenolic compound in Phytochemical analysis.These compounds contain antioxidant, anti-proliferative, anti-inflammatory properties that can help minimize redness and inflammation of skin.

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Phytochemical Analysis of Selected Plants Species and Antifungal Activity of *Catharanthus roseus & Cassia auriculata*

M. D. Kolte
Department of Botany, Shri Shivaji Science & Arts College, Chikhli
And
V. U. Pochhi
Department of Botany, Shri Shivaji Science & Arts College, Chikhli
And
D. L. Gavande
Department of Botany, Shri Shivaji Science & Arts College, Chikhli
And
Y. R. Sonwane
Govt. Institute of Science, Aurangabad

ABSTRACT

The present study aimed that phytochemical screening & their antifungal activity of some selected plant against selected plant pathogenic fungi. In this study we select Catharanthus roseus, Cassia auriculata, Ocimum americana, Parthenium hysterophous, Calatropus procera, and Mentha arvensis for the phytochemical screening plant material. This plant material shade dried for further extraction, by using soxhlet method. We prepared plant extract in aqueous form & then perform the phytochemical screening. In present study we found that all the plants having Tannin, Saponin, Alkaloids & Phenolic compound, in some plant Flavonoids &Terpenoids are absent as well as we also carried out antifungal activity of two plants species against plant pathogenic fungi Alternaria solani and Fusarium oxysporum but it does not show inhibition activity against plant pathogenic fungi.

Keywords: Phytochemical Analysis, Antifungal Activity, *Catharanthus roseus, Cassia auriculata*

Introduction:

Plants generally produce many secondary metabolites which constitute an important source of microbicides, pesticides and many pharmaceutical drugs. Plant products still remain the principal source of pharmaceutical agents used in traditional medicine (Sharma *et al*., 2012).Fungi are the most common cause of plants diseases and they are widespread and very destructive to both plants and humans.The use of chemical pesticides is the most common method for the control of various fungal diseases of fruit and vegetables (Olakunle *et al*., 2019).Plant diseases can be checked completely using synthetic fungicides but due to residual toxicity, environmental pollution and development of resistance in the pathogens it is essential to improve the treatment methods so that these problems can be coped (Fankam *et al*., 2014).

Therefore, investigators are seeking safer alternatives to replace synthetic compounds used as fungicides and preservatives. Environmentally friendly antifungal agents, such as plant extracts have shown great potential to replace synthetic products due their low cost, local availability, lack of toxicity and biodegradability (Caroline Alves Breda *et al*., 2016). Plants generally produce many secondary metabolites which constitute an important source of microbicides, pesticides and many pharmaceutical drugs. Plant products still remain the principal source of pharmaceutical agents used in traditional medicine (P. Sharma *et al*., 2012).

The aim of the present study is to phytochemical screening of plant andinvestigation of theantifungal properties of *Cassia auriculata* and *Catharantus roseus* (Crude Aqueous extract of leaves) against plant pathogen causing plant disease. The phytochemical screening of the leaf extracts was performed on the strains of plant pathogenic fungi *Alternaria solani* and *Fusarium oxysporum.*

Materials and Methods:

Plant Collection

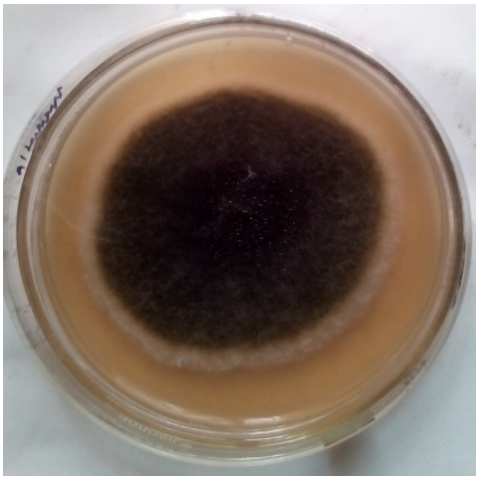
The leaves of *Catharanthus roseus, Cassia auriculata, Ocimum americana, Parthenium hysterophous, Calatropus procera* and *Mentha arvensis* were collected from government institute of science campus and dried in shade for aweek.

Preparation of extract:

Different extracts of *Catharanthus roseus, Cassia auriculata, Ocimum americana, Parthenium hysterophous, Calatropus procera,* and *Mentha arvensis* were prepared. Initially, mature fresh leaves were washed first in sterilized distilled water,followed by washing in mercuric chloride solution (0.1%) and again washed in sterilizeddistilled water and shade dried in weak. Leaf material was weighed and transferred on to a sterile mortar and pestle to make a crude crushing of the material, following which it was transferred on to a sterilehomogenizer and finely crushed. About 30 grams of coarsely powdered plant material was exhaustively extracted for 6 hrs with 300 ml of water solvents individually at their boiling pointtemperature in soxhlet apparatus. The solvents used for extraction was water. The extracts obtained were filtered and evaporated under reduced pressure using Rota-vapour. The extracts were dissolved in dimethyl-sulphoxide (DMSO) to make the final concentrations which were kept in refrigerator till used (Mohamed Sham Shihabudeen *et al*., 2010).

Isolation and identification of test organism

In the present study test organisms are theplant pathogenic fungi *Alternaria solani* and *Fusarium oxysporum* was obtained from different plant source. The test organism, *Alternaria solani* was obtained from the plant *Solanum tuberosum* and another test organism, *Fusarium oxysporum* obtained from *Lycopercicum esculentum*, to investigate the antifungal activity.Thetest organism can identify up to the species level on the basis of their morphological characters.



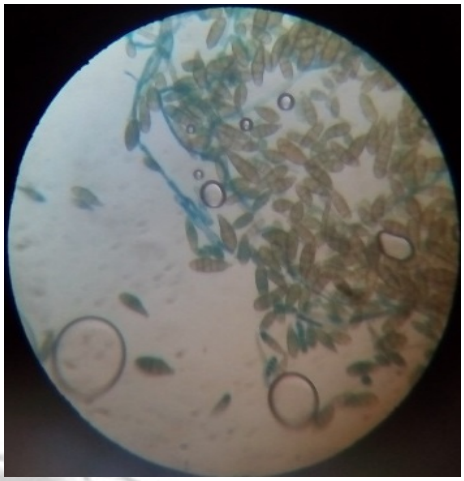


Fig: Colony characteristic of*Alternaria solani* **Fig: Spores of *Alternaria solani***

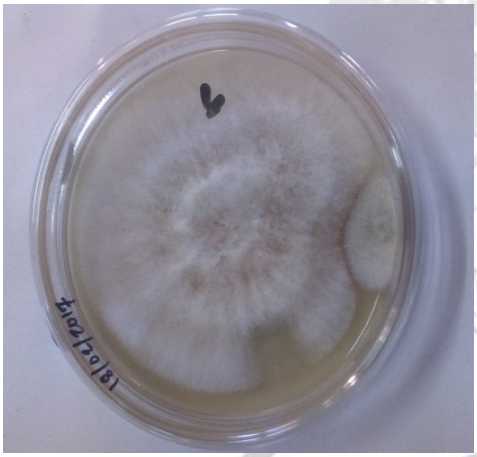


Fig: Colony characteristic of *Fusarium oxysporum.* **Fig: Spores of *Fusarium oxysporum.***

Preparation of media

The 200gm peeled potatoeswere cut into small pieces. They were addedto beaker along with distilled water and boiledtill the colour of water turn whitish.It was then filtered by muslin cloth and to it was added 20gm of dextrose with constant stirring. Then after 20gm of Agar-agar was added and heated to dissolve the agar completely. Finally, the volume was made to 1000ml by adding sterilized distilled water. It was used for isolation of fungi.

Preparation of well Diffusion:

The wells were made using cork borer on agar plate. The borer was dipped in the alcohol for sterilization and then was used to make wells. Plates were used for the zone of inhibition test.

Inoculum test:

Optimally within 5 minutes after solidification of agar medium, the suspension of test organism was inoculatedinto plate containing agar medium with the help of sterilized cotton. It was mixed well and poured into plate which wasthen rotatedfor even distribution. After the inoculation of the test organism the plant extract was poured in the well.

Preliminary Phytochemical Analysis

Phytochemical screening of plant extracts was done following the standard procedure (Mehta Kavit. et al.2 013).

a) Test for Tannins:

About 2 ml of the aqueous extract was stirred with 2 ml of distilled water and few drops of FeCl3 Solution were added. Formation of green precipitate was indication of presence of tannins.

b) Test for Saponins:

5ml extract solution was mixed with 5ml of distilled water in a test tube and was shaken vigorously. The formation of stable foam was taken as an indicationfor the presence of Saponins.

c) Test for Flavonoids:

To 1 ml of aqueous extract, 1 ml of 10% lead acetate solution was added. The formation of a yellow precipitate was taken as a positive test for flavonoids.

d) Test for Terpenoids:

5ml of aqueous extract was mixed with 2ml $CHCl_3$ in test tube to which 3ml conc.$H_2SO_4$was added carefully. The reddish-brown colour shows presence of terpenoids.

e) Test for Alkaloids:

3 ml aqueous extract was stirred with 3 ml of 1% HCl on steam bath. Mayer and Wagner's reagent was then added to mixture. Turbidity of the resulting precipitate was taken as evidence for the presence of alkaloid

f) Test for Phenols:

2-3 ml aqueous extract was added in few drops of 5% frcl3 form a deep blue black colour. Phenols present.

Result & Discussion

The preliminary phytochemical screening of various extracts for the presence of Alkaloids, Terpenoids, Tannins, Flavonoids, Saponins and Phenolic compounds are shown in the table.

Phytochemical Analysis

Plant Name	Tannins	Saponins	Flavonoids	Terpenoids	Alkaloid	Phenol
Catharanthus roseus	+	+	+	+	+	+
Cassia auriculata	+	+	+	-	+	+
Ocimum americana	+	+	-	-	+	+
Parthenium hysterophous	+	+	-	+	+	+
Calotropis procera	+	+	-	-	+	+
Mentha arvensis	+	+	-	+	+	+

(Present + Absent -)

The study which was carried out on the "*Catharanthus roseus*" showed the presence of bioactive compounds which are important both biologically as well as medicinally (M Amin Mir *et al*., 2010).*Cassia auriculata* revealed for the presence of alkaloids,flavonoids, glycosides, proteins, saponins, tannins, phenols and terpenoids (Narayana *et al*., 2001)

Antifungal activity *Catharanthus roseus* & *Caccia auriculata*

The antifungal activity of *Catharanthus roseus* & *Caccia auriculata* were determined by agar well diffusion method atthe concentration of 100µl against the test organisms. It does notshowany inhibitionactivity against *Alternaria solani* and *Fusarium oxysporum.* Kumari *et al*., (2013) evaluated phytopotential of *C. roseus* against various pathogenic microbes. In this study, *C.roseus* aqueous leaf extract was not effective against *Fusarium Spp.*Shagufta Naz *et al*., (2015) it has been reported that methanolic leaf extract was not effective against *Alternaria solani. Caccia auriculata* leaf and flower extractdo not show any activity against fungal strains C. *albicans* and *A. niger*. (Subhadra devi *et al*., 2011).

Conclusion:

The results obtained from this work showed that the aqueous extract of all selected plants contains Tannin, Saponin, Alkaloids and Phenolic compound.In some plant Flavonoids &Terpenoids are absent. Present study also suggests that the aqueous extracts of *C.auriculata and C.roseus* did not show any inhibitory activity against *A.solani* and *F.oxysporum.*

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Phytochemical Analysis of *Bombax ceiba* Thorn Extract

S. G. Jadhao
Department of Botany
Shri Shivaji Science and Arts College, Chikhali, Dist. Buldhana
And
P. J. Solanki
Department of Botany
Shri Shivaji Science and Arts College, Chikhali, Dist. Buldhana
And
Prof. Dr. V. U. Pochhi
Department of Botany
Shri Shivaji Science and Arts College, Chikhali, Dist. Buldhana
And
Prof. D. L. Gavande
Shri Shivaji Science and Arts College, Chikhali, Dist. Buldhana
And
Prof. M. D. Kolte
Department of Botany
Shri Shivaji Science and Arts College, Chikhali, Dist. Buldhana

ABSTRACT

Bombax ceiba is a large decidous tree found in tropical and subtropical regions of Asia, Africa and Australia. Traditional system of medicine such as Ayurveda, Siddha and Unani have been highlighted use of B.ceiba parts (bark , leaves , flowers, throns) for treatment of numerous aliments like algesia, hepatotoxicity, hypertension, HIV infection, fever, dysentery, inflammation, catarrhl affection, ulcer, acne, and urinary infection. The physicochemical properties were determined by phytochemical tests. From the Phytochemical analysis we found that B.ceiba thorn have Alkaoid, Terpinoids, Tannin, Flavonoid, Anthocyanin, Phenolic, Saponin, Carbohydrate.

Keywords: *Bombax ceiba,* Acne, Phytochemical

Introduction:

Traditional medicines play a crucial role in treatment services all around the world. From the Ancient era of human civilization all over the globe relies on plants for curing different health issues. Scientists and medical professionals showed increased interest in this field as they established the real health benefits of these treatments. (Pranabesh Ghosh *et al*., 2019).

Secondary metabolites are those which are needed for the survival of the plants in a harsh environment. They form the smell, color and taste of the plants and secondary metabolites such as

flavonoids, tannins, saponins,alkaloids, steroids, phytosterols are found to have other commercial applications like they can be used ascolouring agents, as drugs as flavouring agents, insecticides, pesticides, anti-bacterial and antifungal products. Moreover, they can also be used to protect humans from many diseases like cancer, diabetes, cardiovascular diseases, arthritis and aging etc. (Vishnu Balamuruganet *al*., 2019).

Phytochemical are the chemical that present naturally inplant. Now a day's these Phytochemical become more popular due totheir countless uses Phytochemical play a vital role against number of diseases such as HIV infection, inflammation, fever, catarral affection, acne and urinary infection etc. Unlike pharmaceutical chemical cure diseases without causing any harm to human being these can also be considered as man-hiendly medicine (K. Sahirabanu 2015).

Thorns or spines are small, sharp structural outgrowth of the epidermis or bark in plants, which either have physiological or anatomical advantages. In xerophytic plants, they are simply the modified leaves to prevent water loss and conserve water for an extended time in dry and harsh conditions.Apart from these advantages, protection of plant from grazing animals is a crucial role played by these thorny structures (Manish A. Kamble *et al*., 2017).

Analysis of the phytochemical properties of the medicinal plants used to show and isolate the drug, lead compounds and components from the parts of the plant. The unique biological activity of the plants can be identified by their phytochemical's properties. Most parts of the plants used for the analysis of the phytochemical properties were leaves, roots, stem barks, and fruits. In this review, medicinal plants were investigated for phytochemical constituents of ethanol, methanol, chloroform, acetone, hexane, petroleum ether, ethyl acetate, and aqueous (water) extraction of different phytochemicals (Misganaw Gedlu Agidew, 2022).

Material and Method:

Collection of Plant Material:

The thorn of *Bombax ceiba* were collected from local area ofBuldana district in the month of august. *Bombax ceiba* is tree occur in non-cultivated land along with road side. Thorn was drying at room temperature for 1week. After drying plant material grinded to make fine powder. Then transfer into labeled 4 conical flasks.

Preparation of solvent extract:

For the extraction 10 gm. of dried powder were added in the different 100ml of solvent that is water, petroleum ether, acetone and ethanol for 24hr. the extract was then filtered through filter paper.

Qualitative Analysis of Bombax ceiba thron extract

Test for Alkaloids

Wagner'stest: Few ml filtrate added 1-2 drops of Wagner's reagent along the the side of test tube. The resulting reddish/brown precipitate indicates positive test for alkaloids.

Test for Tanin

Braymer's test: In a 1ml filtrate add 3ml distilled water and 3 drops of 10% ferric chloride solution blue green color solution occur.

Test for Terpinoides

In a 2ml chloroform add 5ml plant extract (evaporated on water bath) and add 3ml conc. H_2SO_4 (boiled on water bath). A Gray color solution forms.

Test for Flavonoids

Alkaline reagent test: In 1ml extract add 2ml of 2% NAOH solution add few drops of dil. HCL. Formation of intense yellow colour solution, becomes colourless on addition of dil.HCL.

Test for Anthocyanin

In 2ml of plant extract add 2ml of 2N HCL. Observe appearance of pink-red solution.

Test for Phenol

Few drops of 5% ferric chloride solution added in aq. Extract solution appearance of dark green/bluish green colour indicated presence of phenol.

7. Test for Saponins

The small quantity of the sample was taken in a test tube add small amount of sodium bicarbonate honeycomb like foam formation detect presence of saponin.

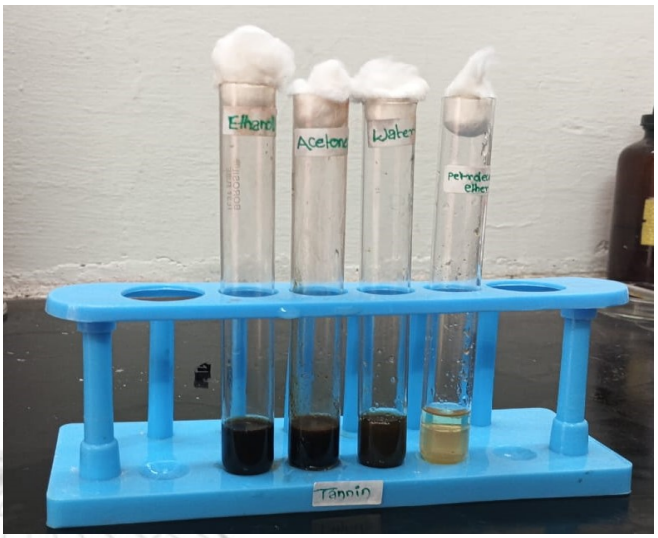
8. Test for Carbohydrates

Benedicts test: In few ml of plant extract in test tube add small quantity of benedict's solution and mix well then boil sample for 2min. and cooled. Red ppt show the presence of carbohydrate

Observation:

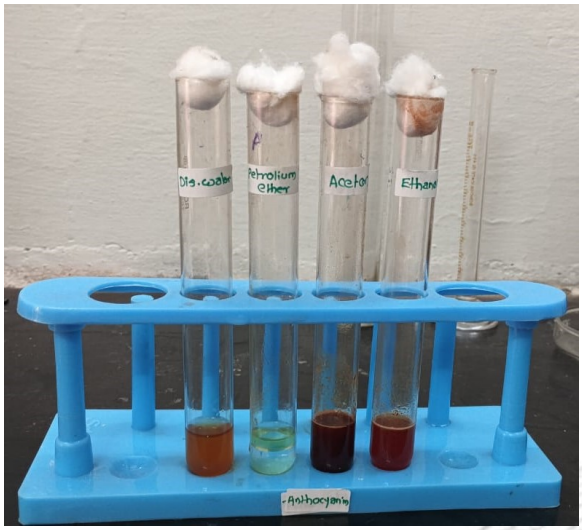
Plant part	***Test***	***Reagent used***	***Dis.water***	***Petroleum ether***	***Acetone***	***Ethanol***
Thorn of Bombax cebia	*Alkaloids*	*Wagner's*	*+ ve*	*-ve*	*-ve*	*-ve*
	Tanin	*Braymer's test*	*-ve*	*-ve*	*+ ve*	*+ ve*
	Terpinoids		*-ve*	*-ve*	*+ ve*	*+ ve*
	Flavonoid	*Alkaline test*	*+ ve*	*+ ve*	*-ve*	*-ve*
	Anthocyanin	*HCL test*	*-ve*	*-ve*	*+ ve*	*+ ve*
	Phenol	*Ferric chloride sol.*	*-ve*	*-ve*	*+ ve*	*+ ve*
	Saponin	*Foam test*	*+ ve*	*-ve*	*-ve*	*+ ve*
	Carbohydrate	*Benedicts test*	*-ve*	*-ve*	*-ve*	*+ ve*

AlkaloidsTest

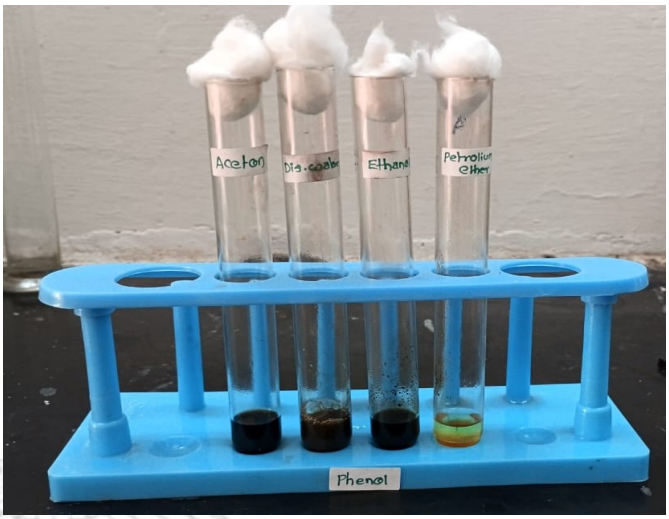


Tanin Test

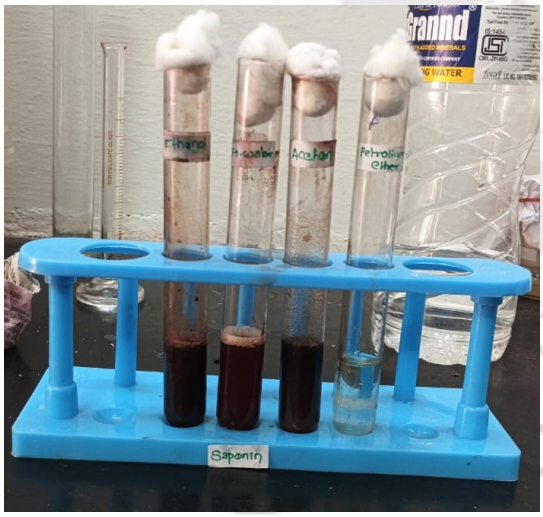
Terpinoid Test Flavonoid Test



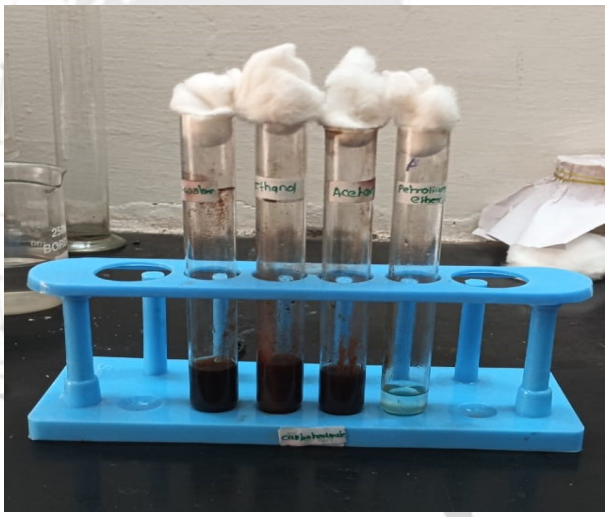
AnthocyaninTest



Phenol Test



Saponin Test



Carbohydrate Test

Result & Discussion:

The aqueous extract of thorn of *Bombax ceiba* showed the presence *of* Alkaloids, Flavonoid and Saponin. In the acetone extract the Terpinoid, Tanin, Anthocyanin and phenol are present. In petroleum ether extract only Flavonoid is present. Terpinoid, Tanin, Anthocyanin, Phenol, Saponin and Carbohydrate shown presence in Ethanol extract.

Conclusion:

The result revealed the presence of medicinally important constituents in wild plants studied. Several studied confirmed the presence of this Phytochemical contribute medicinal as well as physiological properties. Therefore, extract from this plant could be seen as a good source for useful drugs. From above Phytochemical analysis we found that B.ceiba thorn have presence of Alkaloid, Tanin, Terpenoid, Flavonoid, Anthocyanin, Phenol, Saponin, Carbohydrate.

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Comparative Study of Nectar Chemical Composition and Anatomical Characters of *Plumeria sps.*

Ashwini Bhalchandra Phokmare
Department of Botany
Shri Shivaji Arts, Commerce and Science College, Akot

ABSTRACT

The most popular plant reward for pollinators is nectar and also it is having a significant source of energy as it shows chemical composition contains sugar forms such as sucrose, fructose and glucose and various amino acids. This study is aimed to explore a comparative study between Plumeria alba, Plumeria pudica and Plumeria rubra which on investigation showed different morphological and anatomical features and chemical composition. Evidences of presence of amino acids in nectar may increase the fitness benefits in pollinators.

Key Words- Nectar, Sucrose, Thin Layer Chromatography (TLC), Nectar gland, amino acids etc.

1. Introduction-

Plumeria sp. whichis also called white frangipani. *P. alba* features white blooms with yellow centers. It grows at the extremities of its branches and has narrow, corrugated leaves that are evergreen. *P. pudica*, this type features glossy, long, thin, spoon-shaped leaves that are evergreen and white or pink blooms with rounded petals and this kind of *Plumeria sp.*never stops blooming.*Plumeria rubra*, this variety has pinkish red flowers. There are also cultivars with different colors, including orange, ink, yellow, white and multicolored.

These ornamental plants belong to family Apocynaceae selected for the comparative study which includes the quantitative and qualiataive analysis with hand anatomy of nectar gland which secretes nectar. Corbet (2003) gives a useful account of techniques for field measurements of nectar volume and concentration, necessary for collecting data on both standing crop and rate of production. Refractometers are typically used to quantify concentrations; however, for flowers that yield relatively small quantities of nectar, other methods must be used (Kearns & Inouye, 1993; Dafni *et al*., 2005). A semi-quantitative investigation of nectar sugars in 900 angiosperm species was conducted by Percival (1961). According to her research, plant groups with tubular or deep-rooted flowers typically yield nectar that is high in sucrose, while shallow-rooted flowers typically yield nectar that is high in monosaccharides. On a weight-per-weight basis, hexose nectars should evaporate more slowly than sucrose nectars of the same concentration because they include more solute particles, which reduce the solvent's effective concentration (water). (Corbet, 1978). Nicolson, Susan W. (2007) Early on in the growth of flowers, there may be a link between the concentration of nectar and the sugar composition. The production of monosaccharides in nectar is dependent on the availability and activity of several nectary enzyme systems, including invertase.

Nectar is produced from either the sucrose-rich phloem sap or from sucrose generated in the nectary tissue.

2. Material and Method:

Plumeria alba, Plumeria pudica and *Plumeria rubra*, these ornamental plants belong to family Apocynaceae. These ornamental bloomed flowers were collected from different regions of the Akola district such as a campus of Shri Shivaji College, Akot, home garden etc. For the comparative study, the qualitative analysis with anatomy of nectar gland has been done. Qualitative analysis includes sugar and amino acid analysis with the help of TLC methodand hand anatomy has been done with double stating process.

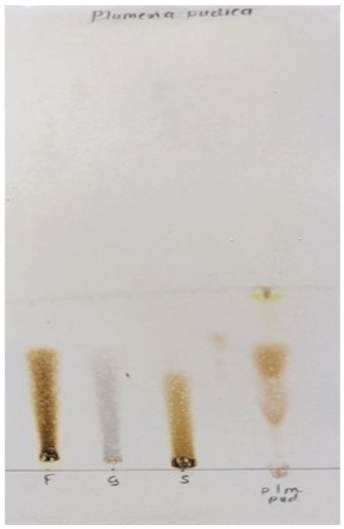
3. Result

3.1. Sugar Analysis- (TLC Photoplates)- Sugar analysis done by TLC method. Table1 provides presence of sucrose, fructose and glucose.

Sr.No.	Species	Fructose	Glucose	Sucrose
1.	*Plumeria alba*	+	-	+
2.	*Plumeria pudica*	+	+	+
3.	*Plumeria rubra*	+	-	+

Chromatograms showing presence of fructose, glucose and sucrose separated from nectar

Plumeria alba



Plumeria pudica

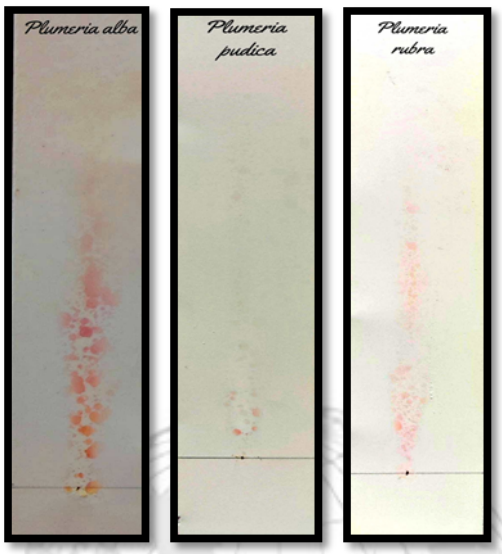
Plumeria rubra

3.2Amino acid Analysis- Amino acid analysis done by TLC method. Table 2 provides presence of various amino acids.

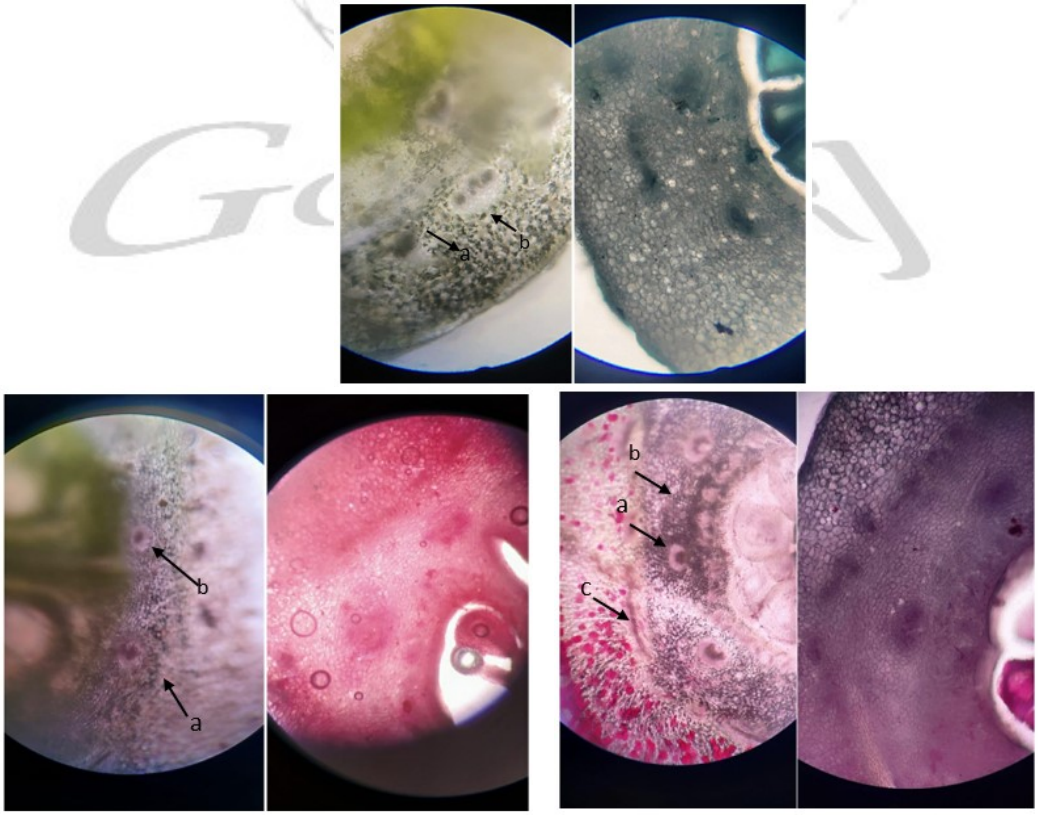
Sr. No.	Name of Plant	Amino Acid
1.	*Plumeria alba*	DOPA, Tyrosine, Histidine, Glutamic acid
2.	*Plumeria pudica*	Am. Butaric acid, Glycin, Aspartic Acid, Histidine
3.	*Plumeria rubra*	Glycin, DOPA, Aspartic acid, Glutamic acid

Chromatograms of separated amino acids extracted from nectar of *Plumeria alba, Plumeria pudica*

and Plumeria rubra



3.3. Anatomical Structure-The nectary parenchyma cells had several plastids, a centrally positioned nucleus, and heavily pigmented cytoplasm. Nectar precursors produced by metabolic activities get past a number of obstacles, including the hydrophobic cuticle, cell wall, and membrane. Through the stomata and cuticle pores, fractures, or detached layer pieces, nectar is secreted onto the nectary surface. Due to capillary pressures and the concentration differential, nectar release through the stomata occurs passively.



Photoplate 1,2,3- a-Parenchyma cell, b-Stomatal cell c- Epidermal cell

4. Discussion:

Morphologically characterizing these types of nectaries is not so straightforward. When the plant organ under examination has additional secretory structures, scanning microscopy is insufficient. The answer lies in histochemical procedures, but many of them require a significant amount of time and work.Caspary conducted the first anatomical study of nectaries in 1848. After researching 64 distinct species, he discovered that the secretion originates from cells rather than vascular bundles. The cells that secrete often have an appearance that is similar to other cells; typically, an epidermis covers them. Many nectaries have elliptical or spherical stomata; however, they are typically only visible when the epidermis is removed. This study showing a comparative study between *Plumeria* species with special reference to anatomy. Here we found sucrose and fructose in all three Plumeria species having various amino acid butfew are commen in two of species.

5. Conclusion-

The present study describes comparative characters within the same species of *Plumeria.* Sucrose and fructose found in all three *Plumeria* species while Glucose found only in *Plumeria pudica.* Glycin and aspartic acid found in *Plumeria pudica* and *P. rubra.* DOPA is common in *P. alba, P. rubra*.anatomical studies shows that nectar gland ring is present at same position same three species having few morphological characterizations.

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Studies on black mold disease in Akola and its control measures on *Brassica oleracea* (Cabbage).

Janjal P. P.
Research Laboratory,
Dept. of Botany, Shri Shivaji Arts and Science College, Chikhli, Buldhana.
And
Dr. V. U. Pochhi
Research Laboratory,
Dept. of Botany, Shri Shivaji Arts and Science College, Chikhli, Buldhana.
And
Waghule A.A
Research Laboratory,
Dept. of Botany, Shri Shivaji Arts and Science College, Chikhli, Buldhana.

Abstract:

Black mold is the most common disease of Cabbage in storage andthe field. The present study was carried out to isolate the fungus associated with the black mold of Cabbage and to control the disease with seven or more different systemic and non-systemic fungicides. Based on morphological characteristics'Aspergillus niger Van Tieghem was found to be associated with black mold of cabbage. It was observed that all the fungicides caused a significant reduction in mycelia growth, lesion diameter, spore germination, and Cabbage severity. Amongst systemic fungicides, carbendazim brought aboutthe highest reduction followed by mycobutanil, respectively. The higher concentrations (1000 ppm and 2000 ppm) of all the fungicides showed more effectiveness than lower concentrations (125 ppm and 500 ppm). The current study showed effective utilization of the control of black Cabbage caused by A. niger.

Keywords: *Aspergillus niger*, black mold, fungicides, cabbage.

Introduction:-

Cabbage (***Brassica oleracea***) is an important commercial vegetable crop in the world as well as in India. It is growing during Kharif and rabbi seasons as animportant part of food, while utilized as salad and also cooked as a vegetable India ranks third in the world in the area of Cabbage cultivation and second in its production, but the productivity is low. The production in India is spread over an area of about 0.33 million hectares with an average annual production of 4.70 million tonnes.

In the Maharashtra region, most of the Nasik and Pune districts' high cabbage production is grown extensively as a main season crop and has become highly economically creative for farmers. Butother crops are attacked by a variety of pathogens in the field and as well as in storage, (Agroone news pepper, 2015).

However, no detailed studies have been carried out to identify the fungus.This causes Cabbage in Vidarbha reason mostly in Akola district. The application of fungicides is one of the most effective control methods for the management of fungal pathogens. Therefore necessity has risen to study the post-harvest fungicidal treatments for the control of black mold in the storage of Cabbage. Therefore present study, "Studies on black mold disease on Cabbage and its control measured," was carried out with the main objective of isolating and identifying the fungal pathogen causing black mold of Cabbagein the field as well as in storage from different areas or localities in Akola district and to work out the management rules for the control of fungal Cabbage with some fungicides.

Preparation of Media:-

Composition of PDA:-

Potato – 200 gm.
Dextrose – 20 gm.
Agar Agar – 20 gm.
Distilled Water – 1000 ml

Preparation of media:-

Peeled the potato & cut it into small pieces & wt. 200gm then add it into a beaker along with distilled water it will be whitish than filtrate by muslin cloth add 20gm dextrose and stir properly heat it for the addition of 20gm agar more the volume 1000 ml then sterilize and use for pouring plate and growth of fungi

Materials and Methods:-

Cabbage Collection:-

The diseased affected Cabbage is collected in the fields, markets, and storage places from different areas of Akola districts.

Isolation Method:-

These collected Cabbage samples are used immediately or stored at 10 ºC or room temperature in the laboratory.The aseptically isolated portions from the Cabbage leaf were purified and maintained on a Potato Dextrose Agar (PDA) medium. The isolated pathogen was identified based on morphological, reproductive, and cultural characteristics.

For the mode of infection, the fungal pathogen was re-inoculated to the healthy Cabbage leaf by different methods as adopted. One set of Cabbage (surface) was sprayed with spore suspension without injury. Another set of Cabbage leaf wasinoculated by introducing the drop of suspension after cutting them with some needles. Un-inoculated worked as control. All the Cabbagewas kept clean, and incubated at 23+ 1ºC for ten days. Afterward, disease symptoms were studied and the identification of the pathogen was determined by comparing it with the original culture.

Chemical control:-

More fungicides, both systemic and non-systemic, viz. carbendazim, myclobutanil, bioethanol, hexaconozole, mancozeb, captan, and zineb were used in different concentrations to control the black mold through food poisoning techniques (Falcke, 1907; Grower and Moore, 1962). The appropriate quantity of each fungicide was separately dispensed in a molten sterilized PDA medium to make the desired concentrations for each fungicide.

The mycelial discs of 5 mm diameter, taken from a 10-day-old culture of the fungal pathogens were aseptically placed in the center of solidified poisoned PDA. Five replications were maintained for each concentration. The Petri-plates were incubated at 24 ± 2°C and observations on the mycelial growth of test fungus were noted after seven days of incubation. The growth of test fungus on non-poisoned PDA served as a control. The percent inhibition in growth due to various fungicidal treatments at different concentrations was computed.

Mycelial growth inhibition (%) = [(dc-dt)/ dc] × 100(%)

Dc = average diameter of fungal colony in control, and

Dt= average diameter of a fungal colony in the treatment group.

Effect of fungicides on lesion diameter

Fresh samples of Cabbage were dipped separately in different fungicidal concentrations for 5 minutes before inoculation of the pathogen by pinprick method as above. Cabbage leaves were then dried under shade and kept in cardboard trays and incubated at 24 ± 2°C for different duration.

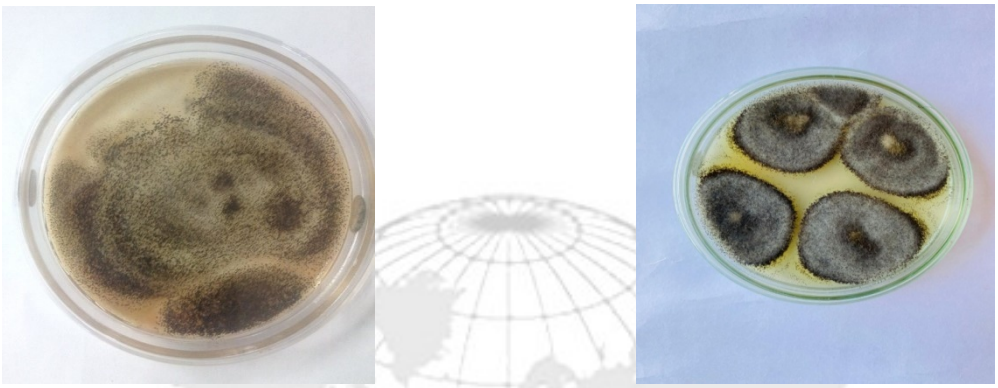
The observations were recorded after 4 days to 10 days of incubation by measuring the average diameter of the resultant lesion.

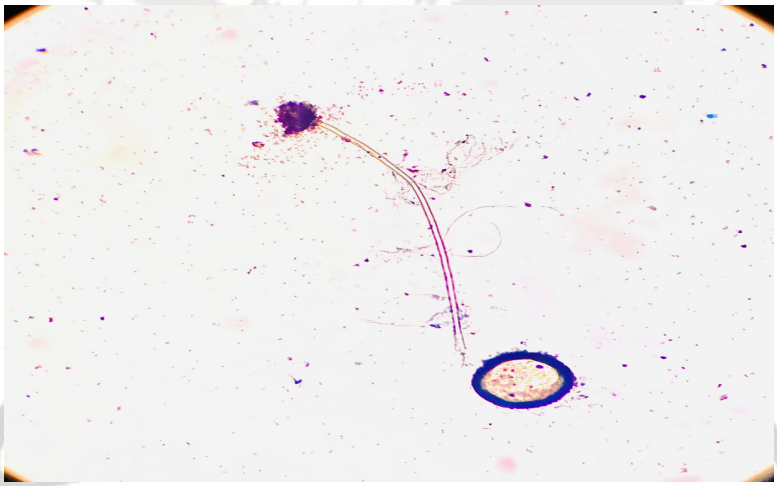
Effect of Fungicides on Cabbage Severity

Different concentrations of fungicides were estimated for their efficiency on Cabbage upper liar severity under storage conditions. The upper layer of Cabbage severity was recorded as per the grade scale and formula adopted by McKinney (1923).

$$\text{Upper Layer CabbageSeverity} = \frac{\text{A sum of all Numerical Rotting}}{\text{No. of Vegetable examined X Maximum grade Value}} \times 100$$

Identification of Isolate:-The pure culture of the fungal isolated was prepared for microscopic observation and identification. The cultural and morphological characteristicsof the isolate were observed end noted end form part of the criteria used for identification. Detail morphology of the fungi such as hyphae in reproductive strata in chain or single. The types of spores etc. were observed and recorded.





Results:-

A. niger was identified as a causal organism of black mold of cabbage. The primary symptom was a black discoloration of tissue on Cabbage. Infected cabbage leaf showed blackening at the neck, in advanced stages, the entire leaf appeared black and became dried up (Plate A). Colonies on Potato dextrose agar (PDA) at 24 ± 2°C were initially white but quickly turned black with conidial production. The mycelium was septet and hyaline. Conidiophores arise from the mycelium. Conidiophores are long (400-3000 µm), smooth, and in a globe's vesicle (30-75 µm in diameter). Metulae and phialides cover the entire vesicle. Conidia are brown to black, very rough, globes and measure 4-5 µm in diameter.

The different concentrations of systemic and non-systemic fungicides evaluated for their effect on the inhibition of mycelia growth, lesion diameter, and disease severity showed a significant reduction in fungi particularly at greater concentrations. All the systemic fungicides at different concentrations brought about significant inhibition in the spore germination. Spore germination was significantly suppressed due to the application of hexaconozole and mancozeb

results.

It was observed from the results that the severity of black mold of cabbage reduced significantly after dip treatment in all the concentrations of fungicides for different durations. The maximum reduction in the severity of black mold Cabbagewas found at the highest concentration (1000 ppm) followed by lower concentrations i.e. 500 ppm and 250 ppm, respectively. Amongst systemic fungicides, carbendazim and mancozeb in reducing the severity of Cabbage rot caused by *A. niger*

Discussion:-

The fundamental agent of black mold of Cabbages showed similar symptoms as described earlier by different workers on Cabbage in storage (Dang and Singh, 1982; Quadri *et al*., 1982; JoonTaek*et al.,* 2001).The results showed that infection occurred on the Cabbage as indicated by the death of the foliates at maturity. As the disease progresses, the fungus may infect the freshly inner scale and the whole outer surface may become black and may cause decay.

The pathogenicity test of fungi studied under the present investigation showed that the injury past to infection was a prerequisite for the diseases. Our results conform to those of Harja and Batra (1978) who considered *Phoma destructive* and other species of fungi more virulent on injured than on non-injured tomato fruits. The antifungal activity of seven fungicides acquired in the present study conforms to several previous results (Singh *et al.,* 1997; Srinivasan and Shanmugam, 2006) on different rot fungi.

Presently, hexaconozole and mancozeb proved effective in reducing the lesion diameter and spore germination. The reduction in the lesion diameter may be due to the effect of fungicides on the mycelial growth of fungal pathogens responsible for the rotting of these vegetables in storage. Similar findings were observed by Patel *et al.* (2005). The severity of black mold of cabbage reduced significantly after dip treatment in all the concentrations of fungicides for different durations.

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Survey and Documentation of Medicinal Plants in Akot Tehsil's Forested Terrain

Sumitkumar L. Mirge
Research scholars
Department of Botany
Shri Shivaji Arts, Commerce and Science College, Akot. Dist. Akola, Maharashtra.444101
And
Dr. Santosh N. Patole
Associate Professor
Department of Botany
Shri Shivaji Arts, Commerce and Science College, Akot. Dist. Akola, Maharashtra.444101
And
Bharat R. Nagare
Assistant Professor[3]
Department of Botany
Shri Shivaji Arts, Commerce and Science College, Akot. Dist. Akola, Maharashtra.444101

Abstract

This study provides an in-depth survey and documentation of medicinal plants in the forested region of Akot Tehsil, Maharashtra. Through systematic field research, 49 plant species were identified, each significant for their traditional medicinal uses. These plants, ranging from herbs to trees, are integral to local healthcare practices, treating conditions such as digestive issues, respiratory disorders, and skin diseases. Notable examples include Terminalia arjuna for heart protection, Azadirachta indica for antimicrobial effects, Woodfordia fruticosa for treating dysentery, fever, and skin disorders, Bacopa monnieri for enhancing memory and reducing anxiety, Wrightia tinctoria for treating psoriasis and gastrointestinal disorders, and Boswellia serrata for its anti-inflammatory properties in arthritis and respiratory disorders. The study highlights the importance of preserving both the biodiversity of the region and the traditional knowledge associated with these plants. Moreover, it emphasizes the convergence between traditional medicine and modern scientific research, with plants like Curcuma longa and Bacopa monnieri being validated for their medicinal properties. The findings point to the urgent need for conservation efforts and sustainable harvesting practices to protect these valuable natural resources.

Keywords: Medicinal plants, Akot Tehsil, Deciduous forests, Ethnobotany, Conservation, Maharashtra.

1. Introduction

The Akot Tehsil region in Maharashtra, India, is characterized by its rich deciduous forests,

which are home to a diverse array of plant species with significant medicinal properties. Traditional medicine in this region has a long history, with local communities relying on native plants for the treatment and prevention of various health conditions. The use of medicinal plants in this area is deeply rooted in local culture and traditional knowledge, which have been passed down through generations (Jain, 1991; Jain, Kumane, & Bhattacharya, 2006).Medicinal plants are defined as those used in the preparation of medicine to treat or prevent diseases. These plants play a vital role in traditional medicine systems globally, and their importance is increasingly recognized in modern scientific research (Kirtikar & Basu, 1935). In the Akot Tehsil region, traditional practices involve a variety of plant species known for their therapeutic effects, reflecting a deep understanding of local flora (Patole, 2014).The flora of the Akot Tehsil region includes a range of medicinal plants, many of which are documented in regional studies. For instance, Kamble and Pradhan (1988) provided a comprehensive account of the plant species in the region, including those with medicinal uses. Similarly, studies on the medicinal flora of Melghat and surrounding areas highlight the diverse applications of local plants in treating various ailments (Dhore & Joshi, 1988; Bhogaonkar & Devarkar, 2012). Despite the rich heritage of medicinal plant use in Akot Tehsil, there is a lack of detailed documentation and analysis of these plants and their uses. This study aims to address this gap by providing a thorough survey and documentation of medicinal plants in the Akot Tehsil region, focusing on their traditional uses and potential for modern applications. By cataloging these plants and their uses, the research contributes to preserving traditional knowledge and promoting sustainable conservation practices (Ingle & Pawar, 2022; Somkuwar, 2013).The findings of this study will enhance our understanding of the medicinal plant diversity in the Akot Tehsil region and support efforts to integrate traditional knowledge with contemporary scientific research, ensuring the preservation and sustainable use of these valuable resources (Sharma, 2015; Kokate & Muratkar, 2012).

2. Materials and Methods

2.1 Study Area

The study was conducted in the Akot Tehsil region of Maharashtra, known for its deciduous forest ecosystem. Thearea is characterized by a wide variety of plant species, adapted to the local climatic conditions, which include a dry season followed by a monsoon period. The forests are predominantly deciduous, shedding leaves during the dry season to conserve water.

2.2 Data Collection

Field surveys were conducted during the peak growing season, ensuring that plants were easily identifiable. The surveys covered various locations within the forested terrain of Akot Tehsil, with special attention to areas known for their medicinal plant diversity. Local herbalists and traditional medicine practitioners were interviewed to gather insights into the medicinal uses of different plant species.

2.3 Plant Identification

Plant specimens were collected and identified based on their morphological features,

including leaves, flowers, and fruits. Taxonomic identification was corroborated using standard references such as Kirtikar and Basu's "Indian Medicinal Plants" and Jain's "Dictionary of Indian Folk Medicine and Ethnobotany." The plants were then cataloged with their common names, botanical families, and medicinal uses.

2.4 Data Analysis

Plant specimens were collected and identified based on their distinct morphological features, including leaves, flowers, and fruits. To ensure accurate taxonomic identification, standard references like Kirtikar and Basu's *Indian Medicinal Plants* and Jain's *Dictionary of Indian Folk Medicine and Ethnobotany* were consulted. Additionally, the expertise of renowned taxonomist Dr. Santosh N. Patole, who has over 15 years of research and teaching experience in the field, was pivotal in validating the botanical classifications. The plants were systematically cataloged, detailing their common names, botanical families, and specific medicinal uses, enhancing the study's precision.

3. Results

The table below presents a detailed list of the medicinal plants identified in the Akot Tehsil region, outlining their common names, habits, botanical names, families, and medicinal applications.

S. N.	Botanical Names or Scientific Names	Common Name	Habit	Family	Medicinal Importance
1	*Terminalia arjuna* (Roxb. ex DC.) Wight & Arn.	Arjuna	Tree	Combretaceae	Cardio-protective, used in heart diseases and hypertension.
2	*Azadirachta indica* A.Juss.	Neem	Tree	Meliaceae	Antibacterial, antifungal; used in skin conditions and blood purification.
3	*Tinospora cordifolia* (Willd.) Miers	Giloy	Climber	Menispermaceae	Immunomodulator, used in fever, diabetes, and respiratory issues.
4	*Emblica officinalis* Gaertn.	Indian Gooseberry	Tree	Phyllanthaceae	Rich in Vitamin C; used for cold, digestive issues, and rejuvenation.
5	*Ocimum sanctum* L.	Holy Basil	Herb	Lamiaceae	Treats respiratory disorders, stress, and inflammation.
6	*Boswellia serrata* Roxb. ex Colebr.	Indian Frankincense	Tree	Burseraceae	Used in the treatment of arthritis, respiratory disorders, and as an anti-inflammatory agent.
7	*Terminalia chebula* Retz.	Chebulic Myrobalan	Tree	Combretaceae	Laxative, anti-inflammatory, improves digestion.

8	*Madhuca longifolia* (J.König ex L.) J.F.Macbr.	Mahua	Tree	Sapotaceae	Used in skin diseases, as a laxative, and in wound healing.
9	*Andrographis paniculata* (Burm.f.) Nees	King of Bitters	Herb	Acanthaceae	Treats liver disorders, fever, and boosts immunity.
10	*Wrightia tinctoria* (Roxb.) R.Br.	Sweet Indrajao	Tree	Apocynaceae	Treats psoriasis, skin diseases, and gastrointestinal disorders.
11	*Asparagus racemosus* Willd.	Shatavari	Climber	Asparagaceae	Female reproductive health, adaptogen, boosts vitality.
12	*Plumbago zeylanica* L.	Ceylon Leadwort	Herb	Plumbaginaceae	Treats digestive disorders, rheumatism, acts as an anti-inflammatory.
13	*Adhatoda vasica* Nees	Malabar Nut	Shrub	Acanthaceae	Treats cough, asthma, bronchitis.
14	*Withania somnifera* (L.) Dunal	Ashwagandha	Shrub	Solanaceae	Reduces stress, used in arthritis and general debility.
15	*Bacopa monnieri* (L.) Wettst.	Brahmi	Herb	Plantaginaceae	Enhances memory, reduces anxiety, used in neurological disorders.
16	*Cassia fistula* L.	Golden Shower	Tree	Fabaceae	Laxative, treats skin diseases, used as a purgative.
17	*Centella asiatica* (L.) Urb.	Asiatic Pennywort	Herb	Apiaceae	Cognitive enhancement, wound healing, treating skin diseases.
18	*Gardenia latifolia* Aiton	Ceylon Gardenia	Tree	Rubiaceae	Known for treating skin diseases, wounds, and fever.
19	*Pterocarpus marsupium* Roxb.	Indian Kino	Tree	Fabaceae	Antidiabetic, treats wounds, inflammation.
20	*Holarrhena antidysenterica* (L.) Wall. ex A.DC.	Kurchi	Tree	Apocynaceae	Treats diarrhea, dysentery, acts as a stomachic.
21	*Alstonia scholaris* (L.) R.Br.	Blackboard Tree	Tree	Apocynaceae	Antipyretic, treats respiratory infections, acts as a tonic.

22	*Aegle marmelos* (L.) Corrêa	Bael	Tree	Rutaceae	Treats diarrhea, dysentery, acts as a digestive tonic.
23	*Saraca asoca* (Roxb.) Willd.	Ashoka	Tree	Fabaceae	Used in gynecological disorders, uterine tonic.
24	*Tylophora indica* (Burm.f.) Merr.	Indian Ipecac	Climber	Apocynaceae	Treats respiratory issues, asthma, allergic conditions.
25	*Syzygium cumini* (L.) Skeels	Java Plum	Tree	Myrtaceae	Antidiabetic, treats digestive disorders, skin problems.
26	*Glycyrrhiza glabra* L.	Licorice	Herb	Fabaceae	Treats cough, sore throat, gastric issues.
27	*Aloe vera* (L.) Burm.f.	Aloe	Herb	Asphodelaceae	Heals wounds, burns, used in skin care, acts as a laxative.
28	*Eclipta prostrata* (L.) L.	False Daisy	Herb	Asteraceae	Promotes hair growth, treats liver disorders, acts as a tonic.
29	*Calotropis gigantea* (L.) Dryand.	Crown Flower	Shrub	Apocynaceae	Used in asthma, skin diseases, acts as an analgesic.
30	*Justicia adhatoda* L.	Malabar Nut	Shrub	Acanthaceae	Treats respiratory disorders like asthma, bronchitis, cough.
31	*Woodfordia fruticosa* (L.) Kurz	Fire Flame Bush	Shrub	Lythraceae	Used in traditional medicine for treating dysentery, fever, and skin disorders.
32	*Ziziphus jujuba* Mill.	Indian Jujube	Tree	Rhamnaceae	Treats digestive disorders, cough, insomnia.
33	*Clerodendrum serratum* (L.) Moon	Blue Glory	Shrub	Lamiaceae	Treats respiratory issues, fever, inflammation.
34	*Ficus religiosa* L.	Sacred Fig	Tree	Moraceae	Used in respiratory disorders, skin diseases, diabetes.
35	*Datura metel* L.	Thorn Apple	Shrub	Solanaceae	Used in asthma, cough, acts as a sedative.
36	*Cassia tora* L.	Sickle Senna	Herb	Fabaceae	Treats skin diseases, constipation, acts as a liver tonic.

37	*Moringa oleifera* Lam.	Drumstick Tree	Tree	Moringaceae	Nutrient-rich, used in inflammation, diabetes, acts as a tonic.
38	*Butea monosperma* (Lam.) Taub.	Flame of the Forest	Tree	Fabaceae	Used in skin diseases, diarrhea, acts as a tonic.
39	*Santalum album* L.	Sandalwood	Tree	Santalaceae	Used in skin care, treats headaches, acts as an antiseptic.
40	*Acorus calamus* L.	Sweet Flag	Herb	Acoraceae	Treats digestive disorders, respiratory issues, acts as a sedative.
41	*Coleus forskohlii* (Willd.) Briq.	Indian Coleus	Herb	Lamiaceae	Used in obesity, hypertension, acts as a cardiotonic.
42	*Ocimum basilicum* L.	Sweet Basil	Herb	Lamiaceae	Antioxidant, antibacterial, used in digestive disorders.
43	*Mentha arvensis* L.	Field Mint	Herb	Lamiaceae	Treats digestive issues, colds, acts as a carminative.
44	*Phyllanthus niruri* L.	Stonebreaker	Herb	Phyllanthaceae	Treats liver disorders, kidney stones, acts as a diuretic.
45	*Cissus quadrangularis*L.	Veld Grape	Climber	Vitaceae	Used in bone fractures, joint pain, acts as an anti-inflammatory
46	*Abutilon indicum* (L.)	Indian Mallow	Shrub	Malvaceae	Treats respiratory disorders, fever, and rheumatism.
47	*Bauhinia variegata* L.	Mountain Ebony	Tree	Fabaceae	Treats ulcers, leprosy, and acts as an anti-inflammatory.
48	*Curcuma longa* L.	Turmeric	Herb	Zingiberaceae	Anti-inflammatory, antiseptic, treats wounds and digestive issues.
49	*Abutilon indicum* (L.)	Indian Mallow	Shrub	Malvaceae	Treats respiratory disorders, fever, and rheumatism.

4. Discussion

This study reveals the rich botanical diversity of Akot Tehsil's deciduous forests,

emphasizing the crucial role these medicinal plants play in the local healthcare system. Traditional medicine in the region has thrived due to the availability of plant species with curative properties, many of which are commonly used for treating ailments such as digestive disorders, respiratory conditions, and skin diseases. The study not only highlights the cultural significance of these plants but also underscores their potential for broader scientific research.

4.1 Key Findings

I. **Traditional Knowledge**: The medicinal practices in Akot Tehsil are deeply rooted in indigenous knowledge passed down through generations. For instance, *Terminalia arjuna* is highly regarded for its heart-protective benefits, and *Azadirachta indica* is widely used for its antimicrobial properties. Plants like *Woodfordia fruticosa* are commonly used for treating dysentery, fever, and skin conditions, while *Bacopa monnieri* is valued for enhancing memory and reducing anxiety. These plants are an essential part of the local healthcare system and are relied upon for their therapeutic efficacy in treating various ailments.

II. **Convergence with Modern Medicine**: Several plants identified in this study, such as *Curcuma longa* (Turmeric), *Bacopa monnieri* (Brahmi), *Wrightia tinctoria*, and *Boswellia serrata*, have been supported by modern scientific research. For example, Turmeric is well-known for its anti-inflammatory properties, *Bacopa monnieri* is recognized for its cognitive-enhancing effects, *Wrightia tinctoria* is effective in treating psoriasis and gastrointestinal disorders, and *Boswellia serrata* is widely used as an anti-inflammatory agent in arthritis. This convergence between traditional uses and modern medical research demonstrates the potential of these plants to be integrated into contemporary medicinal practices, offering safer, more affordable therapeutic options.

4.2 Challenges and Recommendations

I. **Conservation**: The biodiversity in Akot Tehsil is under threat from environmental degradation, primarily due to deforestation and unsustainable land use. The loss of natural habitats not only threatens the survival of medicinal plants but also disrupts the ecological balance necessary for their growth. Conservation strategies, such as establishing protected areas and promoting biodiversity-friendly land management practices, are urgently needed to preserve the region's botanical heritage.

II. **Sustainable Harvesting**: The over-exploitation of high-demand medicinal plants like *Withania somnifera* (Ashwagandha) and *Saraca asoca* (Ashoka) poses a serious threat to their sustainability. The study also highlights plants such as *Wrightia tinctoria* and *Boswellia serrata*, which are increasingly in demand due to their medicinal properties. Sustainable harvesting techniques must be adopted to prevent the depletion of these vital resources. Engaging local communities in conservation efforts and sustainable harvesting processes is essential to preserve both the medicinal plants and the traditional knowledge associated with their use.

5. Conclusion

The comprehensive survey of medicinal plants in the Akot Tehsil region emphasizes the critical need to preserve both traditional knowledge and the biodiversity that supports it. The findings highlight the potential for these traditional medicinal plants to contribute significantly to modern healthcare, provided their medicinal properties are validated through scientific research. However, the increasing threats to biodiversity and the over-harvesting of valuable species demand immediate conservation action. By fostering collaboration between local communities, researchers, and policymakers, it is possible to develop sustainable models that protect these plant resources while ensuring their continued use in both traditional and modern medicinal practices.

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Some Species of *Crucigenia Morren* (Chlorococcales) From Jalgaon District Maharashtra.

Dr. Jayashri Patil
Department of Botany, P.G. Research centre,
Dhanaji Nana Mahavidyalaya, Faizpur - 425503
Dist. Jalgaon (MS)

ABSTRACT

Six species of Crucigenia were collected from the jalgaon districts of Maharashtra. The present paper deals with taxonomy and distribution of 6 taxa. Of these taxa the two taxa Crucigenia apiculata (lemm) Schmidlle and C. triangularis are recorded for the first time of Jalgaon districts of Maharashtra state.

Key words: Green algae Chlorococcales Jalgaon Crucigenia

Introduction:-

During the study of Biodiversity in algae from jalgaon district of Maharashtra the author came across some member of the Chlorococcales. Several accounts of Indian Chlorococcales have appeared closely on the heel of the publication of the monograph by Philipose (1967). Crucigenia is a planktonic in variety of freshwater ecosystem including rivers and lakes, mostly in eutrophic conditions.

Material and Methods

Materials for the present study were collected from different localities of Jalgaon district, Maharashtra. The samples were collected between 7.30 to 9.00 A.M. Later samples were preserved in 3% formalin. The camera lucida drawing was made from fresh as far as possible immediately.The collections were made from August 2022 – May 2023. The specimens were collected from different habitats of all parts of Jalgaon district Maharashtra. The camera lucida drawings were made from fresh as far as possible immediately when the material was brought in the laboratory and salient morphological features were recorded. Photographs of all taxa were taken by Nikon Coolpix P4 camera.

Genus – *Crucigenia* Morren 1830

1.*Crucigenia apiculata* (Lemm.) Schmidle **(Pl. 1, Fig.1 ; Pl. 2, Fig.3)**

Prescott G.W. 1962, p.234, pl.65, fig.3

Colony free floating composed of 4 ovate, rhomboidal or somewhat triangular cells arranged about a 4-sided opening, cone shaped apiculation on the cell wall at the free outer apex, cells adjoin at their bases, cells 2.9-3 µm in diameter, 4.1-5 µm long; colony 6-12.5 µm wide 9-16µm long.

Habitat : Shallow still water, Morgaon, Dec. 2022, Coll.No.4

2.*C. crucifera* (Wolle) Collins. **(Pl. 1, Fig.2 ; Pl. 2, Fig.4)**

Prescott G.W. 1962, p.170, pl.65, fig.4

Colony consisting of sided cells arranged about a central square opening, outer free walls longer and concave, outer free angles of cells rounded, lateral adjoined wall straight, the inner walls about the central opening forming a short, straight side, cells 3.5-5 µm in diameter 5-7 µm long; colony 9-11 µm wide, 14-16 µm long.

Habitat : In a small pond, Vatar,Jan. 2023, Coll.No. 14

3.*C. irregularis* Wille **(Pl. 1, Fig.3 ; Pl. 2, Fig.2)**

Prescott G.W. 1981, p.284, pl.65, fig.6

Colony free floating, consisting of 4, or multiples of 4 ovate cells and definitely arranged about a central space as in other species of the genus and not in quadrangular formation, with both lateral and apical walls in contact; chloroplasts broad parietal plates or discs; as many as 4 in a cell; pyrenoid sometimes absent; cells 5-9 µm in diameter, 8-14 µm long.

Habitat : Muddy bottom of pool,Padsod, Mar. 2023, Coll.No. 20.

4.*C. quadrata* Morren **(Pl. 1, Fig.4 ; Pl. 2, Fig.1)**

Presott, G.W. 1962 P.415, Pl.65, fg. 10

Colony free-floating, consisting of a circular plate of 4 triangular cells, cruciately arranged abot a small central space, lateral wall straight adjoined their length with neighbouring cells, knob like projections, chloroplast parietal as many as 4 in a cell. Cells 2.5-4 µm in diameter 3-7 µm long; multiple quadrate colonies formed by close arrangement of component quartets.

Habitat: On sandy beds of shallow water, Kathorakhurda, Oct. 2022, Coll.No.4

5.*C. tetrapedia* (Kirchner) West. G.S. West.**(Pl. 1, Fig.5 ; Pl. 2, Fig.5)**

Philipose M.T. 1967 P.240 & 241, Fig. 151

Colonies 4 celled or joined in 16 or more celled multiple colonies. Four celled colonies quadrate with a minute rectangular space at the centre cells flattened and triangular with rounded ends. Outer sides of cells always concave cells 3-9.6 µm in diameter. Four celled colonies 8-15 µm in diameter.

Habitat: Stray in the plankton of a swamp, Mondhalde and in river Bhusawal. Jan. 2023, Coll. No. 14.

6.*C. triangularis* Chod **(Pl. 1, Fig.6 ; Pl. 2, Fig.6)**

Hortobagyi T 1973 P.70, FIG. 179

Philipose, M.T. 1967, P.240, Fig.150

Colony 4 celled with a small open space at the centre, sometimes joined in 16 or more celled multiple colonies, cells ovoid to triangular with rounded corners, chloroplast parietal, cells 5-6.5 µm in diameter.

Habitat: In a drying puddle near a streamlet, Kinod and ditch in Kaswa Aug.2022, Coll.No. 2.

Summary and Conclusion:

*Crucigenia*is a variety found in river, lake, ditch and mostly in eutrophic condition.All the taxa are illustrated with microphotographs and described through habitat and periodicity.

The rich and diverse Chlorococcaleshave found during winter season.

Crucigenia apiculata (lemm) Schmidlle and *C. triangularis* are recorded for the first time of Jalgaon districts of Maharashtra state.

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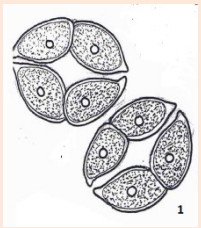
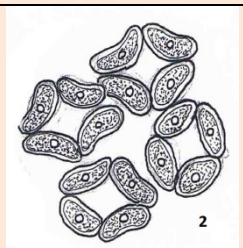
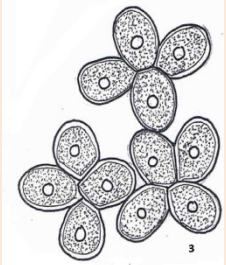
Plate1



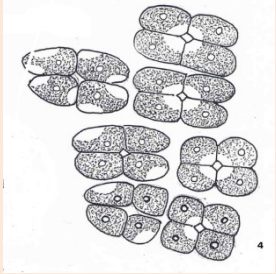
Crucigenia apiculata (Lemm) Schmidle



Crucigenia crucifera (Wolle) Collins



Crucigenia irregularis Wille



Crucigenia quadrata Morren

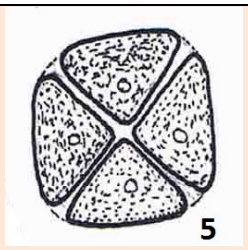
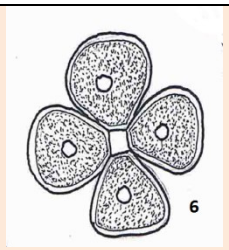
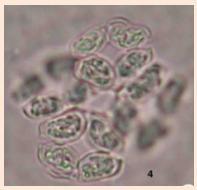
	
Crucigenia tetrapedia (Kirchner) West. G.S. West.	***Crucigenia triangularis*** Chod

Plate 2	
	
Crucigenia quadrataMorren	***Crucigeniairregularis***Wille
	
Crucigenia apiculata (Lemm) Schmidle	***Crucigenia crucifera***(Wolle) Collins
	
Crucigenia tetrapedia (Kirchner) West. G.S. West.	***Crucigenia triangularis*** Chod

The study on Diversity of Hydrophytes in Botanical Garden of Jijamata Mahavidyalaya, Buldhana

Ananta T. More
Jijamata Mahavidyalaya, Buldhana
And
Rahul W. Ukey
Jijamata Mahavidyalaya, Buldhana
And
Rajshri M Yewale
Jijamata Mahavidyalaya, Buldhana
And
Premraj P. Ware
Jijamata Mahavidyalaya, Buldhana

Abstract:

This study, which examines the diversity of hydrophytes in a botanical garden of Jijamata Mahavidyalaya, Buldhana Maharashtra state of India. Nine species Hydrilla verticillata, Nymphaea nouchali, Nelumbo nucifera, Azolla pinnata, Salvinia natans, Wolffia globosa, Pistia stratiotes, Anabaena variabilis, and Nostoc azollae studied from botanic garden.The subject of Every species was examined for its distinct physical characteristics and ecological functions. The results demonstrate the range of adaptations these plants have evolved to survive in aquatic habitat, adding to the biodiversity of the garden. In order to preserve biological equilibrium and improve the garden's educational and aesthetic value, conservation and diversification efforts pertaining to these hydrophytes are essential.

Keywords - Hydrophytes, Submerged, Habitat, Aquatic, Botanical Garden

Introduction:

The study of hydrophytes, or aquatic plants, is crucial for understanding the biodiversity and ecological balance within aquatic ecosystems. This research focuses on the diversity of hydrophytes in the botanical garden of Jijamata Mahavidyalaya, Buldhana which includes a variety of species such as *Hydrilla*, *Nymphaea* (water lilies), *Nelumbo* (lotus), *Azolla*, *Salvinia*, *Wolffia*, various algae,*Pistia* (water lettuce) and cyanobacteria (blue-green algae) like *Anabaena*, *Nostoc*. Hydrophytes play a significant role in maintaining the health of aquatic environments. They contribute to oxygen production, provide habitat for aquatic organisms, and help in nutrient cycling. The botanical garden serves as a microcosm for studying these plants, offering a controlled environment to observe their growth patterns, interactions, and adaptations.This research aims to document the species diversity, distribution, and ecological roles of hydrophytes in the botanical garden. By analysing the presence and abundance of these species, we can gain insights into the factors influencing their growth and the overall health of the aquatic ecosystem.

Additionally, understanding the diversity of hydrophytes can inform conservation efforts and the management of aquatic habitats.

Understanding biological concepts such as speciation, isolation, endemism, and evolutionwhich include ecosystems, communities, species, populations, and individual genesis made possible by the measurement of plant variety, which may be done at both the global and individual levels (1). All bodies of water on Earth, including rivers, lakes, ponds, ditches, streams, and seas, make up the hydrosphere (2). The whole plant is used as a medicine to treat fever, diarrhoea, sleeplessness, gastritis, and imbalanced body temperature. Additionally, China, India, and Korea use it as a haemostatic (3). They are among the significant biotic entities in the aquatic ecosystem that give other aquatic species food, oxygen, and shelter (4), as well as being vital in preventing excessive turbidity and soil erosion and preserving the delicate nutritional balance in the water (5).

Objectives:

1. **Identification and Cataloguing of Hydrophytes**: To methodically identify and catalogue the different hydrophyte species that are found in the botanical garden.
2. **Assess Species Diversity**: To assess the species richness and evenness within the garden in order to determine the diversity of hydrophytes.
3. **Examine Ecological Roles**: To find out how hydrophytes contribute to the upkeep of the aquatic ecosystem in the garden.
4. **Analyses Environmental Factors**: To investigate how soil type, water quality, and availability of light affect the growth and spread of hydrophytes.
5. **Record Seasonal Variations**: To record any changes in hydrophyte variety and abundance that may occur throughout the year.
6. **Assess Conservation Status**: To determine which species of hydrophytes are potentially vulnerable and to evaluate the current state of their conservation.
7. **Examine Medicinal and Economic Uses**: To investigate the possible uses of hydrophytes that can be found in gardens for both medical and commercial purposes.
8. **Encourage Awareness and Education**: To encourage students and tourists to learn about the significance of hydrophytes in aquatic ecosystems.

Hypotheses

1. **Species Richness Hypothesis**: The botanical garden hosts a high diversity of hydrophytes, with a significant number of species representing various families.
2. **Environmental Influence Hypothesis**: The diversity and distribution of hydrophytes in the botanical garden are significantly influenced by environmental factors such as water quality, light availability, and soil type.
3. **Ecological Role Hypothesis**: Hydrophytes play a crucial role in maintaining the ecological balance of the botanical garden's aquatic ecosystems.
4. **Conservation Status Hypothesis**: Some hydrophyte species in the botanical garden are at

risk and require conservation efforts to ensure their survival.

5. **Medicinal and Economic Value Hypothesis**: Several hydrophytes in the botanical garden possess significant medicinal and economic value.

Methodology

1. Study Area and Site Selection

- Location: Jijamata Mahavidyalaya Botanical Garden, Buldhana.
- Site Selection: Identify and select various aquatic habitats within the botanical garden, such as ponds and water tanks.

Google Map Location Image of Jijamata Mahavidyalaya, Buldhana

2. Sampling and Data Collection

- Sampling Techniques: In Botanical Garden different types of ponds and water tanks maintained with intention of reduce the competition and enhance growth of each hydrophyte species without any interference.
- Species Identification: Collect samples of hydrophytes and identify those using standard botanical keys and reference materials. Hydrophytic species are identified by thin, flexible leaves with air spaces, reduced roots, soft stems, floating/submerged flowers, and adaptations for underwater photosynthesis and gas exchange.

3. Data Recording and Documentation

- Species Documentation: Record the species name, family, and abundance of each hydrophyte found in the study area.
- Photographic Records: Take photographs of each species and their habitats for visual documentation.

4. Interpretation and Reporting

- Data Interpretation: Interpret the results to understand the diversity patterns and ecological roles of hydrophytes in the botanical garden.
- Report Writing: Compile the findings into a comprehensive research report, including methodology, results, discussions, and conclusions.

5. Conservation and Awareness

- Conservation Recommendations: Provide recommendations for the conservation of hydrophyte species based on the findings.
- Educational Outreach: Develop educational materials and conduct workshops to raise awareness about the importance of hydrophytes in aquatic ecosystems.

Result and Observations:

- *Hydrilla* observed a caulescent, glabrous freshwater herb with long stems, green leaves, fibrous roots, and nodal scales. It is an invasive aquatic plant with glabrous stems, dense mats, serrate-dentate edges, and pointed teeth, making it an adaptive species. From observations identified the species is *Hydrilla verticillate.*
- *Nymphaea nouchali* species identified from observations Round, green with a darker underside, leaves have undulating edges and float. Stems and Roots: Roots anchored in the mud at the bottom, submerged. Flowers: Up to 0.3 meters above the solitary, bright, long-pedunculate flowers.

List of recorded and identified hydrophytic plant species

Sr. No.	Botanical Name	Common Name	Plant Family
1.	*Hydrilla verticillata*	Water thyme	Hydrocharitaceae
2.	*Nymphaea nouchali*	Water lily	Nymphaeaceae
3.	*Nelumbo nucifera*	Kamal	Nymphaeaceae
4.	*Azolla pinnata*	Aquatic ferns	Salviniaceae
5.	*Salvinia natans*	Water moss	Salviniaceae
6.	*Wolffia globosa*	Watermeal or Duckweed	Araceae
7.	*Pistia stratiotes*	Water lettuce	Araceae
8.	*Anabaena variabilis*	Blue Green Algae (BGA)	Nostocaceae
9.	*Nostoc azollae*	Blue Green Algae (BGA)	Nostocaceae

- *Nelumbo nucifera* ants with large, rounded leaves that have the unique hydrophobic surface that repels water are highly distinctive. It blooms over the water with large, striking flowers. Its robust rhizome structure and spacious air chambers may allow it to spread quickly. The fruit turns brown as the petals fall off, giving it a distinctive large, spongy texture.

- *Azolla pinnata* is a little water fern that floats freely and grows up to 2.5 cm long on a triangular stem. It's overlapping, 1-2 mm-sized, green, blue-green, or dark purple leaves are covered in microscopic hairs that give them a velvety look.
- With two elliptic, light green leaves that rest flat on the water's surface and a third, feather-like leaf that dangles submerged and serves as a root, *Salvinia natans* is a small, free-floating fern. Cuticular papillae, which cover the leaves, aid in keeping them dry and shielding them from decomposition
- *Wolffia globosa*, which has an oval-shaped frond that is less than one millimetre in width. It floats freely on the surface of placid freshwater bodies like as lakes and ponds, lacking stems, leaves, and roots.
- *Pistia stratiotes* is an aquatic plant that floats freely and has velvety, thick leaves that are arranged in a rosette that looks like an open head of lettuce. The roots are submerged beneath the floating leaves, while the leaves themselves are light green, spongy around the base, and covered in dense white hairs.
- The filamentous cyanobacterium *Anabaena* variabilis is distinguished by its long, straight filaments made of a string of beaded cells. It has unique cells known as heterocysts for fixing nitrogen and akinetes for surviving in hostile environments.
- Nostoc azollae creates oval or spherical filaments that are not branching. These filaments can develop into specialised nitrogen-fixing cells known as heterocysts, and they are covered in a gelatinous matrix.

Hydrilla

Nymphaea

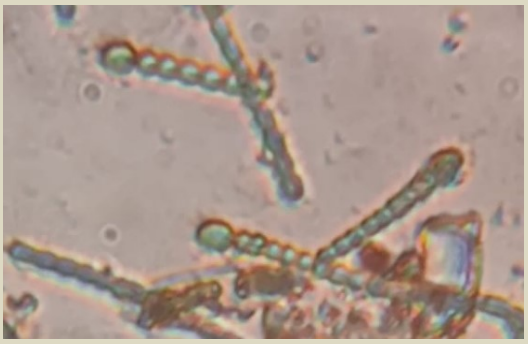
Nelumbo

Azolla

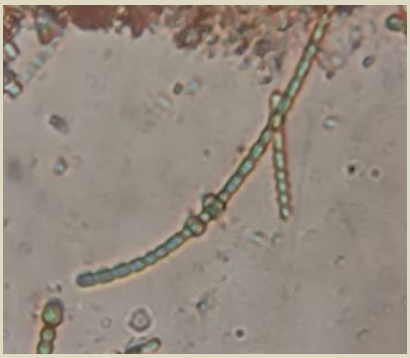
Salvinia

Pistia

***Anabaena* (Microscopic)**



***Nostoc* (Microscopic)**



Photographs of Hydrophytes recorded and studied

Conclusion

Nine hydrophyte species in the Jijamata Mahavidyalaya Botanical Garden in Buldhana, Maharashtra, have been studied to better understand their various aquatic environment adaptations, which increases the richness of the garden. The study emphasises how crucial it is to protect these species and their natural environments. For the garden to remain in an ecologically balanced state and to increase its educational and aesthetic value, conservation and diversification initiatives are essential.

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Ethnobotanical Studies of wild edible vegetables used by Rural and Tribals from Buldhana District

D. R. Sirsat
Department of Botany
And
Shaikh Farah T.
Department of Botany
And
A. S. Jadhao
Department of Botany
And
P. N. Bathe
Department of Zoology
And
N. K. Agrawal
Department of Microbiology
BapumiyaSirajoddin Arts, Commerce and Science College, Pimpalgaon Kale Tq. Jalgaon Jamod Dist. Buldhana

ABSTRACT

In this present study wild edible vegetables plants were studied mostly used by rural and tribals from different places in Buldhana district. These are considered as main food resource for tribal and rural population residing at forest and hilly area. They are used wild plant in their daily food diet tribals have great knowledge about wild vegetables plants. It is a great source for income to poor rurals and tribals.Consumption of wild edibles are sources of vitamins, micro-nutrients minerals and protein. Wild vegetables fulfil our need of nutrition. Different parts of edible plant are used such as stem, leaves, petiole, inflorescence, flowers, petal, fruits and seeds. They are consumed any form like raw or cooked or stored in dried or other form.Wild vegetable having great medicinal value.

Key Words: Nutritional value, Wild vegetables, Tribals.

Introduction

Buldhana is a district place in Maharashtra state. Buldhana district situated between 19°51' to 21°17' North and 75°57' to 76°49' East Longitude.The major rivers in the district are Painganga and Purn .The district consists of 13 tahsils . The climate of the districts is dry and hot considered to be healthy.This district is a major tourist attraction to Lonar crater (second largest in the world), declared a world heritage. Wild edibles vegetables are important contributor to the global food

basket in World. Trible and rural people are use various part of plants such as leaves, flowers, fruits, and roots of numerous plants.

Wild edible plants are the gift of our nature, day to day life ethnic communities strongly depend on it. They are good sources of important nutrients. It plays significant roles in nutrition, food security and serves as supplements for the management of nutrition related illnesses. Foods plants are supplement to the food quality, also an important option during starvation for survival.Wild edible plant species are to be considered as main food resource for tribal and rural population residing at forest area (Lilhare *et al.,* 2017). The knowledgeof wild edible plants by rural and tribal communities have been very well known and traditionally it is transferred. Wild edible plants are an alternative to food deficit as well as valuable supplement for nutritionally balanced diet of rural and tribal communities. Such plants are naturally resistant. They are adaptive to microclimate change like low rainfall, high temperature, etc. (Jadhav *et al*.,2015).Wild edibles is an important part of natural conservation, human nutrition, and human health. Wild edible plant provides food quantity for the last few years the situation we are looking at is how rapidly the atmosphere is changing and is affecting the animalas and plants. The condition is getting worse day by day with rapidly growing deadly diseases, health issue, environmental crises, out of reach (chute *et al.,*2022).

Wild edible plants are not cultivated nor domesticated, but available from natural habitats and used as source of food (Mundeep *et al,* 2022).Wild edible plants not are alternatives to cultivated food during periods of food scarcity. It contain supplement which are essential for nutritionally balanced diet (Borse*et al.,*2012).Wild edibles consumptionis a major source of vitamins and micro-nutrients for people using only vegetarian diets rich in carbohydrates (Kiran *et al*.,2019).

Peoples are losing their own valuable nutritious due tolack of communication with rural people, lack of knowledge about traditional food plant and acceptance of hybrid plant varieties in daily diet. Wild plants under the managed cultivation to make them as source of income for poor rural families. They will fulfill the need of nutrition in coming generations. (Deshpande *et al*., 2019).Now a day Tribal people are well aware about nutritional values and delicious test of wild vegetables because of this so many wild vegetables being are sold in the market (Madavi *et al.,*2023).Wild vegetable are the species which are not cultivated at large scale commercially. They are grown on waste land by tribal communities or collected from their natural habitat, fields etc. It used as source of food and income. Wild vegetables provide variation in diet and nutrition (Khan *et al.,* 2014).There are number of products which made from wild plant and now it come to light in the recent year with miraculous effects such as disease and drought resistant so it is essential conserve such plants (Padmavathi, 2023)

Materials and methods

The study was conducted among the Nandura and Jalgaon jamodtaluka from Buldhana district. The survey carried out June 2023 to March 2024.The information was collected with field works, knowledgeable persons,rural, tribals and local peoples. During the survey data like local names, habitat, plant part, usages, recipes. market surveys were collected.

In this study total 17 family (25 plant species) were studied. These plant species are having great medicinal value. Tribal and local rural people are consuming these wild vegetables in their diet.Wild vegetables are great source of vitamins, minerals, amino acids and so much things. Some wild vegetables are eat without cook and some are eat with cook.These wild plants are helpful to curing many disease such as cough, cold, nasal congestion, throat infection, diabetes problem, constipation, Skin, digestion, heart diseases.

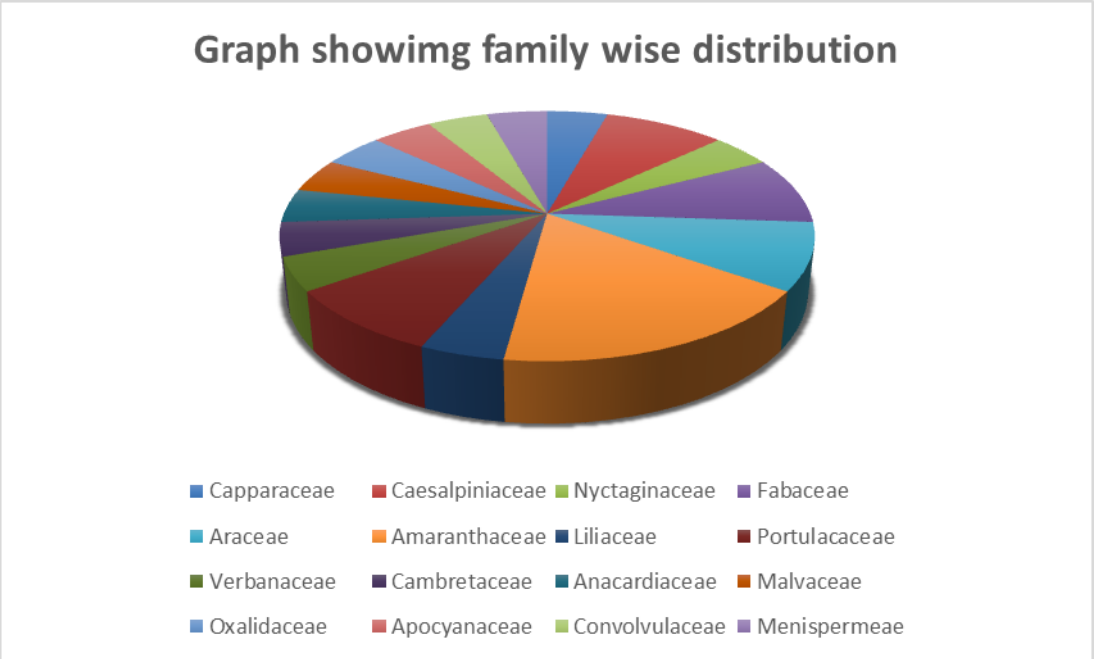

Table: Wild Edible Vegetables Plant With Their Common Name, Botanical Name Family

Sr. No	Common name	Botanical name	Family	Uses and importances
1.	Kartule	*Momordica dioica Roxb.*	Cucurbitaceae	Useful in antiasthmatic, antipyretic, antileprosy, antidiabetic,
2.	Vaghate	*Capparis zeylanica* L.	Capparaceae	Helpful in cough, cold, nasal congestion and throat infection
3.	Sherani	*Citrullus colosynthis L.*	Cucurbitaceae	*malaria, diabetes, hepatitis, stomach problems*,
4.	Tarota	*Cassia tora* L.	Caesalpiniaceae	Insect bite treating bloating making sabji,
5.	Khaprkhuti	*Boerhaavia diffusa Linn*	Nyctaginaceae	as a veggie pain relief

6.	Koilari	*Bauhinia purpurea* L.	Caesalpiniaceae	headache, fever, skin diseases, blood diseases, dysentery
7.	Kanchanr	*Bauhinia variegate* L.	Fabaceae	skin disorders, lymphadenitis.
8.	Alu	*Calocasia antiquorum* L.	*Araceae*	vitamins.
9.	Bofan	*Amaranthus viridis L.*	Amaranthaceae	Anti rheumatoid.antiulcer,asthama
10.	Safed Musali	*Chlorophytum borivilianum* L.	Liliaceae	Diabetes anti inflammatory
11.	Kardu	*Celosia argentea* L.	Amaranthaceae	Improving eyesight, dysentary
12.	maath	*Amaranthus spinosus* L.	Amaranthaceae	Snake bite
13.	Chiu	*Portulaca oleracea* L.	Portulacaceae	nervous anorexia, headaches, depression, panic attacks
14.	Bharangi	*Clerodendrum serratum* L.	Verbanaceae	Cold,cough,allergic rhinits
15.	Behda	*Terminalia bellirica* Roxb.	Cambretaceae	Diarrhoea.asthma vosion
16.	Surkand	*Amorphophallus companulatus*	Araceae	Skin,digestion,heart diseases
17.	Charodi	*Buchana nialanzan* Spreng	Anacardiaceae	Diabetes problem,constipation
18.	Ghorbhaji	*Portulaca oleracea* L.	Portulacaceae	Cholesterol level antioxidant
19.	Ambadi	*Hibiscus cannabinus*	Malvaceae	High fiber vitamins antioxidant
20.	Ambushi,	*Oxalis corniculate* L.	Oxalidaceae	swelling,cough
21.	Tandulja	*Amaranthus blitum L.*	Amaranthaceae	Piles,snake bite,menstrual bleeding
22.	Karwand	*Carissa carandas L.*	Apocyanaceae	kin diseases, urinary disorders and diabetic ulcer
23.	Phandi	*Rivea hypocrateriformis* L.	Convolvulaceae	Fever,malaria,skin problem
24.	Gulvel	*Tinospora cordifolia* Thnub	Menispermeae	Diabetes problem,constipation
25.	Heta	*Sesbania grandiflora* L.	Fabaceae	Rich in sugar and iron,used in salad

Conclusion:

From this present study it concluded that there are lots of wild edible plants are available in the Buldhana district and also it is highly nutritious.It a rich source of vitamin.

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Green Algal diversity from the Wainganga river water near Bramhapuri Taluka, Chandrapur District, Maharashtra State, India

Supriya B. Gedam
Assistant Professor,
Shri Pundlik Maharaj Mahavidyalaya, Nandura (Rly). Dist.Buldhana
And
Dr. Mundeep Awaley
Assistant Professor,
Shri Pundlik Maharaj Mahavidyalaya, Nandura (Rly).
Dist. Buldhana Associate Professor, Bhawbhuti Mahavidyalaya, Amgaon, Dist. Gondia

ABSTRACT

The present paper enumerates the data on the green algal biodiversity of Wainganga fresh water river situated within the Chandrapur district of Maharashtra state (India). It's the survey of algal flora of different sites of selected study area of river Wainganga for the purpose of reporting the cholrophycean algal taxa. A total 54 taxa belonging to 17 genera of chlorophycean algae were recorded from six different collection sites of river during two year of investigation from 2020 to 2022. In the present investigation, numbers of algal species Microphotograph have been recorded and data was used to identify algal species. Among identified taxa in green algae Cosmarium was the dominant genus with 11 number of species, Pediastrum-10,Scenedesmus-07,Spirogyra -5, Staurastrum-5 then Closterium -3, Tetraedron-2 and Ankistrodesmus-2 number and Neprhrocytium, Coelestrum, Chorella, Rhizoclonium, Oedogonium, Mougeotia, Zygnema, Sirogonium and Euastrum were present singly.

Keywords: Green algae, Wainganga River, Bramhapuri, Chandrapur

1. Introduction:

Freshwater algae are of various taxonomic groups such as diatoms (Bacillariophyceae), green algae (Chlorophyceae), blue green algae (Cyanophyceae), dinoflagellates (Dinophyceae), brown algae (Phaeophyceae), and red algae (Rhodophyceae) because of their characteristic adaptations to specifichabitats in environments. Algae are the most diverse and are environmental assets that help to port organisms and generate oxygen into the environment utilized by organisms in all trophic levels (Bergman and Bump 2015).the present study was under taken with the aim to study the diversity of algal communities which are harmful and useful for aquatic natural occurring organisms as well as human being from different sampling stations of Wainganga river , Taluka Bramhapuri ,district Chandrapur in Maharashtra during the present investigation of two year period from February, 2021 to January 2022.

2. Material and Method

2.1. Study Area: To study the algal biodiversity of Wainganga river near Bramhpuri taluka of

District Chandrapur, 6sites were selected for the collection of algae on the different tributaries of riverThe stations were chosen from the Wainganga river.

1) Site R1-Wainganga Bridge -(20.619338^0 Nand 79.943046^{0}E)
2) Site R2-Wirshi Ghat (Lat 20.6230358^{0}Nand 79.943534^{0}E).
3) SiteR3-River bank near Chincholi Village (20.62325^{0}Nand 79.943787^{0}E)
4) Site R4-River bank near Hardoli Village (20.623843^{0}Nand N79.939483^{0}E)
5) Site R5-shiv mandir near railway bridge (20.613315^{0}N and 79.943902^{0}E)
6) Site R6-Gosikhurd right bank canal (20.6082178^{0}Nand 79.8342411^{0}E)

Sampling sites of Wainganga River near Bramhapuri Taluka

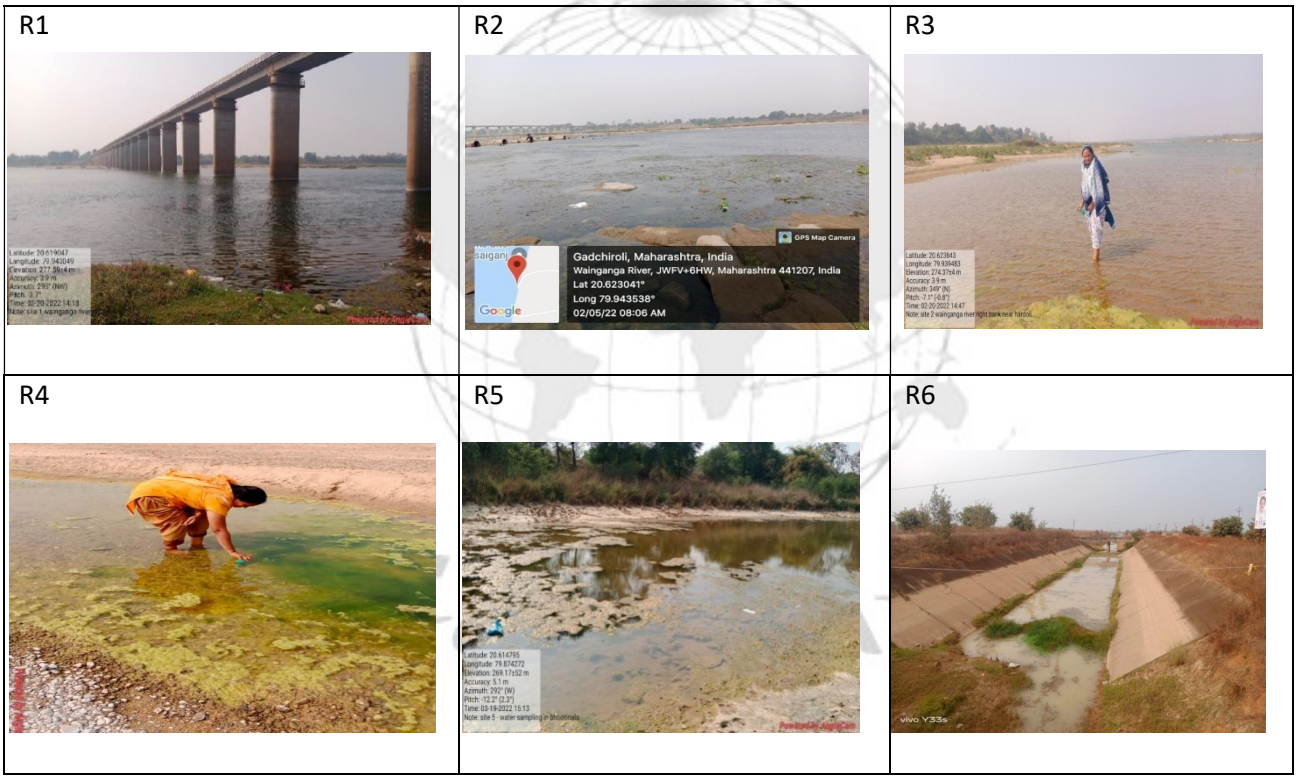


fig 1: images showing an actual view of sampling site

2.2. Collection of Samples:

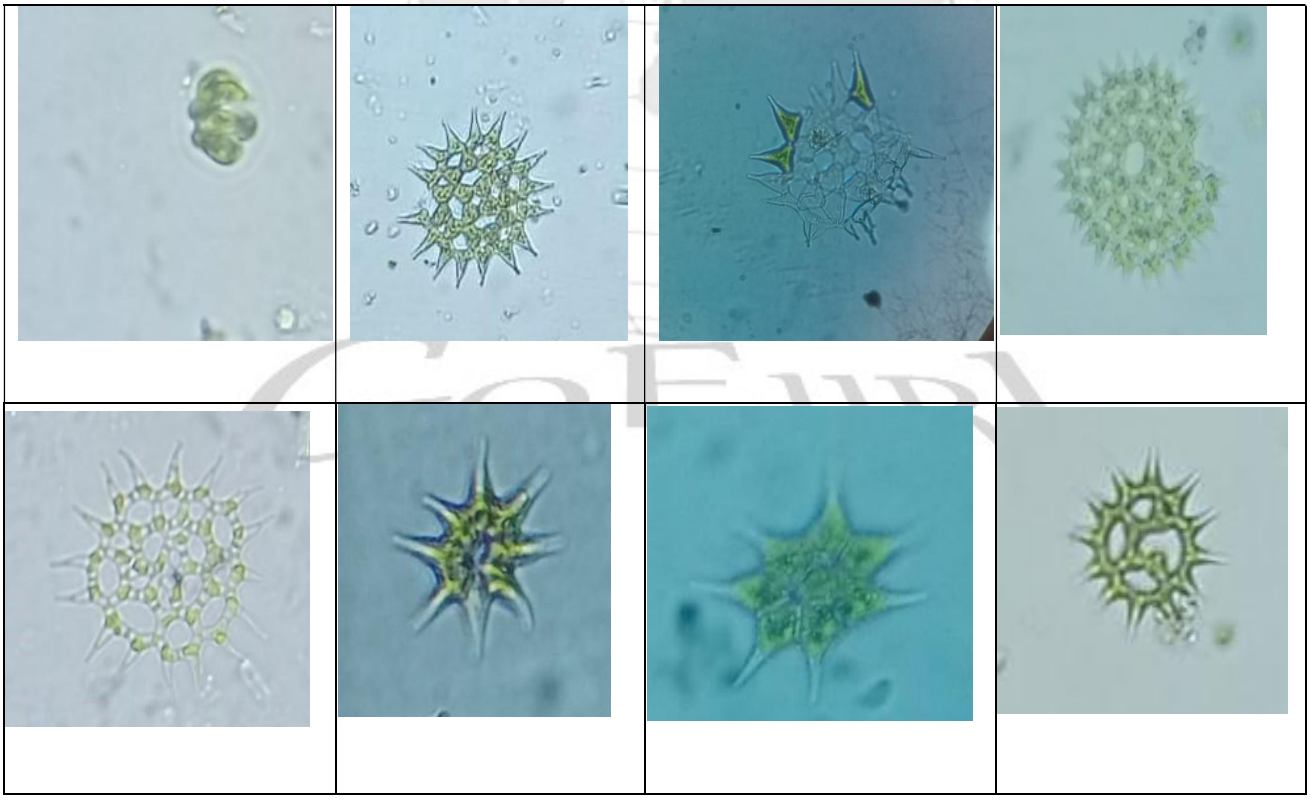
All algal samples were in liquid form. Forceps, gloves, notebook, polythene bags, permanent marker, and bottles were used for collection purpose. Freshwater algal samples were collected in airtight bottles in morning hours from February 2020 to January 2021 and from February 2021 to January 2022.The field data of collected samples are mentioned in Table 1. After collecting the samples were brought to laboratory and observed under microscope. The remaining samples were further preserved in 4% formaldehyde solution. Identification of algae following the keys given by Desikachary (1959), Prescott (1951), Randhawa (1959), Fritsch(1961). Prasad and Mishra (1992) and Kant and Gupta (1998).

3: Observation

Table 1: algal distribution in Wainganga river near Bramhapuri taluka in different sites

Sr. No	Name of Algae	Place of Occurrence					
		R1	R2-	R3	R4	R5-	R6
CHLOROPHYCEAE							
1.	*Nephrocytium lunatum*	-	+	-	+	+	+
2.	*Pediastrum biwae*	+	+	+	+	-	+
3.	*Pediastrum boryanum*	+	-	+	-	+	+
4.	*Pediastrum duplex*	+	+	-	+	+	-
5.	*Pediastrum duplex var gracillimum*	-	-	-	+	+	+
6.	*Pediastrum simplex meyen*	-	+	+	+	+	+
7.	*Pediastrum simplex var.echinulatum*	+	-	+	+	-	_
8.	*Pediastrum simplex var duodenarium*	+	-	-	-	+	_
9.	*Pediastrum tetras*	+	-	+	-	+	+
10.	*Pediastrum tetras var excisum*	+	+	+	+	+	+
11.	*Pediastrum tetras var tetraodon*	+	+	+	+	+	-
12.	*Tetraedron Minimum*	+	+	+	+	+	+
13.	*T muticum*	+	+	-	-	+	+
14.	*Chlorella vulgaris*	+	-	+	+	-	-
15.	*Ankistrodesmus falcatus*	+	-	+	+	+	+
16.	*Ankistrodesmus fusiformis*	+	+	+	+	+	+
17.	*Coelastrum proboscideum*	-	+	+	+	+	_
18.	*S.acuminatus*	-	+	+	-	+	+
19.	*S.acunae comas*	+	+	+	+	+	_
20.	*S.acutus*	+	-	+	-	+	+
21.	*Scenedesmus dimorphus*	+	+	+	+	+	+
22.	*Scenedesmus obliqus*	_	+	+	+	+	+
23.	*Scenedesmus perforates*	-	+	+	+	+	+
24.	*Scenedesmus quadricauda*	+	+	+	+	+	+
25.	*Rhizoclonium sp*	-	+	+	-	+	-
26.	*Oedogonium sp*	+	-	+	_	+	+
27.	*Mougeotia sp*	+	-	+	+	-	+
28.	*Spirogyra communis*	-	+	+	+	-	-
29.	*Spirogyra fallax*	+	-	+	-	+	+
30.	*Spirogyra nitida*	+	+	+	-	+	+
31.	*Spirogyra rectangularis*	+	-	+	-	+	+
32.	*Spirogyra thankamaniensis*	-	+	-	+	+	-
33.	*Sirogonium sp*	+	+	-	-	+	+
34.	*Zygnema*	+	+	-	+	+	+
35.	*Cosmarium awadhense*	+	+	+	+	+	+
36.	*Cosmarium difficile*	+	+	+	+	+	-
37.	*Cosmarium discrepens*	+	+	+	+	+	-
38.	*Cosmarium formulosum*	_	+	+	+	+	+
39.	*Cosmarium granatum*	-	-	+	+	-	+
40.	*Cosmarium humile*	+	+	+	-	+	+

41.	*Cosmarium isthmium*	+	+	_	-	+	+
42.	*Cosmarium monoliformae*	+	+	-	-	+	+
43.	*Cosmarium portianum*	_	_	_	+	+	+
44.	*Cosmarium quandrum*	+	+	+	+	+	+
45.	*Cosmarium subgranatum*	+	-	+	+	_	+
46.	*Closterium acutum*	-	+	+	+	+	+
47.	*Closterium leibleinii*	+	-	_	+	-	+
48.	*Closterium venus*	+	-	_	+	+	+
49.	*Euastrum spinulosum*	-	+	+	+	+	+
50.	*Saurastrum anatinum*	+	-	+	+	_	+
51.	*Saurastrum gracile*	+	-	+	-	+	_
52.	*Saurastrum paradoxum*	_	+	+	-	+	+
53.	*Staurastrum saltans var. polycharax*	+	+	+	_	_	+
54.	*Staurastrum tetracerum*	+	+	_	+	+	+



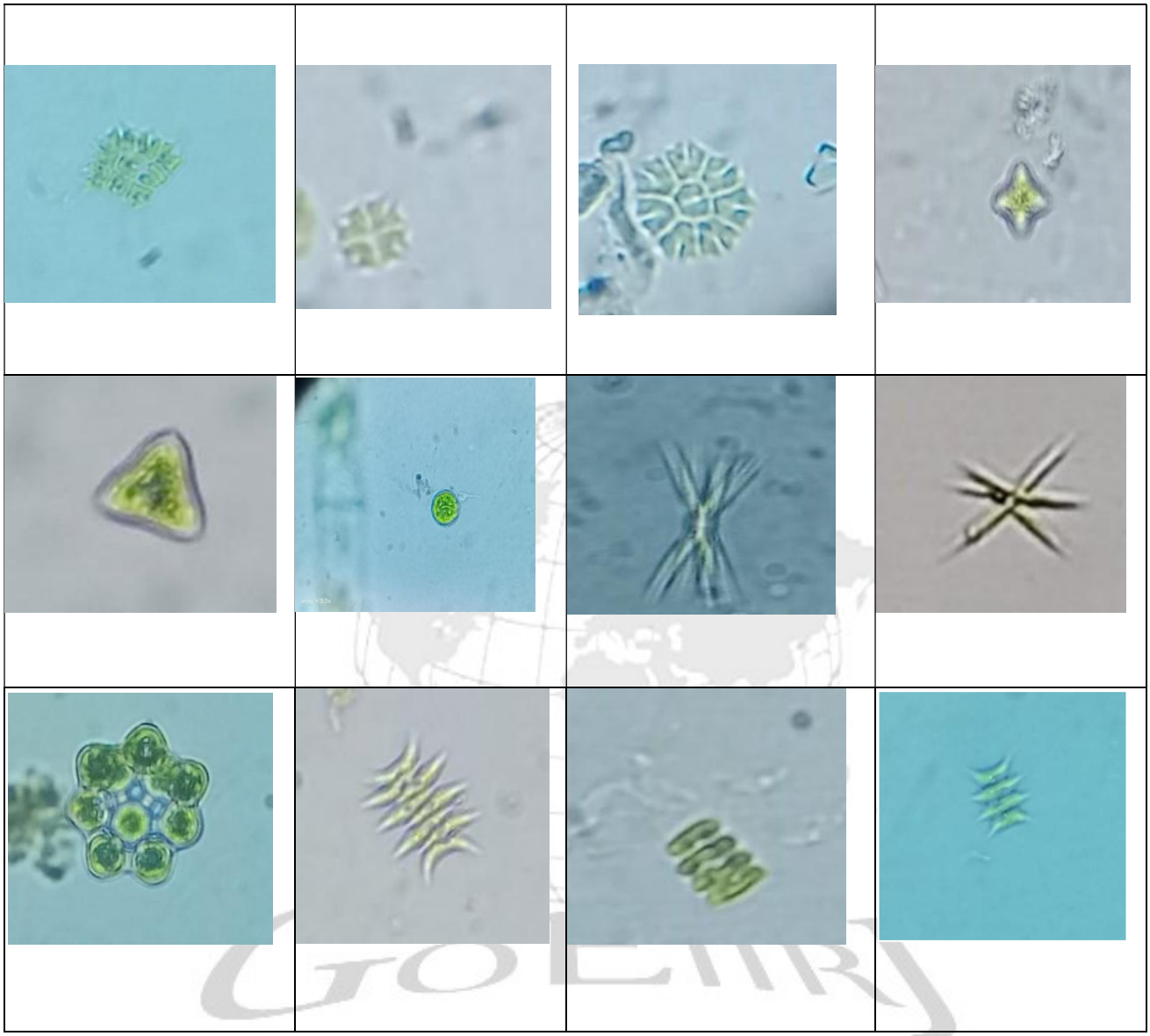
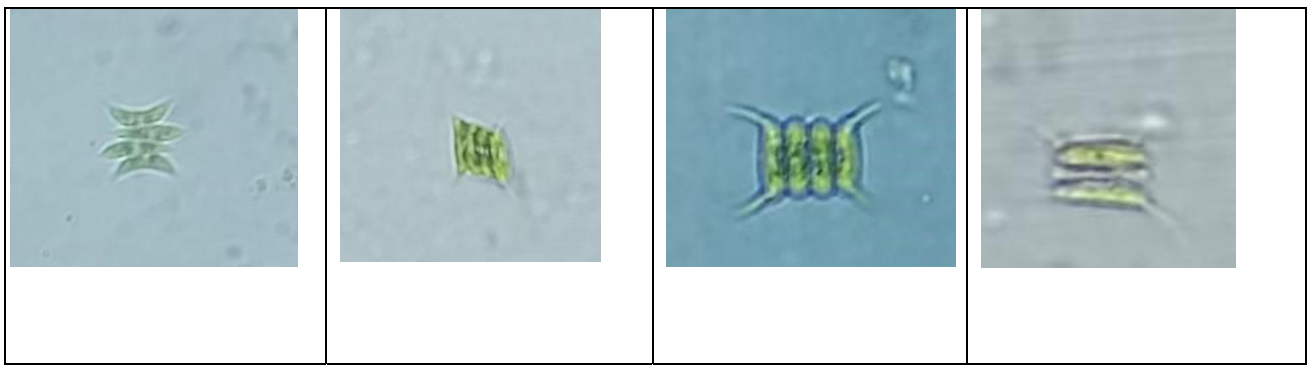


***Fig 2. A**-Nephrocytium lunatum , **B**-Pediastrum biwae , **C**- Pediastrum boryanum , **D**-Pediastrum duplex, **E**-Pediastrum duplex var gracillimum , **F**-Pediastrum simplex meyen, **G**-Pediastrum simplex , **H**-Pediastrum simplex var duodenarium , **I**-Pediastrum tetras, **J**-Pediastrum tetras var excisum , **K**-Pediastrum tetras, **L**-Tetraedron Minimum , **M**. T muticum , **N**-Chlorella vulgaris , **O**-Ankistrodesmus falcatus **P**- Ankistrodesmus fusiformis, **Q**- Coelastrum proboscideum ,**R**-S.acuminatus , **S**-S.acunae comas , **T**-S.acutus*



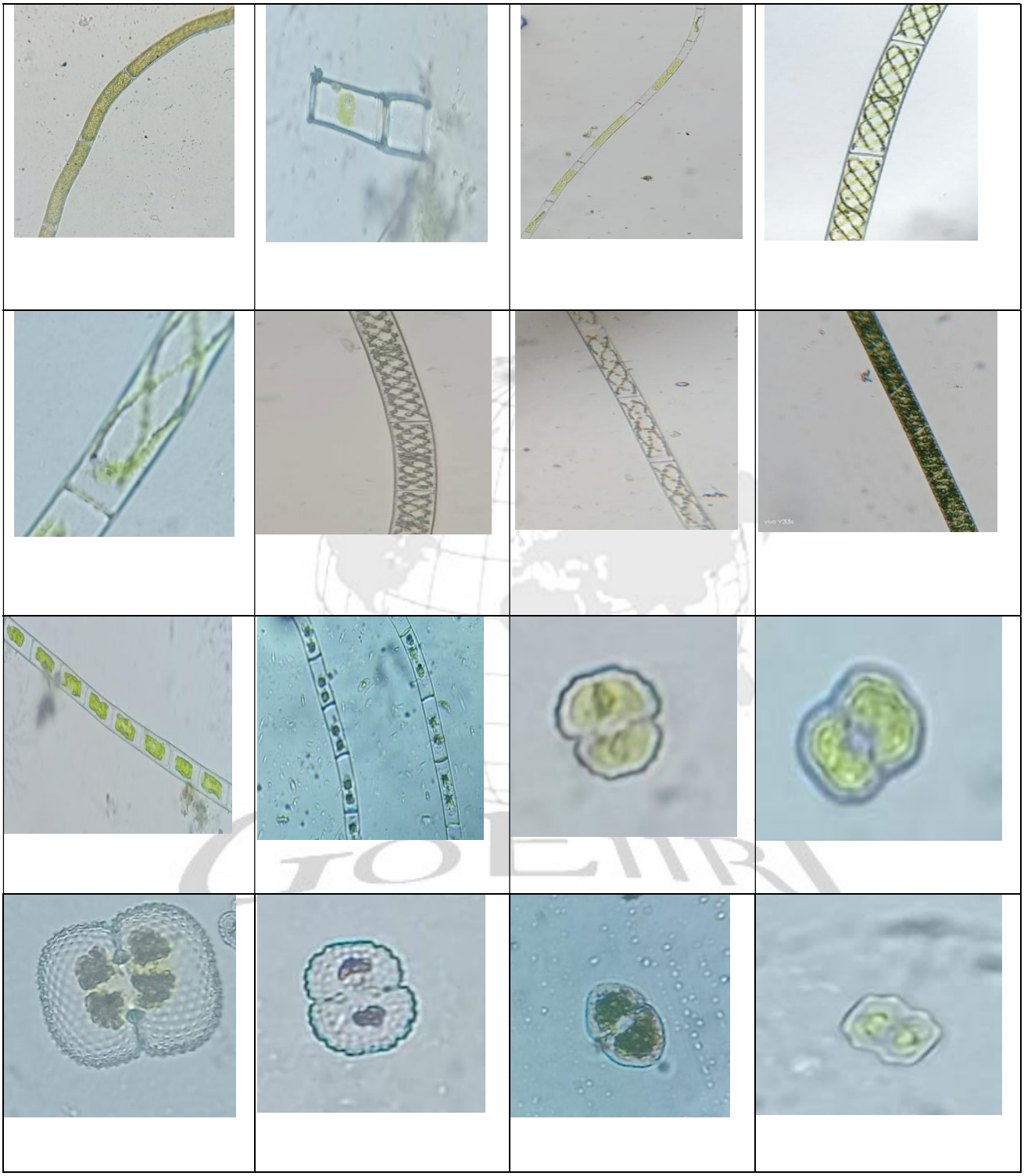


Fig3. **A**- *Scenedesmus dimorphus* ,***B***- *Scenedesmus obliqus* ,***C***- *Scenedesmus perforates*,***D***- *Scenedesmus quadricauda*,***E***- *Rhizoclonium sp* ,***F***- *Oedogonium sp* ,***G***- *Mougeotia sp*,***H***- *Spirogyra communis*, ***I***- *Spirogyra fallax* ,***J***- *Spirogyra nitida*, ***K***- *Spirogyra rectangularis*,***L***- *Spirogyra thankamaniensis*,***M***- *Sirogonium sp*,***N***- *Zygnema*,***O***- *Cosmarium awadhense*,***P***- *Cosmarium difficile* ,***Q***- *Cosmarium discrepens* ,***R***- *Cosmarium formulosum*,***S***- *Cosmarium granatum*,***T***- *Cosmarium humile*

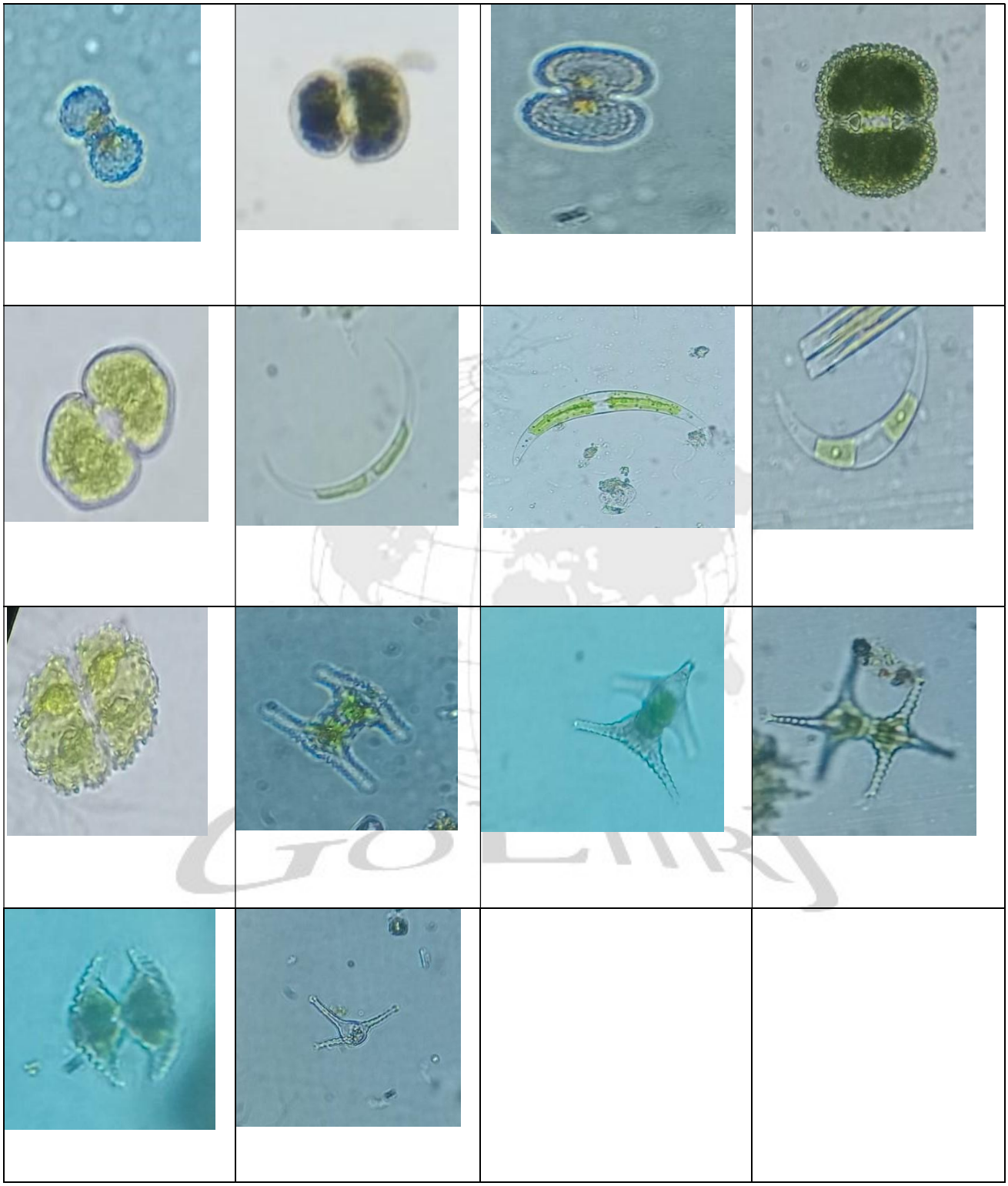


Fig 4.A- *Cosmarium isthmium* ,***B***- *Cosmarium monoliformae,****C***- *Cosmarium portianum* , ***D***- *Cosmarium quandrum,* ***E***- *Cosmarium subgranatum,****F***- *Closterium acutum,* ***G***- *Closterium leibleinii,* ***H***- *Closterium venus,****I***- *Euastrum spinulosum****,*** ***J***- *Saurastrum anatinum ,****K***- *Saurastrum gracile ,* ***L***- *Saurastrum paradoxum ,****M***- *Staurastrum saltans var. polycharax,****N***- *Staurastrum tetracerum*

Result and Discussion

In the present study total 54 green algal taxa were encountered. Among these *Cosmarium* was the dominant genus with 11 number of species, *Pediastrum*-10*, Scenedesmus*-07*, Spirogyra* -5*, Staurastrum* -5then *Closterium* -3*, Tetraedron* -2and *Ankistrodesmus*-2 *number a*nd one each of *Neprhrocytium ,Coelestrum, Chorella, Rhizoclonium, Oedogonium, Mougeotia, Zygnema, Sirogonium* and *Euastrum* were isolated from Wainganga river water.The following are the taxonomic character and distribution details of them.

Taxonomic Enumeration

1. Nephrocytium lunatum ;W. West 1892:736,pl.X[10] **[Fig.2.A]**

Colony ovate, consisting of 4, lunate, bluntly pointed cells; concave wall directed towards the centre of the colony; cells 4.5-5.5µ in diameter, 13-17.5µ long, chloroplast one, parietal, with a pyrenoid; 4 celled colonies upto 29µ in diameter**.**

2.Pediastrum biwae ;Negoro Tippawan and Yuwadee 2012, pp 33-37. **[Fig 2.B]**

Cell wall ultra structure is smooth or slightly punctuate. Diameter of Coenobia is 60-130 µm, cells 7-20µm wide, 10-35µm long.

3.Pediastrum boryanumMeneghini; Prescott 1951, P – 222, pl – 47, Fig – 9, Pl – 48. **[Fig 2.C]**

Colonies entire; cells 5 – 6 sided with granular walls; peripheral cells with outer margins extended into 2 blunt tipped process; cells 14 µ in diameter; processes 21 µ long; 32 – 36 celled colonies 85 – 90 µ in diameter.

***4.Pediastrum duplex* Meyen;** Prescott 1951, P – 223, pl – 48, Fig – 4. **[Fig 2.D]**

Colony 8 – 128 celled, the walls smooth, with lens shaped spaces between the inner cells, which are quadrate, the outer margin concave; peripheral cells quadrate.cells 15.6 µ in diameter; 36 – celled colony 105 µ in diameter.

5.Pediastrum duplex* var. *gracillimum; John *et al*. 2011 pp 464, pl 119L **[Fig 2.E]**

Coenobia up to 125 µm across; cells with concave straight or convex side walls; marginal cells 15 µm X 5 µm, often very long projections, inner cells 23 µm; cell wall smooth, without granulations.

6.Pediastrum simplex (Meyen) Lemmermann; Prescott, 1951, P. 227, Pl. 50, F. 02 **[Fig 2.F]**

Colony entire, composed of 16-32-64 smooth-walled cells; inner cells 5 or 6 sided; peripheral cells with the outer free wall extended to form a single tapering, horn-like process with concave margins; cells 17.94 µ in diameter.

7.Pediastrum simplex Meyen var. ***echinulatum*** Wittrock. **[Fig 2.G]**

Jena, M. and Adhikary, S.P. 2007, P 171 Pl-1 Fig.8-9

Colony mostly 4-8-celled, the cells are arranged in a plate, which is continuous or with interstices; outer cells have one elongated outward pointing process, inner cell polygonal, cell wall surface is ornamented with teeth like protuberance. Cells 11.2-13.1 µm broad and 22.1-24.7 µm long.

8.Pediastrum simplex* Lemmermann *var. duodenarium (Bailey) Rabenhorst **[Fig 2.H]**

Prescott, 1951, P. 227, Pl. 50, F. 4-5

Colony perforates composed of 36-48-64 cells with their inner margins concave, the outer margin

of inner cells forming a long process peripheral cells forming a shout process; cells 10-15 µ in diameter, 28.1 µ long; 36 celled colony 137 µ in diameter.

9.Stauridium tetras (Ehrenberg) Ralf; Prescott 1951, P – 227, pl –50, Fig – 3, 6. **[Fig2.I]**

Colonies entire having 4 – 8 celled; inner cells with 4 – 6 straight sides, one margin deeply incised; peripheral cells crenate with a deep incision in the outer free margin, their lateral margins adjoined along 2/3 of their length; cells 8 – 12 (16) µ in diameter.

10.Pediastrum tetras (Ehr.) Ralfs var. ***excisum*** (Rabenh.) Hansg. **[Fig2.J]**

Philipose, M. T., 1967, P.129-130, Fig. 45 f.

Colony 4-celled and with a very small space in the centre. Cells divided into two lobes by a deep incision reaching slightly below the middle of the cell, lobes more or less deeply concave. Colonies 28.1-30.7 µm in diameter. Cell 9.3-12.0 µm in diameter, 12.3-13.1 µm long.

11.P. tetras var. tetradon (Corda)**;** Philipose, M.T. 1967, P. 129, Fig. 45g. **[Fig2.K]**

Colonies with 4-8-16 celled; each colony 30 µm in diameter; the marginal cells 10 µm long, 9-10 µm broad; the inner cells 8.5 µm long and 9.5 µm broad.

12.Tetraedron minimum Hansg.**;** Philipose, M. T., 1967, P. 138, Fig. 53a-c. **[Fig2.L]**

Cell small and quadrangular with the sides concave and angles rounded, cell wall smooth, Cells 7.1-10.8 µm in diameter.

13.Tetraedron muticum **Hansgirg;** M.T. Philipose, 1967, p. 137, Fig. 51 **[Fig2.M]**

Cells small, flat and triangular with the sides slightly concave and angles broadly rounded or truncate. Cell wall smooth. Cells 6-30um in diameter

14.Chlorella vulgaris Beijerinck ;G.W.Prescott, 1951, p. 237, pl. 53, fig. 13 **[Fig2.N]**

Cells 9 µm wide, spherical, chloroplast broadly cup shaped; pyrenoid spherical to broadly ellipsoidal and usually surrounded by 2-4 starch grains.

15.Ankistrodesmus falcatus **(Corda) Ralfs 1848;**John *et al*. 2011 pp 424,pl 105J **[Fig2.O]**

Colonies of 4, 8 cells, cells united by convex sides, cells parallel to one another,enclosed in mucilaginous envelop; cells 3.7 µm wide, 45 µm long, needle to narrowly spindle-shaped, slightly sigmoid, tapering gradually to acute apices.

16, Ankistrodesmus fusiformis;John *et al*. 2011 pp 424,pl 105N **[Fig2.P]**

Colonies of 8-16 cells, mucilaginous envelop present, cells 2.5 µm wide, 35 µm long, cells cylindrical in centre and apices acute.

17.Coelastrum proboscideum Bohlin**;** Philipose, 1967. p. 229, fig. 137 **[Fig2.Q]**

Colonies are mostly pyramidal and with4-8-16, intercellular spaces usually large and polygonal; cells conical, truncate and six-sided with the lateral sides slightly concave; poles of cells thickened; cells 12.82 µ in diameter; colonies 32.3µ in diameter

18.Scenedesmus acuminatus**;** Philipose, 1967. p. 251, fig. 161 **[Fig2.R]**

Coenobia 2 or 4 celled, cells elongate fusiform, variably bent, their processes, in contrast to the acuminate type cells, are well separated from the cell-body; size of the cells 11.7 to 21.7 x 2-4 µ; processes terminating in small globules.

***19.Scenedesmus acunae* Comas;**Gonzales 1980:7,fig.7 d-f, **[Fig2.S]**
Cells are organized in linear or slightly curved coenobia (colonies).Coenobia generally consist of 2, 4, or 8 cells.cells linear Cylindrical of inner cells, convex outer cell, round apices. xvCell dimensions typically range from 10-20 µm in length and 2-5 µm in width

20.Scenedesmus acutus Meyen;Meyen, 1829: 775,pl.XLII[42] **[Fig2.T]**
Elongate and cylindrical.,Acute, giving the cells a pointed appearance. Cells typically form linear or slightly curved coenobia (colonies), cell wall Smooth and lacking ornamentation. Each cell contains one or more parietal chloroplasts

21.Scenedesmus dimorphusKuetzing;Smith 1916, P. 434, Pl.32, F185-189 **[Fig3.A]**
Colonies of 2,4 or 8 celled. Cells are linearly or distinctly alternately arranged cells in 1 or 2 rows , cells 2-4um wide , 6-27um long , broadly spindle shaped ,tapering to slightly extended apices,inner cells straight,marginal cells slightly outwardly curved but only in subapical parts.

22.Scenedesmus obliquus Kuetzing; Prescott, 1951, P. 279, Pl. 63, F. 17 **[Fig3.B]**
Colonies usually of 4, sometimes 2 or 8 erect cells arranged in a linear or sub-linear series. cell wall smooth and without terminal teeth or spines; cells 6.6 µ broad, 25.64 µ long.

23 Scenedesmus perforatus; Prescott, 1951, P. 279, Pl. 46, F. 24, 25 **[Fig3.C]**
Colonies usually 8 celled, sometimes 4 celled; cells with capitate ends; outer face of external cells slightly convex, inner face concave; poles curved outwards arid with a long re-curved spine; cells 10.2 µ broad, 20.5 µ long; spines 10.4 µ long; perforations 3.2 µ broad.

24.Scenedesmus quadricauda (Turp.) Breb.; Prescott, 1951, P. 280, Pl. 64, F. 02 **[Fig3.D]**
Colonies usually 4 celled, sometimes 2 or 8 celled; cells oblong-cylindrical with rounded ends and arranged in a linear series; poles of terminal cells with a long more or less straight or curved spine; cell wall smooth and without ridges; cells 7.6 µ broad, 21.5 µ long; spines 20 µ long.

***25.Rizoclonium* Kutzing** **[Fig3.E]**
Unbranched uniseriate filaments; Cells cylindrical, 14-16 µm broad, 45- 48 µm long, Chloroplast parietal with pyrenoids, often packed with starch.
(Guiry and Guiry 2014, http://www.algaebase.org.)

***26.Mougeotia*C.Agardh** **[Fig3.F]**
Filament is unbranched and uniseriate; cells are cylindrical, 8-10 µm broad, 110- 115 µm long, chloroplast axil, uncoiled, one per cell, plate like.
(Guiry and Guiry 2014, http://www.algaebase.org.)

***27.Oedogonium* Link Horae Phys. Berol. 5. 1820.** **[Fig3.G]**
Filaments single, unbranched; vegetative cells cylindric or sometimes capitellate, nodu- lose, or undulate; basal cell with holdfast; terminal cell obtuse, apiculate, or hyaline.

28.Spirogyra Communis (Hassal) Kutzing **[Fig3.H]**
Prescott, G.M. 1951, pp.312.
The Vegetative cells slender, cylindrical, the cells are (18)-20-26µ in diameter, (35)- 65-100µ long, with plane end walls; chloroplast solitary, making 1% to 4 turns.

29.Spirogyra fallax; Prescott, 1951, p 314, pl 77, f 10 **[Fig3.I]**
Filaments of rather slender cylindrical cells, 35 µ in diameter and up to 8 times the diameter in length, with replicate end walls, conjugation scalariform, the tubes short but formed from both gametangia; fertile cells inflated. Zygospores ellipsoid; wall layer smooth; 45 µ in diameter.

30.Spirogyra nitida Dumortier; Randhawa 1959, pp.320-321, fig. 299 **[Fig3.J]**
Vegetative cells 88-92pmx64-176pm; septum plane; chloroplasts 3-5, making 0.5-1.5 turns; conjugation scalariform; tubes formed by both gametangia; receptive gametangia slightly swollen on the outside

31.Spiroyra rectangularis; *Transeau 1954: 291,pl.25:figs 9-11* **[Fig3.K]**
Filaments usually scattered; vegetative cells 35-40 u X I50-320 g, dissepiments replicate; chromatophores 2-4, making 2-5 turns in the cell; fertile cells quadrately inflated toward the middle.

32.Spirogyra thankamaniensis **[Fig3.L]**
Vegetative cells 40-45 _mx 330-390 _m; septa plane; chloroplasts 3, making 1-1.5 turns.
Conjugation scalariform; tubes formed by both gametangia; the spore is 25- 30 um x 40-42 um, elongated zygospore is 20-22 x 50-55 um; mesospore thick, yellowish brown and smooth.

33.*Sirogoniu* Kutzing **[Fig3.M]**
Unbranched uniseriate filaments; up to several times as long, lacks outer mucilage layer and non slimy to touch; cells cylindrical, 15-18µm broad, 42- 45µm long, chloroplast ribbon like, straight, with pyrenoids; sexual reproduction by scalariform conjugation.
(Guiry and Guiry 2014, http://www.algaebase.org.)

34. Zygnema C. Agardh **[Fig3.N]**
Thalli comprised of unbranched uniseriate filaments, cells cylindrical, 15-17 µm broad, 42-45 µm long, and chloroplast two per cell, stellate.

35.Cosmarium awadhense ; Prasad & Misra (1992) (Pl. 21, fig. 27, pg. 153) **[Fig3.O]**
Cells size31.5 µ x 28 µ, isthmus 8.5 µ; small, slightly longer than broad, constriction deep, sinus narrowly linear towards apex and slightly open outwards; semi-cells sub-semicircular, chloroplast, containing one paranoid.

36.Cosmarium difficile Lutkemuller 1892:551 **[Fig3.P]**
Small, a third longer than broad, deeply constricted by a very narrow linear sinus. Semicells subhexagonal with a straight or subreniform base, subparallel sides slightly flattened, top with a flat rounded apical pit, lower corners rounded, upper ones broadly truncated.

37.Cosmarium discrepens;Guiry, M.D., & Guiry, G.M. (2023). **[Fig3.Q]**
Cells are solitary and exhibit a distinct median constriction, giving them a characteristic 'bow-tie' shape. Each cell is composed of two semicells that are typically rounded, with a deep sinus separating them. The cell wall can be smooth or ornamented with granules, spines, or other structures.

38.Cosmarium formulosum Hoff;Tiffany and Britton 1952, p. 190, pi. 54, fig. 589. **[Fig3.R]**

Cells 46 x 59 pm, isthmus 15 pm, slightly longer than wide, deeply constricted, sinus linear, the apex slightly dilated; semicells trapeziform subsemicircular or subpyramidate in outline, basal angles rounded, sides convex and 6-7 crenate.

***39.Cosmarium granatum* Brb. & Ralfs;** John *et al*. 2011 pp 653, pl 160V **[Fig3.S]**

Cells 13-28 µm wide, 22-45 µm long, ellipsoidal, sinus narrow, linear, slightly dilated inside; semicells pyramidate-truncate, lateral margins almost parallel, walls smooth.

40.Cosmarium humile* var. *substriatum(Nordst.) Schmidle 1895 **[Fig3.T]**

Cells 17-28 µm long, 16-26 µm wide. The cell wall is sculptured by both incurvations and granules. Differs from the nominate variety by larger cell dimensions and in that the granules are arranged in two intramarginal series.

41.Cosmarium isthmium West; Prescott et al. 1981, p. 163, pl. 243, fig. 6. **[Fig4.A]**

L. 46.6–48.2 µm, Br. 28.4–29.8 µm, Isth. 13.1–14.0 µm. L.:Br. 1.6. The cells here have a wider and deeper constriction, with more granules and are about half the size.

42.Cosmarium moniliforme (Turp.) Ralfs **[Fig4.B]**

Mahendra Perumal and Anand, 2009, P. 65, Pl. 17, F. 25

Cells 20 µ x 12.69 µ, (isthmus 7.36-9.47 µ wide), margin entire; semi-cell circular or sub-circular; constriction deep; sinus open; wall smooth; chloroplasts axile, in each semi-cell; pyrenoids 2.

***43.Cosmarium portianum*;** Prasad and Misra, 1992, p. 172, pl. 23, fig. 13. **[Fig4.C]**

Cells small, 34 µm long and 18.4 µm wide, about 1.3 times longer than broad, deeply constricted, sinus gradually opening from a rounded extremity, isthmus slightly elongated. ***44.Cosmarium quadrum*** Lundell.; Britton and Tiffany, 1952, P. 193, Pl. 53, F. 580 **[Fig4.D]**

Cells 54 x 60 µ and 35 µ thick (isthmus 18-29 µ wide), about as long as wide or slightly longer, quadrate in outline, deeply constricted, sinus linear and slightly dilated at the apex

45.Cosmarium subgranatum (Nordstedt) Lütkemüller 1902. **[Fig4.E]**

[West & West 1905, p. 188, pl. LXIII, f. 5-8]

Cells medium, near about 1.3 to 1.5 times as long as broad, cell wall punctuate. Semi cells pyramidate, constriction deep and linear with slightly dilated apex.

Size: Cell: 24µ-26µ × 32µ-36µ; Isthmus: 6µ-7µ.

46.Closterium acutum Breb.; West W. and West G.S., 1904, P. 177, Pl. 23, Fig. 9-14. **[Fig4.F]**

Cells small, needle shaped, 14-21 times longer than broad, straight, Cells 42.3-73.0µm long, 2.2-8.3 µm broad; apex 1.1-3.7 µm wide

47.Closterium leibleinii Kuetz.; West and West 1904, P. 141, Pl. 16, F. 9-14. **[Fig4.G]**

Cells 15.38 x 155.5 µ (apices 5-7 µ wide), 6-8 times longer than wide, strongly curved, outer margin 124-190 degrees of arc.

48.Closterium venus Kuetz.**;** Prescott, 1966, P. 8, Pl. 1, F. 13 **[Fig4.H]**

Cells 70 µ x 10.5 µ (apices 2-2.5 µ wide), 8-9 times longer than wide, strongly curved, outer margin about 160-130 degrees of arc.

49.Euastrum spinulosum Delponte;Scott and Prescott, 1961. p. 40, pl. 10, fig. 3 **[Fig4.I]**

Cells longer than broad deeply constricted, 46.9-53 µ in diameter 60-63µ long, isthmus 11.6 µ wide, sinus linear, open, dilated at apex, semicells circular, with three crenulations on each side; .

50.Staurastrum anatinum Cooke & A. Wills **[Fig4.J]**

Cells solitary, broader than long, constricted at the middle; sinus widely open outwards; cells granulated; cells 20-25 µm long and 30-40 µm, with horns 40-60 µm broad; isthmus 10-12 µm.

51 Staurastrum gracile Ralfs 1848.; West et al., 1923, p. 96, pl. CXLIV, f. 3-7 **[Fig4.K]**

Cells medium sized, about 1.5 as broad as long including processes, cell wall smooth. Constriction slight, open, usually an acute notch.

52.*Staurastrum paradoxum var. parvum*; West et al., 1923, p. 101, pl. CXLV, f. 1-5 **[Fig4.L]**

Cells small, about 1.5 times as broad as long, constriction moderate and open from acute apex.

Size: Cell: 36µ-40µ X 24µ-28µ (with arms); Isthmus: 3µ-5µ.

53.Staurastrum saltans;Scott and Prescott, 1961. p. 105, pl. 51, fig. 8 **[Fig4.M]**

Cell length - 43µm, Cell breadth - 30µm, Isthmus - 9µm.Cells with external side convex covered with short spines, sinus open.

54.Staurastrum tetracerum Ralfs; Prescott, 1966, P. 40 **[Fig4.N]**

Cells small, 31 µ x 24-28 µ, as broad as long; semi-cells sub-tri-angular with lateral margins convex and diverging from a notch like incision at the apex of an open sinus

Discussion:

The distribution of the green algal flora depicted in Table-1 consisted of 17 genera and 54 species collected from 6 different sites of Wainganga river near Bramhapuri taluka District.Chandrapur.The above mentioned 54 taxa of chlorophyceae belonging to 7 orders where Desmidiales represent 4 genera and 20 species, Sphaeropleales 4 genera and 19 species, Chlorococcales 3 genera and 5 species, Conjugales 1 genera and 5 species, Zygnematales 3 genera with single species, Cladophorales and Oedogoniales with single genera.

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Phytochemical Profile, Safety and Efficacy of an Herbal Plants Used for Contraception

Dr. Asha Bhausaheb Kadam
Research Center and Post Graduate Department of Botany,
Dada Patil Mahavidyalaya Karjat, Ahmednagar,
Affiliated to Savitribai Phule Pune University, Pune, Maharashtra, India.

ABSTRACT

The use of medicinal plants for contraception remains a common practice among Indian ethnic groups. The present study assessed the phytochemical profile, acute oral toxicity, and efficacy of synergistic herbal plant extract used for contraception in various tribal communities in India. An aqueous extract was prepared from equal quantities (in terms of weight) of seeds of Trigonella foenum-gracum (Fenugreek), Moringa oleifera (Drumstick)and Ricinus comunis based on a crude extract process used by traditional health practitioners. The phytochemical profiles of the freeze-dried herbal extract were analyzed using gas chromatography-mass spectrometry (GC-MS).

In addition, In vivo contraceptive efficacy was evaluated using seven rats per control and treatment groups. The control group received distilled water while test groups received 5, 50 and 300 mg/kg of the synergistic herbal crude extract, administered orally once daily for three consecutive days. Subsequently, female rats were paired 1:1 with males for 3 days. Their weights were measured weekly and the incidence of pregnancy was recorded. The GC-MS chromatogram revealed the presence of various phytochemical compounds. Regarding safety, the herbal crude extract had an IC50 value of 855.2 g/mL and 2000 mg/kg, the highest tested dose that caused no mortality or morbidity in the rats.

A contraceptive efficacy of 24.5% was exerted with 50 mg/kg herbal mixture extract while other doses had no effects given that all the rats were pregnant. Based on a chi-square test ($p < 0.05$), there was no correlation between the tested herbal mixture doses and contraception, nor on the weight of the rats. Hence, the synergistic herbal crude extract was found to be safe but had limited contraceptive efficacy at the tested doses. In future studies, will explore increased dose range, solvent extract types and hormonal analysis.

Keywords: Contraceptive, Acute toxicity, Medicinal plants, Herbal crude extract.

Introduction:

Globally, the potential of various parts and extracts of medicinal plants as contraceptiveagents is gaining increasing interest [1–6]. Based on existing anecdotal evidence, researchers have explored natural resources, including plants, as an alternative to conventional contraceptive [3,7,8].

As an indication of the unlocked potential in medicinal plants, recent studies have

efficiently established *Trigonella foenum graecum* as an effective contraceptive agent [9,]. In Indian societies, the use of plants for purposes of regulating fertility has been practiced for centuries, thereby highlighting their potential as contraceptives [7,10].

In Maharashtra, several herbalists confirmed the existence of some herbs that might act aspostnatal contraceptives when taken for several weeks after the delivery of a baby [11].
Likewise, similar evidence on the dependence on plants and associated herbal products has been reported in several regions of Maharashtra. Examples of common plants used in contraception include *Moringa oleifera, Ricinus Comunis, Cannabis sativa, Withania somnifera and Ziziphus mucronata.*

In tribal area, medicinal plants used for contraception showed that herbal contraceptivesare usually administered orally as single species or as herbal mixtures [7,15,16].Based on indigenous knowledge among different ethnic groups, the use of herbal mixtures or concoctions is often geared at enhancing the effectiveness and safety of the herbal product[17,18]. The importance of establishing the phytochemical profiles, safety and biological efficacy of herbal mixtures cannot be overemphasized [17,19–22].

Recently, we documented the use of medicinal plants as an important approach for preventing pregnancy among the different tribal communities[23]. Particularly, a herbal mixture consisting of the roots *(Bulbine frutescens* (L.)) and leaves (*Helichrysum caespititium* (DC.) Harv. and *Teucrium trifidum* Retz.) is considered as a popular remedy for preventing pregnancy.

However, the herbal mixture's chemical composition, safety and efficacy remain unknown. Thus, this study assessed the phytochemical profile, cytotoxicity, acute oral toxicity and efficacy of the herbal mixture used for contraception by traditional health practitioners in India.

2. Materials and Methods

2.1. Collection and Identification of Voucher Specimens

A traditional health practitioner with knowledge and experience of medicinal plants used for contraception in the study area assisted with the collection of the three plantspecies between August and September 2016. Voucher specimens were sent to the Botanical Survey of India (BSI) in Pune for identification. In addition, voucher specimens were deposited at the BSI, Herbarium. The names and botanical families of species were validated taxonomically using theWorld Flora Online http://www.worldfloraonline.org (accessed on 29 December 2016).

2.2. Preparation of the Herbal Mixture

Individually, the three plants were washed under running tap water and shadedried for approximately 3–4 weeks. The samples were pulverized to powder using a Bennett Read 1200 W power mechanical blender. A kitchen sieve with 1 mm poreswas used to remove solids. We combined equal portion (approximately 80 g each) ofground plant materials from *Trigonellafoenum-graecum* (seeds), *Moringa oleifera* (seeds) and *Ricinus comunis* (seeds). This was based on a recipe used by traditional health practitioners in tribal area of Maharashtra. By

using Soxhelete Apparatus extract was done and stored in refrigerator for further use.

2.3. Phytochemical Profile of the Herbal Mixture

Phytochemical profile of the herbal mixture was determined using Gas chromatography–mass spectrometry (GC-MS).One milligram (1 mg) of the freeze-dried herbal mixture was weighed and dissolved in 1 mL of methanol. The GC capillary column (HP-5MS, 30 m 0.25 mm i.d., 0.25 m) was used. High purity helium (99.996%) was used ascarrier gas at a flow rate of 1.25 mL/min and a linear velocity of 37 cm/s. An aliquotof 1 L of the sample was injected into the column with an inlet temperature of 250 ^{0}C and split-fewer modes at time of 30 s. An initial oven temperature of 35 ^{0}C was set andprogrammed to increase up to 285 ^{0}C at the rate of 10 ^{0}C per min with a holding time of3 min at each increment. The ion source temperature maintained at 230 ^{0}C was employedwhile electron impact (EI) mass spectra were obtained at the acceleration energy of 70 eV.

The mass acquisition range was 40–550 DA with a data acquisition rate of 10 spectra/S. The relative quantity of the chemical compounds present in the extract was expressed asa percentage based on peak area produced in the chromatogram. The compounds wereidentified by direct comparison of the mass spectrum of the analyte at a particular retentiontime to that of reference standards found in the National Chemical Laboratory (NCL), pune. The area percentage of each component was calculated by comparingits average peak area to the total areas obtained.

2.4. Acute Oral Toxicity of Herbal Mixture

Acute oral toxicity refers to those adverse effects occurring following oral administration of a single dose of a substance, or multiple doses given within 24 h. The acute toxicity of the extract was determined as per the OECD guideline 423 [25]. The preferred species and strain was Rattus norvegicus (rat). Healthy, non-pregnant rats (8–10 weeks) were randomly marked for identification and kept in cages 5 days prior to dosing to acclimatize to the laboratory conditions. The temperature in the experimental animal room was 22 _C (+3 _C) with relative humidity not exceeding 70% and lighting was artificial, the sequence being 12 h light and 12 h dark. For feeding, conventional laboratory chow was used with an unlimited supply of drinking water.

The 2000 mg/kg starting dose was selected from the required acute toxicity startingdoses (5, 50, 300 or 2000 mg/kg) based on cytotoxicity results. Dose, used interchangeably with concentration in this study, refers to the amount of test substance administered andis expressed as weight of test substance per unit weight of test animal (e.g., mg/kg) [25].The maximum volume of aqueous solution administered was 0.2 mL/100 g body weight and doses were prepared shortly prior to administration. Rats were fasted prior to dosing, with food but not water with held overnight.

Following the period of fasting, the animals were weighed and the herbal mixture administered. The herbal mixture was administered in a single dose orally using oral gavage. A 10% loss in body weight was considered critical and a threshold. The weight of each rat was measured 30 min, 2 h and 3 h after oral administration of the herbal mixture. Animals were

thereafter observed for clinical signs of acute oral toxicity and their weight measured daily for 14 days. All observations and measurements were systematically recorded with individual records being maintained for each animal. At the end of the test, all animals were weighed and euthanized.

2.5. In Vivo Contraceptive Efficacy of Herbal Mixture

Healthy female Sprague Dawley rats of 8–10 weeks were kept in cages five days prior to dosing. The temperature, relative humidity, lighting, housing and care, feeding and supply of water were as described above. The efficacy study consisted of control and three test doses (5, 50 and 300 mg/kg) of herbal mixture extract with 7 rats per group as established by power analysis to be statistically viable. The three doses were selectedbecause they were less than the lethal dose (LD50) of 2000 mg/kg determined from the acute oral toxicity study.The rats in the control group had an average mass of 194.83 g while 5, 50 and300 mg/kg treatments had an average weight of 197.93 g, 196.51 g and 191.75 g, respectively.

The test herbal mixture extract was administered orally for three consecutive days. The female rats were caged with males at a ratio of 1:1 for three days at the end of administration of treatments. The weight of each female rat was measured before herbal administrationand once after every seven days for 3 weeks. The animals were observed daily for 21 daysand were all euthanized after the study. A formula for contraceptive efficacy was adapted from the study by Sewani-Rusike [16], as highlighted below:

Contraceptive efficacy (CE) = number of non-pregnant rat/total number of rats × 100

2.6. Ethical Considerations

A plant collection permit for scientific curating and research was obtained from the Biodiversity Conservation center, Pune.The animal (in vivo) experiment was approved by the Animal care ethical Committee.

2.8. Data Analysis

SPSS statistical analysis software (IBM Analytics, Version 25), in conjunction with the Probit Analysis Method, was used to calculate IC50 (50% viability) values and 95% confidence limit ranges from the MTT analyses [26]. The Global Harmonized Classification System (GHS) was used to interpret the lethal dose (LD50) of the extract, and to categorizethe acute toxicity of herbal mixture extract [25]. The chi-square test for independence was used to analyze correlations between contraception and concentrations ($p < 0.05$). The effectsize (denoted by d) was used to analyze the effect of concentration on weight, where

- d = 0.2 represented small effect and no practically significant difference;
- d = 0.5 represented medium effect and practically visible difference;
- d = 0.8 represented large effect and practically significant difference.

3. Results

3.1. Phytochemical Profile of the Herbal Mixture

The GC-MS chromatogram revealed the presence of 12 identified and 9 unidentified phytocompounds. These includedpregnane, pyrrolidin-1-acetic acid, 2, 3-butanedione, 2-

propanone, 2, 5-dimethyl-4-hydroxy-3(2H)-furarone and glycerin. Phenol, 4-ethyl and 2-methoxy-4-vinylphenol were detected with retention times of 1163.4 s and 1219.1 s, and peak area % of 0.2300 and 2.6723, respectively. The first compound to be detected was 2,3-butanedione with a retention time of 130.9 s. The least abundant compound was Benzeneethanol, 4-hydroxy- with a peak area of 0.0030054%. The most abundant compound was 2,3 butanediol with a peak area of approximately 44.7%.

3.2. Acute Oral Toxicity of the Herbal Mixture

Animals were observed daily for 14 days post-dosing and the weight of each animal was measured. The first 3–4 h after administration of the extract was considered most important for acute toxicity studies [25]. After 2 h of herbal administration, the percentage in loss in body weight of animals was, on average, 2.07%, while the percentage loss in body weight after 3 h was 3.17 %, on average. However, only one rat showed vocalization when handled within the first 2 h after herbal administration.

After 3 h of herbal administration, the weight of the rats decreased further by an average of 3% and all rats showed vocalization when handled. The average weight decreased from 193.61 g to 183.94 g within the first two days after extract administration. The percentage loss in body weight over the firsttwo days after herbal extract administration was less than the 10% threshold. There was a general increase in average body weight over the next 12 days of the 14-day period

No mortality or morbidity was observed after 14 days, an indication that the 2000 mg/kgdose was safe. Consequently, the lethal dose (LD50) value of the extract was interpreted tobe between 2000 mg/kg to 5000 mg/kg, i.e., 2000 mg/kg < LD50 < 5000 mg/kg. Therefore, the herbal mixture extract was classified as a category 5 substance following the Globally Harmonized Classification System for Chemical Substances and Mixtures (GHS).

3.3. Contraceptive Efficacy of the Herbal Mixture

The weight of the rats in the control (0 mg/kg) increased by 56% on average, whilethe test groups, namely 5, 50 and 300 mg/kg, increased by 57%, 58% and 56%, respectively. Therefore, the highest increase in weight occurred in animals treated with 50 mg/kg herbal extract. Apart from 50 mg/kg treatment with 14.5% contraceptive efficacy, all the rats (in control, 5 and 300 mg/kg) fell pregnant, an indication of the absence ofcontraceptive effect. The chi-square test of independence did not show any correlation ($p < 0.05$) between concentration and contraception. Concentration had a minimal effect onweight with no practically significant difference.

4. Discussion

The most abundant compound was Pregnane and 2, 3 butane-diol, but no information from theliterature suggested that it could exert a contraceptive effect. Phenolic compounds are important bioactive compounds found in many medicinal plants [21,27,28].

In addition, phenolic profiling and evaluation of contraceptive effects on animals using contraceptive plants revealed the presence of phenols [6,8]. Furthermore, aryl 4-

guanidinobenzoates that possess phenols have shown themselves to be potential vaginal contraceptives [29], andpregnane, has a reputed contraceptive effect [30]. Therefore, these two detected in the herbal mixture could be bioactive compounds responsible for contraceptive activity in the herbal mixture in traditional medicine, especially among the Maharashtra.

An investigation of *Trigonella foenum-graecum*, one of the species that formed the herbal mixture in our study, found the IC50 value of its extracts to be 428.77 _g/mL (hexane), 82.86 _g/mL (dichloromethane), 357.39 _g/mL (methanol) and 394.36 _g/mL (water) [31].Some of the medicinal plants in Maharashtra reported to be used for contraception have been investigated for cytotoxicity. For example, the IC50 of *Moringa olefera* was found to be 20.535 _g/mL [32]. The IC50 value of *Ricinus communis* was 350, 250 and 200 _g/mLwhen cells were treated for 24 h, 48 h and 72 h, respectively [33].

Our findings revealed that the IC50 value of the herbal mixture was higher than for *Moringa olefera*, includingsome medicinal plants used for contraception in South Africa. Similarly, medicinal plants investigated for contraception in Maharashtra showed higher acute toxicity than the herbal mixture. For example, an aqueous seed extract of *Trigonella foenum-graecum* orally administered to rats had a lethal dose (LD50) of 771 mg/kg [34]. Several medicinal plants in Maharashtra have been investigated for their contraceptive efficacy using both in vitro and in vivo test systems [7]. For example, the contraceptive efficacy of 300 mg/kg aqueous extracts of *Trigonella* was investigated using three groups and eight animals per group [16].

Only two animals did not fall pregnant, a finding that is relatively similar to our result. However, the absence of significant contraceptive effect by the tested herbal mixture does not conclusively translate to its ineffectiveness. Several factors are known to influence the pharmacological response of medicinal plants [20,22,35].

For instance, the type of extracting solvent is known to strongly influence the qualityand quantity of phytochemicals [21], which may determine the resultant biological activities[36,37]. In the current study, the choice of water as the extracting solvent was influencedby the need to mimic the approach used in traditional medicine. However, water extractsare known to often exert weak biological activities due to the indiscriminate nature of theextracting phytochemical constituents, which may exert diverse and undesired biologicaleffects [18,37].

5. Conclusions

In this study, a preliminary phytochemical profile of the tested herbal mixture used as a contraceptive among indigenous people was generated. Of particular interest was the presence of two phenolic compounds that are known for their contraceptive effects.The safety of the herbal mixture was established using both in vitro and in vivo models.

However, the herbal mixture had a limited contraceptive effect at the tested doses. Inaddition, there was no correlation between applied doses of the herbal mixture extract in relation to the contraception effect and weight of the tested animals. The limited contraceptive efficacy may be related to the use of one solvent (water extract) in the current study. The absence of

contraceptive efficacy by the herbal mixture does not mean it is ineffective, as it has a long history of use in the study area. Future studies may entail a range of solvents for the extraction process and a varying range of doses for testing. It will also be pertinent to establish the effect of the herbal mixture on various biochemical parameters involved in contraception.

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Conflicts of Interest:

We declare no conflict of interest with regard to this study. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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Some members of *Euglenophyceae* and *Cyanophyceae*, from Faizpur region Dist. Jalgaon

Dr. S. A. Patil
Department of Botany,
S.V.P. Arts and Science College, Ainpur
And
S. P. Magar
Department of Botany,
Dhanaji Nana Mahavidyalaya, Faizpur

ABSTRACT

The present communication deals with the study of 15 algal taxa of which 11 taxa of Euglenophyceae and 4 taxa of Cyanophyceae collected from different polluted unpolluted localities around Faizpur region. All these taxa are systematically describe with microphotographs of these 11 taxa of Euglenophyceae belongs to 2 genera viz. Phacus (7) and Euglena(4) and 4 taxa of Cyanophyceae belongs to 4 genera viz. Chroococcus, Merismopedia, Arthrospira, Spirulina.

Key words: Euglenophyceae, Cyanophyceae, *Euglenaacus, taxa. Faizpur, Jalgaon.*

A member of the Euglenaceae family, Euglena has an eyespot that detects light and helps it move. Euglenophyceae is believed to be an ancient lineage of algae. Some scientists consider the colorless euglenophytes to be an older group. Euglenophyceae (phototrophic euglenids) are an important lineage within the Euglenida, Euglenozoa. Most of the approximately 3000 described species are free-living, phototrophic, unicellular flagellates with one to several plastids.

Cyanobacteria are Gram-negative prokaryotic oxygenic photoautotroph that evolved during the Precambrian epoch (4.5 billion years ago) and transformed the earth from an anoxic to an oxic environment. It exhibits both morphological and ecological diversity and has the ability to tolerate a wide variety of stress conditions. They are cosmopolitan in distribution. Some of the cyanobacteria have unique ability of nitrogen fixation and have been successfully used in rice-ecosystem as biofertilizers.

Materials and Methods

1. **Study area:** Faizpur and surrounding area
2. **Lattitude :** 21.1644.N Longitude : 75.8621.E
3. **Study period** : October 2022 to March 2023
4. **Collection time:** Morning period specially during 8 to 9.30 AM.
5. **Collection:** Sample was collected from temporary rain water bodies in plastic along with

water. Free swimming, benthic, epiphytic all the forms have been collected in plastic bottles.

6. **Preservation:** To preserve the phytoplankton in the sample, Formaline was used bottles are allowed to stand and precipitate settle in the bottles. Supernant was decanded and in the precipitate 4% formaline was added to the bottle.
7. **Prepratiion of slide:** A drop of glycerine, Formaline (6 ml glycerine +10 ml 40% Formaline + 84ml distilled water) was taken on slide to which a drop of concentrated preserved sample was added and covered by rectangular cover glass. The examination of plants was made with Olympus Microscope model no. Cx-41 RF. Microphotographs were taken with the help of Nikon Coolpix P4 digital camera under appropriate magnification of microscope.
8. **Identification:** Identification of taxa is based on the standard monographs such as Desikacharya (1959), Randhawa, M.S (1959), Ramnathan (1967) Prescott (1970), Hortobagyi(1973),Asual, Z.I (1975), Iyenger, M.O.P and Desikacharya, T.V.(1981), and other relevant literature.

Systematic Account

1. ***Euglenaacus*** var. ***hyalina*** Klebs**.** **(Pl.1 ,Fig.1)**

Division- Euglenophyta
Class-Euglenineae
Family- Euglenophyceae
Genus- ***Euglena*** Ehr.1938

Asaul, Z.I 1975, P.184, Pl.99, Fig.8-10

It differs from the *E. acus* in being weaker or slacker, full of paramylum rods and granules, posterior end with longer pointed tail, chromatophore slightly larger, discoid, and nucleus larger, central.

Habitat**:** In brownish green water contaminated with waste water near Faizpur July-2019

2. ***E. oxyurish*** *Schmarda* **(Pl.1,Fig.2)**

Z. I. Asual , 1975, P.189, Pl.102,Fig.5-8

Cell cylindrical, twisted to left. Pellicle marked striated, chromatophores numerous, small ovoid without pyrenoids. Paramylum usually two, large, rectangular, grooved centrally, on either side of nucleus stigma red granular. 102.9x319.5 µm.

Habitat **:** Polluted puddle containing organic debris near Fekari July- 2019

3. ***E. stellata*** Mainx**.** **(Pl.1,Fig.2)**

M.Gojdics, 1953, P.71, Pl.4, Fig.2

Cell spindle shaped. Pellicle spirally striated, chromatophores about ten band shaped, showing stellate arrangement at the middle of cell. Paramylum. Small rods near the middle of cell.29×17.5µm.

Habitat**:** Tiny polluted pool Udali July.2019

4. ***E. vagans*** Delf**.** **(Pl.5,Fig.4)**

Z. I. Asual, 1975, P.181, Pl.97, Fig.1,2,5.

Cells cylindrical with slight truncate anterior end, posteriorly tapering to a point pellicle finely , spirally striated. chromatophore numerous. small discs, without pyrenoids. Paramylum mostly two rods shaped. One anterior and another posterior to the nucleus. Flagellum ½ body length. Stigma large, oval slightly irregular, granular nucleus ellipsoidal 35.1x3.9 µm.

Habitat**:** From mixture of algae near Bharat Petroleum Nov- 2019

5. ***Phacus acuminatus*** Stokes **(Pl.1,Fig.5)**

Genus – ***Phacus*** Duj.1841

Z. I. Asaul, 1975,P.241, Pl.141, Fig.1-5

Cells broadly ovoid to suborbicular, broder posteriorly. It differs from the type species in having well developed, pointed, slightly curved tail, pellicle longitudinally striated, paramylum 1-2 rings about 5-11 µm in diameter. 25-33.4x19-25.1 µm.

Habitat: Small pond near power station, Deepnagar, July-2019

6. ***P .agillis*** Carter **(Pl.1,Fig.6)**

Z. I. Asaul, 1975, P.222, Pl.124, Fig.1-10.

Cell nearly fusiform, pellicle indistinctly spirally striated. Chromatophores two with a sheathed pyrenoid. Paramylum small, ovoid and granuler 11.7x9.75 µm.

Habitat**:** Widely distributed throughout Varangaon, Sep 2019

7. ***P. ankylonoton*** Pochm **(Pl.1,Fig.7)**

Z. I. Asaul, 1975, P.251, Pl.150, Fig.1-5

Cells oval with a dorsal flange; abruptly narrowed posteriorly forming a firm sharp, straight or slightly curved tail, margins with several notches and convolutions. pellicle longitudinally striated, paramylum two circular sometimes squarish discs or rings, anterior one large. Flagellum1/2 to body length. 33.1x16.7 µm.

Habitat**:**A small rock pool in river, Sakegaon Oct- 2019

8. ***P. anomalus*** Fritsch et Rich**.** **(Pl.2,Fig.1)**

Z. I. Asual, 1975, P.234, Pl.135, Fig.2-5.

Cell ovate, little asymmetrical with short, pointed curved tail. Pellicle longitudinally striated. paramylum 2 thick circular disc at the center of each half .30.1x25.7 µm.

Habitat**:** This is very common species in yellow-greenish water habitats, waste water pond, Faizpur, Dec-2019

9. ***P. birgei.*** Prescott **(Pl.2,Fig.2)**

Waghodekar, V. 1980, P.193, Pl.9, Fig.18

Cell broadly avoid with brodly rounded anterior end, posterior with along (2.8 µm) tapering, oblique caudus, margins sharply notched with 4 small indentation on either side, pellicle longitudinally, finely striated. Paramylum one large and other many small circular plates-flagellum of the cell length. Nucleus Cell green, 87.75 x 46.8 µm.

Habitat**:** In a small ditch, Near Bharat Petroleum Faizpur. Dec.2019

10. ***P. longicauda*** (Ehr.) Duj. var***cordata*** Pochm. **(Pl.2,Fig.3)**

Z. I. Asaul, 1975, P.261, Pl.160, Fig.5

Cell broadly ovoid, tapering gradually posteriorly to form a long straight, sharply pointed tail, anteriorly broadly rounded. pellicle longitudinally striated, paramylum bodies 2, larger, circular plates. 90.2x51.3 µm.

Habitat**:** In a fresh water surface,Savada, Nov-2019

11. ***P. orbicularis*** Huebner var**.** ***orbicularis*** Hueb. **(Pl.2,Fig.4)**

Z. I Asual, 1975, P.253, Pl.153, Fig.1-9

Cell orbicular in outline, with a short tail curved to the right, broadly rounded anteriorly. Pellicle longitiudinaly striated. Paramylum body one large circular plate 76.8x46.8µm.

Habitat**:** Widely distributed in generally found in fresh water ponds where vigorous plant growth is present, Pimprisekam, Jun-2019

12. ***Chroococcus varius*** A.Braun. in Rabenhorst**.** **(Pl.2, Fig.5)**

Class -Cyanophyceae

Order – Chroococcales

Family- Chroococcaceae

Prescott G.W. 1962, P.451, Pl.100, Fig.15

Shape irregular, colony 2-6 spherical cells, sometime colured, gelatinous envelope, brownish, colonial envelope lightly lamellate, individual cell sheath not distinctly evident, cells 2-4 µm in diameter.

Habitat**:** Along with the floating masses, near police station Faizpur, Dec-2019

13. ***Merismopedia convulata*** Breb**.** **(Pl.2,Fig.6)**

Genus**.** ***Merismopedia*** Meyen.1839

T.V. Desikachary, 1959 P.152, Pl.29, Fig.8,12,13

Cells spherical to ablong , 4-5.2 µm broad, 9-11.7 µm long, rarely longer, forming a large 1-4 µm long and broad, ,flat, leaf like convolute colonies, blue green, olive green or yellowish.

Habitat**:** A small ditch Nhavi. Sep-Oct 2019

14. ***Arthrospira jenneri (***Kuetz.) Stizenberger **(Pl.2,Fig.7)**

Order- Nostocales

Family- Oscillatoriaceae

Genus- ***Arthrospira*** Stizenb, 1852

Prescott. G. W 1982 P.481, Pl.108, Fig.22,23

Trichomes blue green, scattered, loosely coiled, not tapering towards the apices 6-8 µ in diameter, cells quadrate, dissepiments granular 4-5 µ long, spiral 10-15 µ wide distance between turn 12-14 µ.

Habitat**:** Widely distributed in unpolluted water Sakegaon, Sep-Oct 2019

15. ***Spirulina princeps,*** G.S.West**.** **(Pl.2,Fig.8)**

Genus- ***Spirulina*** Turpin em, Gardner, 1827

T.V. Desikachary, 1959 P.197, Pl.36, Fig.7

Trichomes 6.2 µm broad, deep blue green, slightly granules, loosely regularly spirally coiled, spirals 10.1 µm wide and distance between spirals 12.5 µm.
Habitat**:** Waste sewage near Nhavi Sep- Oct 2019

Conclusion:

There are 15 algal taxa of which 11 taxa of Euglenophyceae and 4 taxa of Cyanophyceae collected from different polluted unpolluted localities around Faizpur region.

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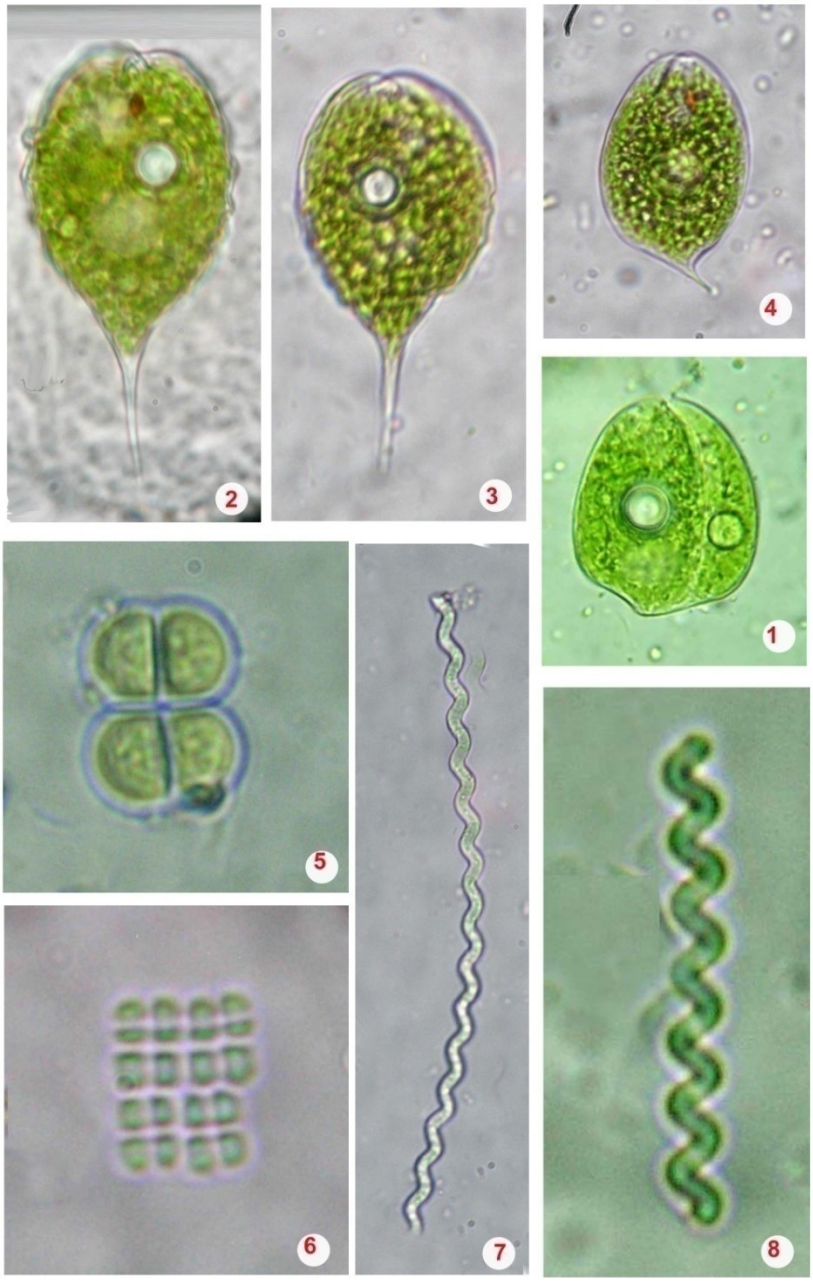
Plate No.1

1. ***Euglena acus*** var.***hyalina*** Klebs ***2. E. Oxyurish*** Schmarda **3.** ***E. stellata*** Mainx.

4. ***E. Vagans*** Delf. **5.** ***P. acuminatus*** Stokes **6.** ***P. agillis*** Carter **7.** ***P. ankylonoton*** Pochm

Plate No.2



1. *Phacus anomalus* Fritsch et Rich. **2. *P. birgei,*** Prescott **3. *P. Longicauda*** (Ehr.)Duj.Var ***cordata*** pochm ***4. P. Orbicularis*** Huebner var. ***orbicularis*** **5. *Chroococcus varius*** A.Braun. in Rabenhorst. **6. *Merismopedia convulata*** Breb. **7. *Arthrospira jenneri*** *(*Kuetz.) Stizenberger

8. *Spirulina princeps,* G. S. West.

Comparative Ultraviolet Spectroscopic (UV) identification of different morphotypes of *Thevetia peruviana* (Pers.) K. Schum ethanolic leaf extracts

Krati Ghavri
Department of Botany, Government Holkar (Model Autonomous) Science College, Indore Madhya Pradesh
And
Madhavi Adhav
Department of Botany, P.M.B. Gujarati Science College, Indore, Madhya Pradesh, India

Abstract:

Plant based therapeutics play an important role in the public health care system of any nation. The plant Thevetia peruviana (Pers.) K. Schum belongs to the family Apocynaceae and is commonly known as yellow oleander. Thevetia peruviana (Pers.) K. Schum is a medicinal as well as ornamental plant with a wide array of pharmacological properties. On the basis of flower colour, the Apocynaceae member Thevetia peruviana (Pers.) K. Schum can be grouped into three morphotypes, viz. yellow, orange and white.

This study investigates the application of ultraviolet (UV) spectroscopy as a tool for the qualitative and quantitative analysis of phytochemicals present in different morphotypes of Thevetia peruviana ethanolic leaf extracts. Comparative UV spectra were obtained from different morphotypes of Thevetia peruviana leaf ethanolic extract. The results revealed a distinct absorption maxima corresponding to the presence of alkaloids, flavonoids, glycosides and other secondary metabolites. These findings provide a spectral fingerprint that can aid in the rapid identification and purity assessment of different morphotypes of Thevetia peruviana (Pers.) K. Schum leaf ethanolic extracts, contributing to quality control in herbal medicine.Furthermore, the comparative analysis of different plant parts and solvents offers insights into the optimal extraction conditions for specific bioactive compounds.

Keywords: *Thevetia peruviana* (Pers.) K. Schum, morphotypes, ultraviolet (UV) spectroscopy, Alkaloids, Flavonoids, Glycosides.

Introduction:

In India, various sections of the population widely use plants with therapeutic potential, both as folk medicines in indigenous systems like Siddha, Ayurveda, and Unani, and as processed products from the pharmaceutical industry. India is home to approximately 4.5 million plant species, but only an estimated 250,000 to 500,000 of these species have been studied phytochemically for their pharmacological or biological activity.

Thevetia peruviana (Pers.) K. Schum is an evergreen plant of family Apocynaceae, native to Tropical America. It is an evergreen and glabrous small tree with 3-6 m height. The leaves are simple, glabrous and narrowed at both ends. The flowers are bright yellow and are borne in few-flowered cymes. (Kaushik and Dhiman, 1999). The plant is bitter, pungent, acrid, hot, and

astringent to the bowels, useful in urethral discharge, worms, skin diseases, leucoderma, wounds, piles, eye trouble, itching, fever and bronchitis. (Kirtikar and Basu,1981). The cardiac glycosides obtained from bark, kernals and flowers are useful for heart diseases. (Prajapati *et al*, 2007). Leaf decoction is given to prevent conception. (Retnam and Martin, 2006).The root of this plant are made into a paste and applied to tumours.(Singh and Dey, 2005). Seeds used as an abortifacient and purgative in rheumatism and dropsy; also used as an alexeteric (Ambasta, 1986).

The present study was carried out to characterize the phytochemical constituents in (leaf) morphotypes of *Thevetia peruviana* (Pers.) K. Schum. In present research work three morphotypes of *Thevetia peruviana* (Pers.) K. Schum are selected.

Morphotype I - *Thevetia* Yellow
Morphotype II - *Thevetia* Orange
Morphotype III - *Thevetia* White



Fig.No.1 : Thevetia Yellow **Thevetia Orange** **Thevetia White**



Fig.No.2: Thevetia Yellow Flower **Thevetia Orange Flower** **Thevetia White Flower**

2. Material and methods

For present investigation the plant material of *Thevetia peruviana* (Pers.) yellow and orange leaves were collected from Devi Ahilya Vishwavidyalaya campus, Indore and white

flowers and leaves were collected from Nehruvangram, Indore. The collected plant material was identified with the help of Flora of Madhya Pradesh (Mudgal *et al.*, 1997). To obtain ethanolic extract 100 gms of shade dried plant material was extaract with 500 ml of ethanol (95%) in "Soxhlet Extraction apparatus". Finally, the prepared plant was macerated with water for 24 hrs to obtain aqueous extract. The extract was concentrated by distilling off the solvent (Kokate, 1988; Kokate *et al.,* 2013).

Spectral studies have been done for identification of flavonoids, alkaloids, chromophoric and functional groups present in the studied plant morphotypes extract. Ultraviolet Spectroscopy of all the tested samples of Thevetia peruviana (Pers.) K. Schum morphotypes [Thevetia leaves ethanolic extract] were analyzed by Pious Laboratories, Indore and Infrared Spectroscopy was done by CLL, Indore [Choksi Laboratories Limited] Madhya Pradesh.

3. Observations and discussion:

Comparative analysis of *Thevetia peruviana* (Pers.) K. Schum morphotypes were performed by using parameter - Ultraviolet Spectroscopy

Morphotype I - Thevetia Yellow

The UV spectrum of Thevetia Yellow Leaf shows the absorption band at 291 nm which indicates the presence of thiocarbonyl containing compounds, C=S, sulfur containing groups [R-S (=O)-R'] and flavanone (2, 3- dihydroflavone). The band at 268 nm reveals the presence of C=S, sulfur containing groups, thiophene [SCH=CHCH=CH], 1- phenyl, 3- butadiene. Flavones (2-phenyl-γ- benzopirone) and chalcones (2, 4'- dihydroxy-3'-methoxy-chalcone) flavonoids are present and reserpine types of indole alkaloid are also present. The shoulder band at 260 nm confirms the occurrence of C=S sulfur containing group, carbonyl (-CHO) containing groups [α, β -unsaturated ketones], β-diketones, pyridine and [flavone (2-phenyl-γ- benzopirone) and chalcones (2, 4'-dihydroxy-3'-methoxy-chalcone)] flavonoids. The most characteristic absorption of β-diketones, α, β-unsaturated ketones (R-COR'), aldehydes (R-COH) and carbonyl (-CHO) containing groups.Flavone (2-phenyl-γ- benzopirone) and chalcones (2, 4'-dihydroxy-3'-methoxy-chalcone) type of flavonoids and aricine type of indole alkaloid occurs at 245 nm. Strong absorption is observed at 210 nm arising from aromatic compounds, amides ($-CONH_2$), S=O stretching, sulfoxide, di-n- butyl sulfide, acrolein, lactams, ketones (R-COR') and aldehydes (R-COH). (Fig No.3, Table No. 1).

UV spectrum reported following kinds of indole alkaloids and flavonoids:

Indole Alkaloids	Flavonoids
1). Reserpine	1). Flavone (2-phenyl-□- benzopirone)
2). Aricine	2). Flavanones (2, 3- dihydroflavone)
	3). Chalcones (2, 4'-dihydroxy-3'-methoxy-chalcone)

Morphotype II - Thevetia Orange

The UV spectrum of Thevetia Orange Leaf shows weak absorption at 297 nm is due to the presence of carbonyl (-CHO) containing groups, C=S, sulfur containing groups [R-S (=O)-R'], thiophene [SCH=CHCH=CH] and flavonoid-flavanone (2, 3- dihydroflavone). The band 280 nm, reveals the presence of carbonyl (-CHO) containing groups, C=S, sulfur containing groups,1-phenyl -1,3- butadiene [$(CH_2=CH)_2$], indole alkaloids (aricine, sarpagine) and [flavone (2-phenyl-γ- benzopirone), chalcones (2, 4'-dihydroxy-3'-methoxy-chalcone)] flavonoids. Another band at 259 nm , confirms the presence of α, β – unsaturated ketones (R-COR'), pyridine, β – diketones and C=S, sulfur containing groups [R-S (=O)-R'] .It also shows the occurrence of flavone (2-phenyl-γ- benzopirone) and chalcones (2, 4'-dihydroxy-3'-methoxy-chalcone)flavonoids. The strong band is seen at 212 nm, which indicates methyl vinyl ketone, amides ($-CONH_2$) and lactams. (Fig No.4, Table No. 1).

UV spectrum of Thevetia Orange Leaf reported following types of indole alkaloids and flavonoids:

Indole Alkaloids	**Flavonoids**
1). Aricine	1). Flavone (2-phenyl-γ- benzopirone)
2). Sarpagine	2). Flavanones (2, 3- dihydroflavone)
	3). Chalcones (2, 4'-dihydroxy-3'-methoxy-chalcone)

Morphotype III - Thevetia White

In UV spectrum of Thevetia White Leaf the weak absorption band at 349 nm does not shows any chromophoric groups , only the presence of flavone (2-phenyl-γ- benzopirone) types of flavonoid. The band at 296 nm reveals the presence of C=S, sulfur containing groups [R-S (=O)-R'], thiophene [SCH=CHCH=CH], pyridine, carbonyl (-CHO) containing groups and reserpine type of indole alkaloid and flavanone (2, 3- dihydroflavone) type of flavonoid. The C=S, sulfur containing groups[R-S (=O)-R'] is also confirmed by the presence of absorption band at 250 nm which also indicates the presence of β diketones, pyrrole ,di– n-butyldisulfide [$(CH_3(CH_3)_3SS(CH)_2CH_3$],α- β- unsaturated ketones (R-COR'),aldehydes (R-COH), indole alkaloids (reserpinine and aricine) as well as flavone and chalcones (2, 4'-dihydroxy-3'-methoxy-chalcone) flavonoids. The intense absorption band at 213 nm is typically due to amides ($-CONH_2$), methyl vinyl ketones and lactams.(**Fig No. 5, Table No. 1).**

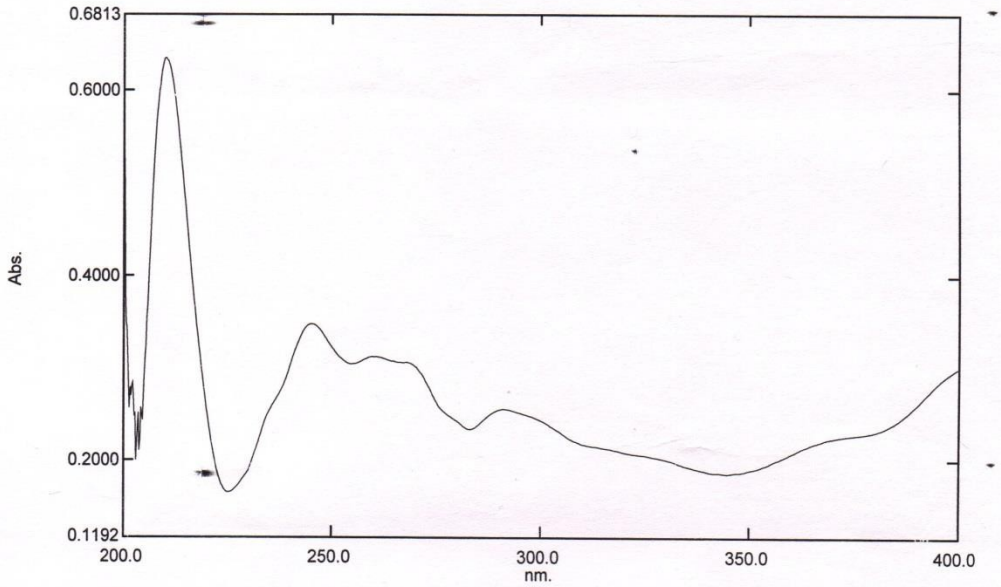
UV spectrum of Thevetia White Leaf reported following types of indole alkaloids and flavonoids:

Indole Alkaloids	**Flavonoids**
1). Reserpine	1). Flavone (2-phenyl-γ- benzopirone)
2). Aricine	2). Flavanones (2, 3- dihydroflavone)
	3). Chalcones (2, 4'-dihydroxy-3'-methoxy-chalcon

Fig No. 3: Ultraviolet spectra of morphotype I [Thevetia Yellow] ethanolic leaf extract

Pious LaboratoriesPvt. Ltd.

Data set: Storage 200150 - RawData - 2018_DATA$Laboratory - 1-48-1 - Thevetia peruviane yellow leaf.spc



No.	P/V	Wavelength	Abs.	Description
1	↑	291.0	0.2554	
2	↑	267.8	0.3062	
3	↑	259.6	0.3123	
4	↑	245.2	0.3479	
5	↑	210.0	0.6344	
6	↓	344.8	0.1859	
7	↓	283.2	0.2337	
8	↓	267.0	0.3056	
9	↓	254.6	0.3043	
10	↓	225.2	0.1660	
11	↓	203.0	0.2004	

Analysed By:- 09/06/18

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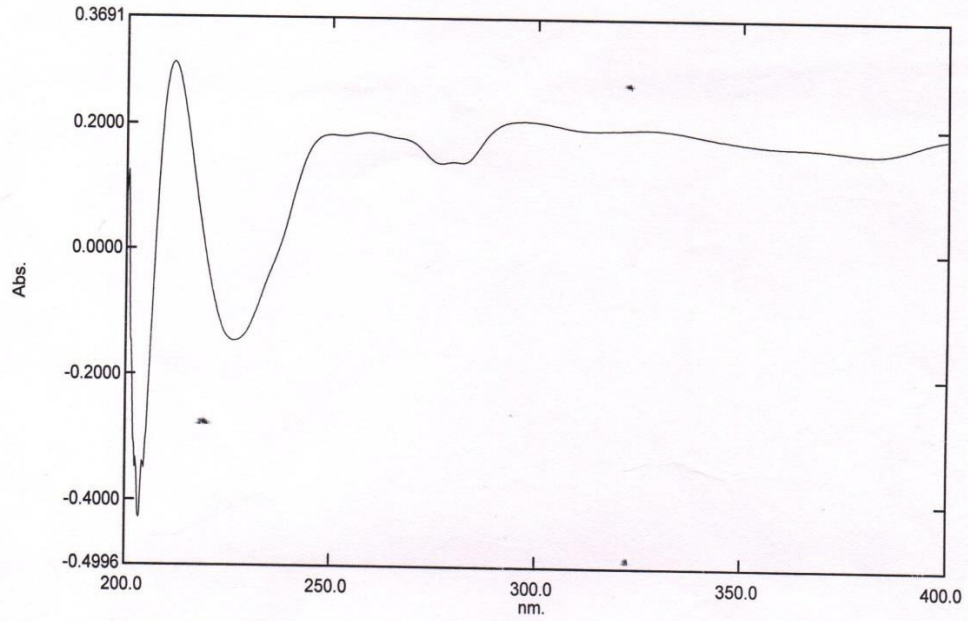
Checked By:- 09/06/18

Fig No. 4: Ultraviolet spectra of morphotype II [Thevetia Orange] ethanolic leaf extract

Pious LaboratoriesPvt. Ltd.

Data set: Storage 192955 - RawData - 2018_DATA$Laboratory - 1-44-1 - Thevetia Peruviana orange leaf.spc



No.	P/V	Wavelength	Abs.	Description
1	↑	297.4	0.2073	
2	↑	279.8	0.1421	
3	↑	259.0	0.1872	
4	↑	249.8	0.1832	
5	↑	211.6	0.2967	
6	↓	382.6	0.1595	
7	↓	314.8	0.1936	
8	↓	281.8	0.1409	
9	↓	276.8	0.1397	
10	↓	253.0	0.1820	
11	↓	226.6	-0.1467	
12	↓	203.4	-0.4272	

Analysed By:- 09/06/18

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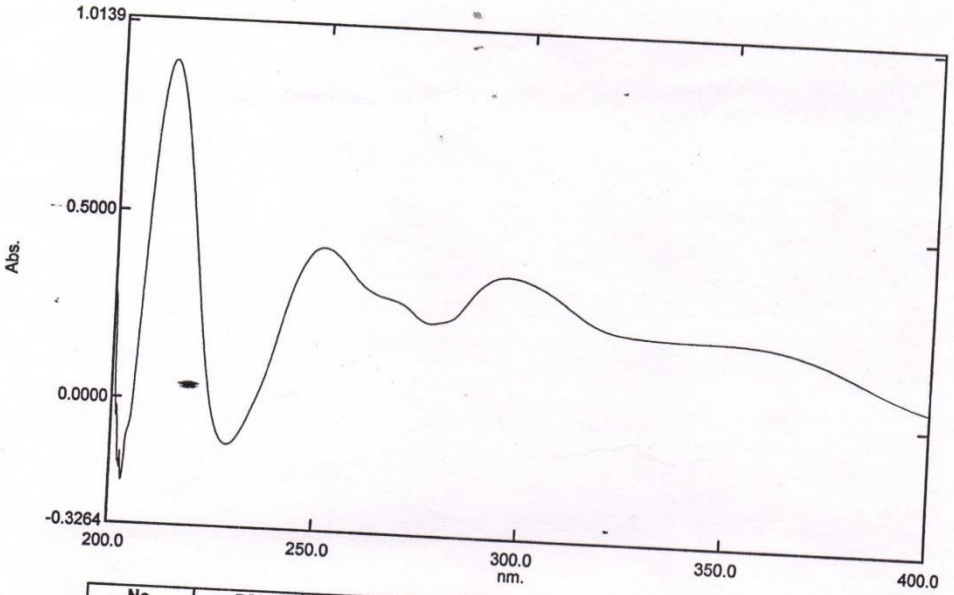
Checked By:- 09/06/18

Fig No. 5: Ultraviolet spectra of morphotype III [Thevetia White] ethanolic leaf extract

Pious LaboratoriesPvt. Ltd.

Data set: Storage 193747 - RawData - 2018_DATA$Laboratory - 1-45-1 - Thevetia Peruviana White Leaf.spc



No.	P/V	Wavelength	Abs.	Description
1	↑	348.6	0.2130	
2	↑	295.8	0.3659	
3	↑	250.4	0.4220	
4	↑	212.6	0.9022	
5	↓	277.2	0.2325	
6	↓	228.4	-0.1126	
7	↓	203.0	-0.2147	

Analysed By:- 09/06/18

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Checked By:- 09/06/18

Table No. 01

Comparative Ultra violet Spectrum of *Thevetia peruviana* (Pers.) K. Schum morphotypes

Tested for ethanolic leaf extract of *Thevetia peruviana* (Pers.) K. Schum Morphotypes																
Thevetia Yellow Leaf				Thevetia Orange Leaf						Thevetia White Leaf						
Wave no. (nm)	Absorb -ance	Alkaloids detected	Chromophoric groups detected	Flavanoids detected	Wave no. (nm)	Absorb-ance	Alkaloids detected	Chromophoric groups detected	Flavanoids detected	Wave no. (nm)	Absorb- ance	Alkaloids detected	Chromophoric groups detected	Flavanoids detected		
291	0.2554		Thiocarbonyl containing compounds , C=S, sulfur containing groups[R-S (=O)-R']	Flavanones (2, 3-dihydro-flavone)	297	0.2073	–	C=S , sulfur containing groups [R-S (=O)-R'] and thiophene [SCH=CHCH=CH]	Flavanones (2, 3-dihydro-flavone)	349	0.2130	–	–	Flavone (2-phenyl-γ- benzopirone)		
268	0.3062	Reserpine	C=S,sulfur containing groups [R-S (=O)-R'], thiophene, 1-Phenyl,3-butadiene [(CH2=CH)2]	Flavone (2-phenyl-γ-benzopirone),chalcones (benzyl acetophenone)	280	0.1421	Aricine, Sarpagine,	carbonyl containing groups(-CHO) , C=S,sulfur containing groups [R-S (=O)-R'], 1- phenyl -1,3- butadiene	Flavone (2-phenyl-γ-benzopirone), Chalcones (benzyl acetophenone)	296	0.3659	Reserpine	C=S,sulfur containing groups [R-S (=O)R'], thiophene, pyridine , carbonyl containing groups(-CHO)	Flavanones (2, 3- dihydro-flavone)		
260	0.3123	–	C=S sulfur containing groups [R-S (=O)-R'], α,β -unsaturated ketones(R-COR') ,pyridine	Flavone (2-phenyl-γ-benzopirone), chalcones (benzyl acetophenone)	259	0.1832	–	α,β – unsaturated ketones (R-COR'), pyridine, β – diketones and C=S , sulfur containing groups [R-S (=O)-R']	Flavone (2-phenyl-γ-benzopirone), chalcones (benzyl acetophenone)	250	0.4220	Reserpinine, Aricine	C=S sulfur containing groups [R-S (=O)-R'], α,β -unsaturated ketones(R-COR') , aldehydes (R-CHO), β diketones, Pyrrole , di– n-butyldisulfide [(CH3(CH3)3SS(CH)2C	Flavone (2-phenyl-γ-benzopirone), chalcones (benzyl acetophenone)		
245	0.3479	Aricine	β-diketones ,α,β unsaturated ketones (R-COR') and aldehydes (R-CHO), carbonyl containing groups(-CHO)	Flavone (2- phenyl-γ-benzopirone), chalcones (benzyl	212	0.2967	–	methyl vinyl ketone [CH 3C(O)CH=CH2], amides (-CONH2) and lactams	–	213	0.9022	–	methyl vinyl ketones [CH-C(O)CH=CH2], amides(-CONH2) and lactams	–		
	0.6344		Amides (-CONH2), Lactams, S=O , sulfoxide , di-n- butyl sulfide [(CH3(CH3)3SS(CH)2 CH3], aromatic compounds, ketones(R-COR')and aldehydes (R-CHO).					–	–				–	–		

Conclusion:

Spectral analysis (UV Spectroscopy) indicates the presence of chromophoric and functional groups like carbonyl, thiocarbonyl, phenolic, sulfur containing groups, amide, lactam, nitro groups, alkaloids viz. reserpine, aricine, voacamine, serpentine, sarpagine and reserpinine. Among flavonoids – Chalcones, quercetin, fisten, flavones, flavanones, myricetin, and Sodium (Na) salt of Quercetin 5'- Sulfonic Acid [NaQSA]. Since, these groups are attributed to antibacterial activity of the morphotypes. They show presence of uniform functional groups which are very good evidence that any one of the *Thevetia peruviana* (Pers.) K. Schum morphotypes leaf might be used as an alternative source for healing disorders and diseases.

Acknowlegement:

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Design, Synthesis and Spectral Characterization of 1,3,4-Thiadiazole Derivatives

Mr. Nityanand D. Dahake
Assistant Professor
Department of Chemistry, Arts & Commerce Collegeo Warwat Bakal
And
Prof. Dr. Vijay H. Masand
Professor
Department of Chemistry, Vidyabharti Mahavidyalaya, Amravati

Abstract

This paper includes a detailed analysis of the synthesis, design, and spectrum characterization of selected 1,3,4-thiadiazole derivatives. 1,3,4-thiadiazole is a significant heterocyclic compound having a wide range of biological and industrial applications. The research focuses on the strategic design and synthesis of these novel 1,3,4-thiadiazole derivatives employing a range of functional groups in order to explore the potential applications of these compounds. By adjusting reaction conditions to improve yield and purity and applying a range of synthetic strategies, we were able to successfully synthesize a large number of derivatives. The method led to a better yield and simple work-up procedure.

Keywords : Molecular design, chemical properties, derivatives of thiadiazole, synthetic chemistry, chemical structure, 1,3,4-thiadiazole,heterocyclic compounds, chemical synthesis,spectral characterization

Graphical abstract

Introduction

1,3,4-thiadiazole is a versatile heterocyclic molecule that has generated quite a few hobby withinside the discipline of natural chemistry because of its several organic and business packages[1]. The 1,3,4-thiadiazole ring structure, with its fused nitrogen and sulphur atoms, gives a primary framework for the synthesis of novel materials, agrochemicals, and pharmaceuticals[2]. The molecule in query possesses several exciting homes, which include antibacterial, antifungal, anti-

inflammatory, and anticancer homes, making it an attractive difficulty for chemical studies and development[3]. Design and synthesis are important for optimizing the capacity packages of 1,3,4-thiadiazole derivatives. Thanks to improvements in artificial techniques, chemists can also additionally now synthesize an extensive variety of 1,3,4-thiadiazole-primarily based totally molecules with custom designed practical groups, improving their selectivity and effectiveness. Understanding those materials` reactivity and chemical homes is important to their powerful utility in a whole lot of contexts. Spectral characterization is important for comprehending the structural and electric homes of 1,3,4-thiadiazole derivatives[8]. Numerous spectroscopic techniques, together with nuclear magnetic resonance (NMR), infrared (IR), and ultraviolet-visible (UV-Vis), offer important statistics approximately the molecular structure, useful groups, and interplay dynamics of those compounds. Comprehensive spectrum evaluation permits researchers to examine the chemical behaviour and capacity reactivity of synthesized materials at the same time as additionally confirming their validity and purity[6]. The goal of this studies is to feature to the growing quantity of statistics to be had on 1,3,4-thiadiazole with the aid of using concentrating at the methodical creation, synthesis, and thorough spectral evaluation of recent derivatives. These studies will enhance our knowledge of 1,3,4-thiadiazole chemistry and make it simpler to construct novel substances and programs primarily based totally in this enormous heterocyclic framework with the aid of using numerous artificial approaches and analytical tools[5].

One top notch studies hole withinside the subject of Design, Synthesis, and Spectral Characterization of 1,3,4-Thiadiazole Derivatives and Schiff`s Bases is the constrained exploration of environmentally sustainable artificial methodologies. While large development has been made in synthesizing those compounds the usage of traditional methods, there stays a loss of attention on greener and extra sustainable strategies that limit waste technology and make use of renewable resources. This studies hole is especially applicable withinside the context of developing issues approximately environmental pollutants and the want for sustainable chemistry practices.

Additionally, there's a dearth of complete research inspecting the capability toxicological profiles of newly synthesized 1,3,4-thiadiazole derivatives and Schiff`s bases. Despite their promising pharmacological activities, the protection profiles of those compounds have now no longer been very well evaluated, posing a large hole in information concerning their capability damaging consequences on human fitness and the environment. Addressing this studies hole is vital for making sure the secure and accountable improvement of those compounds for numerous applications[10].

Methodology

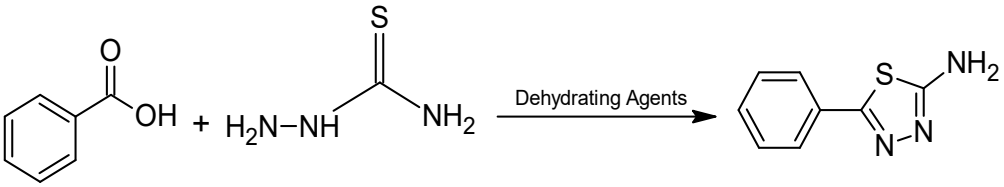
Experimental Section: All solvents were distilled before use.

Synthetic Protocol:

The target molecule 1,3,4-thiadiazoles were synthesized by following a simple route involving POCl3as dehydrating agent to form targeted molecule.

1) General Scheme: Synthesis of 1,3,4-Thiadiazole Derivative using Appropriate Reaction Conditions, the route involves heating a mixture of aromatic carboxylic acid with

thiosemicarbazide in a molar proportion in the presence of different dehydrating agent viz. $POCl_3$, H_2SO_4, $ZnCl_2$, PPA etc as a condensing agent to yield 1,3,4-thiadiazol-2-amine



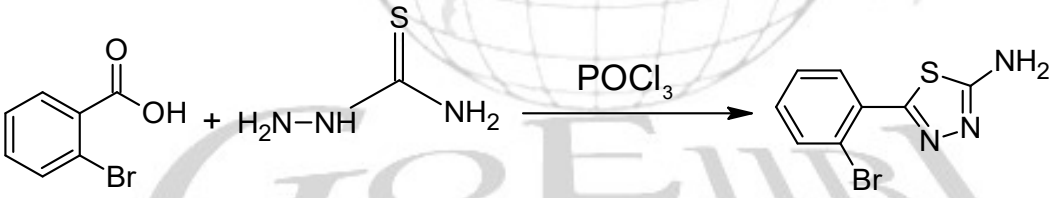
Experimental Procedure:

Experiment No. 1(P):

The synthesis of targeted molecule viz. 5-phenyl-1,3,4-thiadiazol-2-amine is represented as follows:

Formation of 5-(2-bromophenyl)-1,3,4-thiadiazol-2-amine $POCl_3$as a cyclising agent:

In a 50 ml round-bottom flask, a solution of 2-bromobenzoic acid, thiosemicarbazide (TSC) at a molar ratio of 1:1, and excess phosphorus oxychloride was heated over a water bath for two hours. Excess ice-cold water was added after the mixture had cooled to room temperature. A 5% $NaHCO_3$ solution was added to the mixture drop-wise while being constantly stirred to raise the pH above 8. After filtering and recrystallizing the precipitate from 50% ethanol, a solid known as 5-phenyl-1,3,4-thiadiazol-2-amine was obtained.



Compound Name: 5-(2-bromophenyl)-1,3,4-thiadiazol-2-amine:

Yield = 73%, Molecular Formula = $C_8H_6BrN_3S$,

Molecular Weight = 256.12, Melting Point = 219^0C

IR (Cm^{-1}): 523, 689, 853, 1058, 1153, 1290, 1441, 1519, 1614, 1915, 2049, 2189, 2304, 2665, 2768, 3090,3279, 3339, 3736, 3860

NMR ($CDCl_3$): δ 2.5 (Triplet), 2.4 (Triplet), 3.4 (Singlet), 7.5 (Multiplate), 7.9(Multiplate)

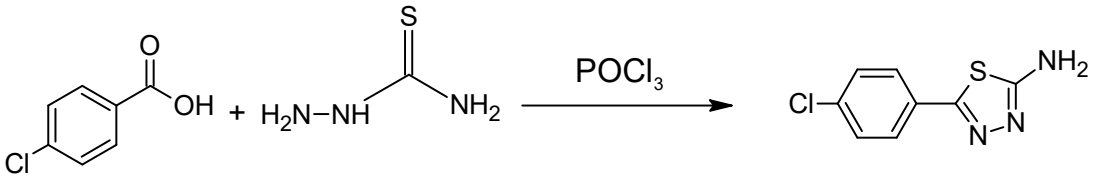
UV: Absorbance at 293.00 nm

Experiment No. 2(Q):

Formation of 5-(4-chlorophenyl)-1,3,4-thiadiazol-2-amine $POCl_3$ as a cyclising agent:

In a 50 ml round-bottom flask, a solution of 4-chlorobenzoic acid, thiosemicarbazide (TSC) at a molar ratio of 1:1, and excess phosphorus oxychloride was heated over a water bath for two hours. Excess ice-cold water was added after the mixture had cooled to room temperature. A 5% $NaHCO_3$ solution was added to the mixture drop-wise while being constantly stirred to raise the pH above 8. After filtering and recrystallizing the precipitate from 50% ethanol, a solid known as

5-(4-chlorophenyl)-1,3,4-thiadiazol-2-amine was obtained.



Compound Name: 5-(4-chlorophenyl)-1,3,4-thiadiazol-2-amine

Yield = 78%, Molecular Formula = $C_8H_6ClN_3S$,

Molecular Weight = 211.67, Melting Point = 228^0C

IR (Cm^{-1}): 527, 557, 830, 1093, 1329, 1509, 1629, 1899, 2059, 2197, 2309, 2410, 2693, 2778, 3108, 3282, 3825, 3882, 3981

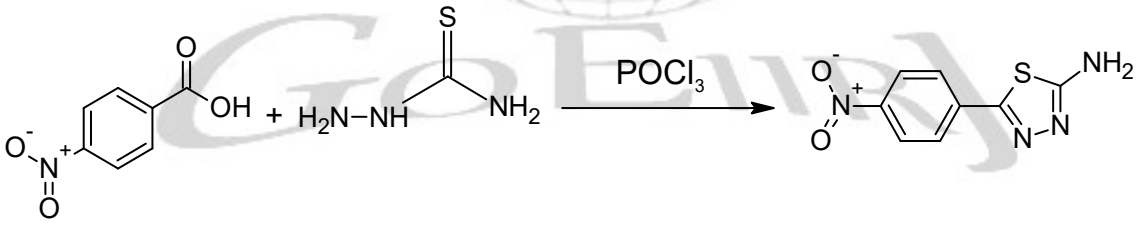
NMR ($CDCl_3$): δ 2.5 (Triplet), 3.3 (Singlet), 7.6 (Multiplet), 7.9 (Multiplet)

UV: Absorbance at 307.00 nm

Experiment No. 3 (R):

Formation of 5-(4-nitrophenyl)-1,3,4-thiadiazol-2-amine $POCl_3$ as a cyclising agent:

In a 50 ml round-bottom flask, a solution of 4-nitrobenzoic acid, thiosemicarbazide (TSC) at a molar ratio of 1:1, and excess phosphorus oxychloride was heated over a water bath for two hours. Excess ice-cold water was added after the mixture had cooled to room temperature. A 5% $NaHCO_3$ solution was added to the mixture drop-wise while being constantly stirred to raise the pH above 8. After filtering and recrystallizing the precipitate from 50% ethanol, a solid known as 5-(4-nitrophenyl)-1,3,4-thiadiazol-2-amine was obtained.



Compound Name: 5-(4-nitrophenyl)-1,3,4-thiadiazol-2-amine

Yield = 80 %, Molecular Formula = $C_8H_6N_4O_2S$,

Molecular Weight = 222.22, Melting Point = 255^0C

IR (Cm^{-1}): 445, 524, 690, 854, 986, 1112, 1344, 1513, 1622, 1926, 2063, 2198, 2311, 2444, 2699, 2953, 3116, 3302, 3361, 3420,

NMR ($CDCl_3$): δ 2.6 (Triplet), 3.4 (Singlet), 7.9 (Singlet), 8.1 (Multiplet), 8.4 (Multiplet)

UV: Absorbance at 350, 907, 943 nm

Result and Discussion

The results obtained from the design, synthesis, and spectral characterization of 1,3,4-thiadiazole derivatives are presented and discussed below:

1. Synthetic Methodologies: Several synthetic methodologies were explored for the efficient

and selective synthesis of 1,3,4-thiadiazole derivatives and Schiff's bases. The cyclization of thiosemicarbazide with various electrophiles under suitable reaction conditions yielded a diverse range of compounds with different structural motifs and functional groups. Notably, the use of use of $POCl_3$as dehydrating agent resulted in improved reaction yields and reduced reaction times, highlighting the potential of this methodology for the synthesis of complex organic molecules.

2. Spectral Characterization: Advanced spectroscopic techniques, including FTIR, NMR and UV were employed to analyse the chemical structures and properties of the synthesized compounds. FTIR spectroscopy provided information about the functional groups present in the compounds, while NMR spectroscopy offered insights into their molecular structures and chemical environments. UV analysis enabled the determination of unsaturated system of compounds. Overall, the spectral characterization confirmed the successful synthesis of the target compounds and provided valuable information about their molecular structures and properties. The NMR, IR and UV data for synthesized derivatives is as follows

Compound Name: 5-(2-bromophenyl)-1,3,4-thiadiazol-2-amine:

Yield = 73%, Molecular Formula = $C_8H_6BrN_3S$,
Molecular Weight = 256.12, Melting Point = 219^0C
IR (Cm^{-1}): 523, 689, 853, 1058, 1153, 1290, 1441, 1519, 1614, 1915, 2049, 2189, 2304, 2665, 2768, 3090,3279, 3339, 3736, 3860
NMR ($CDCl_3$): δ 2.5 (Triplet), 2.4 (Triplet), 3.4 (Singlet), 7.5 (Multiplate), 7.9(Multiplate)
UV: Absorbance at 293.00 nm

Compound Name: 5-(4-chlorophenyl)-1,3,4-thiadiazol-2-amine

Yield = 78%, Molecular Formula = $C_8H_6ClN_3S$,
Molecular Weight = 211.67, Melting Point = 228^0C
IR (Cm^{-1}): 527, 557, 830, 1093, 1329, 1509, 1629, 1899, 2059, 2197, 2309, 2410, 2693, 2778, 3108, 3282, 3825, 3882, 3981
NMR ($CDCl_3$): δ 2.5 (Triplet), 3.3 (Singlet), 7.6 (Multiplet), 7.9 (Multiplet)
UV: Absorbance at 307.00 nm

Compound Name: 5-(4-nitrophenyl)-1,3,4-thiadiazol-2-amine

Yield = 80 %, Molecular Formula = $C_8H_6N_4O_2S$,
Molecular Weight = 222.22, Melting Point = 255^0C
IR (Cm^{-1}): 445, 524, 690, 854, 986, 1112, 1344, 1513, 1622, 1926, 2063, 2198, 2311, 2444, 2699, 2953, 3116, 3302, 3361, 3420,
NMR ($CDCl_3$): δ 2.6 (Triplet), 3.4 (Singlet), 7.9 (Singlet), 8.1 (Multiplet), 8.4 (Multiplet)
UV: Absorbance at 350, 907, 943 nm

Compound	Name	Solvent	Dehydrating Agent	Temperature	Time (Hrs.)	Yield
P	5-(2-bromophenyl)-1,3,4-thiadiazol-2-amine	Neat	$POCl_3$	100 ^{0}C	2 Hrs	73 %
Q	5-(4-chlorophenyl)-1,3,4-thiadiazol-2-amine	Neat	$POCl_3$	100 ^{0}C	2 Hrs	78 %
R	5-(4-nitrophenyl)-1,3,4-thiadiazol-2-amine	Neat	$POCl_3$	100 ^{0}C	2 Hrs	80 %
P	5-(2-bromophenyl)-1,3,4-thiadiazol-2-amine	50 % ethanol	$ZnCl_3$	120 ^{0} C	2 Hrs	52 %
Q	5-(4-chlorophenyl)-1,3,4-thiadiazol-2-amine	50 % ethanol	$ZnCl_3$	120 ^{0} C	2 Hrs	41 %
R	5-(4-nitrophenyl)-1,3,4-thiadiazol-2-amine	50 % ethanol	$ZnCl_3$	120 ^{0} C	2 Hrs	30 %
P	5-(2-bromophenyl)-1,3,4-thiadiazol-2-amine	Neat	H_2SO_4	100 ^{0} C	3 Hrs	38 %
Q	5-(4-chlorophenyl)-1,3,4-thiadiazol-2-amine	Neat	H_2SO_4	100 ^{0} C	3 Hrs	40 %
R	5-(4-nitrophenyl)-1,3,4-thiadiazol-2-amine	Neat	H_2SO_4	100 ^{0} C	3 Hrs	48 %

Conclusion

In this study, we have successfully designed and synthesized a series of 1,3,4-thiadiazole derivatives, showcasing the versatility and potential of this heterocyclic framework. Through the application of various synthetic methodologies, we achieved high yields and purity for the target compounds, demonstrating the effectiveness of our approach in creating diverse 1,3,4-thiadiazole derivatives with tailored functional groups.

The comprehensive spectral characterization, utilizing Nuclear Magnetic Resonance (NMR), Infrared (IR), and Ultraviolet-Visible (UV-Vis) spectroscopy, provided valuable insights into the

structural and electronic properties of the synthesized compounds. NMR spectroscopy confirmed the successful incorporation of functional groups and the integrity of the 1,3,4-thiadiazole ring system. IR spectroscopy revealed key vibrational features associated with the thiadiazole ring and substituents, while UV-Visibleis spectroscopy offered information on the electronic transitions and conjugative effects within the molecules.

The data obtained from these spectral analyses not only validated the structures of the synthesized 1,3,4-thiadiazole derivatives but also highlighted their potential for further applications in pharmaceuticals, agrochemicals, and materials science. This study emphasizes the critical role of spectral characterization in confirming the synthesis and understanding the chemical behaviour of novel compounds.

Overall, our research contributes to the expanding knowledge base of 1,3,4-thiadiazole chemistry and opens avenues for future investigations into the biological and industrial applications of these compounds. The insights gained from this study lay a foundation for the development of new materials and bioactive molecules, demonstrating the continued relevance and utility of 1,3,4-thiadiazole in modern chemical research.

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Biological Applications of Thiosemicarbazones and their Metal Complexes

Vrushali S. Gavhane
R. B. Attal Arts, Science & Commerce College, Georai, Dist. Beed
And
Kirti. K. Amolik
R. B. N. B Arts, science College, Shrirampur. Dist. Ahmednagar
And
Satish B. Jadhav
R. B. Attal Arts, Science & Commerce College, Georai, Dist. Beed
And
Amol. J. Shirsat
R. B. Attal Arts, Science & Commerce College, Georai, Dist. Beed.

ABSTRACT

This review explains the synthesis and coordination chemistry of thiosemicarbazone and its bonding with transition metals like Copper, Nickel, Zinc, Cobalt, Palladium and their biological Applications. Study of chelation of thiosemicarbazones with metal complexes to assume various geometries including tetrahedral, Square planar as well as Octahedral. Thiosemicarbazones have demonstrated a variety of possible anticancer, antimicrobial, antioxidant, antitubercular, antimalarial, antiviral activities when they bind with metal ions is done in this article.

Keywords: Thiosemicarbazones, Biological Activity.

Introduction:

Thiosemicarbazones and their large number metal complexes are potent intermediates for the synthesis of pharmaceutical bioactive compounds and therefore, of and they're used considerably in the field of medicinal chemistry. The imine bond (- NCH-) in this emulsion are useful for inorganic synthesis. The influence of the functional group and position of substituent on anti- bacterial activity of composites is analysed too. The primary results indicated that all of the tested compounds showed good activity against the test organism. Thiosemicarbazone derivations are of special significance because of their protean natural and pharmacological conditioning. The imine bond (-N=CH-) in this compound are useful in organic synthesis, in particular for the preparation of heterocycles and synthetic ß-amino acids (1-5). These compounds present a great variety of natural conditioning ranging from antiviral (6), anticancer (7), antitumor (8-10), anti-inflammatory and anti-amoebic (11-13)

conditioning. The anti-bacterial activity thiosemicarbazide derivatives has been also reported activity of composites or agents, which inhibit the growth, the natural effect, is known as antibacterial activity. of (14-20) series of The and spread bacteria The bacteria are unicellular,

bitsy prokaryotes and wide spread in nature being as autotrophic, heterotrophic and organisms. parasitic the parasitic bacteria using antibacterial agents work either by stopping bacterial growth or by killing the bacteria. without harming the mortal host. The main targets for antibacterial exertion inhibit synthesis of peptidoglycan, alter the microbial cytoplasmic membrane, alter restatement and inhibit nucleic acid replication by blocking topoisomerases and inhibit recap. (21)

The activity of composites or agents, which will inhibit the growth and spread malarial para-sites and the natural effect, is known as antimalarial exertion. Species of Plasmodium are the Plasmodium, the sponger responsible for mortal malaria most investigated rubrics of spongers in causative agents of malaria. is among the Cyclic- the world. dependent kinesis plays an important part in cell cycle progression and are conserved in all eukaryotic species. Cyclic-dependent kinesis have been examined as possible medicine. (22) Chellan et al. (23) reported the antimalarial activity of free ligands, similar as 3,4- dichloro-acetophenone thiosemicarbazone and 3,4- dichloro-propiophenone thiosemicarbazone and their Pd (II) complexes. The authors tested the antimalarial activity against Plasmodium falciparum strains, 3D7 (chloroquine sensitive) and K1 (chloroquine and pyri-methamine resistant). They concluded that the binded complexes of the below mentioned thiosemicarbazones have lesser activity than the free ligands

D. Rogolino et al. (24) designed eight hydroxy quinoline thiosemicarbazone ligands containing an ONN'S donor set, their Zn (II) and Cu (II) complexes and characterized for their antitumour activity. The Complexes were more stable and active than corresponding ligands Cu towards NSCLC and bone cancer cell proliferation, with IC50 values ranging from 0.3 to 0.7 µM, in A549 cell line and zine (II) complexes showed reduced activity. Qi. Jinxu et al (25) synthesized and determined X-ray diffraction of two types of 2- pyridine carboxaldehyde thiosemicarbazones Ga (III) complexes which are 21 and 11 ligand Ga (III) complexes and their anti-proliferative exertion. Ga (III) complexes where the metal/ligand ratio is 1:1 had higher anti proliferative activity than 1:2. After incubation, Ga (III) complexes. Showed a marked increase of caspase 3 and 9 activity in NCT-11460 compared to metal free ligand. Caspase activation was mediated by the release of Cyt C from the mitochondria. Both types of Ga (III) complexes showed more effective in inhibition of the G1/S transition than the ligand alonell. F. Vandresen et al (26) synthesized a series of nineteen thiosemicarbazones derived from a natural monoterpene R-(+)-limonene and evaluated their antitumor activity. Overall, the majority of tested compounds exhibited considerable inhibitory effects on the growth of a wide range of cancer cell lines. Almost all of tested thiosemicarbazones were especially sensitive to prostate cells (PC-3). Metal complexes formed with other metals like Copper, Gold, Gallium, Germanium, Tin, Ruthenium, Iridium was shown significant antitumor activity in animals.

Schiff base with active sites show considerable antiviral activity. Analysed metal complexes in oxidation state showed inhibition against cucumber mosaic contagion. In the recent studies, appear to be structural class with antipox contagion exertion. (27) Isatin derivatives similar as methisazone (marboran), the ß-thiosemicarbazone of N-methyl isatin have been described as smallpox chemo propylactic agents. (28) Methisazones descreases morbidity and has direct

remedial effectiveness vs mortality variola in susceptible connections but and it is no longer manufactured as a medicine substance. (29) It has been proved that thiosemicarbazone block DNA synthesis in mammalian cells big by inhibiting the enzymes, ribonucleoside diphosphate reductase, presumably moreover via chelation with an iron ion needed by the enzymes or because a performed metal chelate of the asset interacts with the target enzyme. (30-32) The reports also point Dimitra Kovala-Demertzi et al. (34) have been reported the antibacterial and antifungal conditioning of nickel (II) and palladium (II) complexes of 2- acetyl pyridine thiosemicarbazone. Antibacterial activity was estimated against Staphylococcus aureus and Antifungal activity was estimated against (35) have reported the antibacterial gram-negative bacteria gram-positive bacteria Escherichia coli, Candida albicans. Sathisha et al. and coworkers studied the antifungal activity of the bis-isatin thiosemicarbazone metal complexes of copper (II), cobalt (II), nickel (II) and zinc (II) ions. The authors have characterized the antibacterial activity against the bacteria Bacillus cirroflagellosus and antifungal activity against Aspergillus niger and Candida albicans by mug- plate system.

The antibacterial activity of complexes of nickel (11), bobby (11) and cobalt (11) with a series of thiosemicarbazone derivations of 2-hydroxy-8-R-tricyclotridecane-13-one (R-H、 CH3, C6H5) was reported by Rosu et al. (36) Antibacterial conditioning are estimated against five bacterial strains i.e. Acinetobacter boumanii, Klebsiella pneumonia, Escherichia coli, Staphylococcus aureus and Pseudomonas auriginosa. Noriko Chikaraishi Kasuga et al. (37) have reported the synthesis and antibacterial activity of twelve zinc (II) complexes of semi- and thiosemicarbazones. Kizilcikli et al. (38) have reported antimicrobial activity of a series of The antibacterial activity of complexes of nickel (II) and cobalt (II) with a series of thiosemicarbazone derivations of 2-hydroxy-8-R-tricyclotridecane-13-one (R-H. CH3, C6H5) was reported by Rosu et al. (36) Antibacterial conditioning are estimated against five bacterial strains i.e. Acinetobacter boumanii, Klebsiella pneumonia, Escherichia coli, Staphylococcus aureus and Pseudomonas auriginosa. Noriko Chikaraishi Kasuga et al. (37) have reported the synthesis and antibacterial activity of twelve zinc (II) complexes of semi- and thiosemicarbazones. Kizilcikli et al. (38) have reported antimicrobial activity of a series of thiosemicarbazones and alkyl thiosemicarbazones.

Conclusion-

Thiosemicarbazones are synthetically protean substrates, where they can be used for the preparation of a large variety of heterocyclic composites, and as raw material for medicine synthesis. The advances in the use of Thiosemicarbazone for organic synthesis during the last twenty-five times, as well as a check of its natural and pharmacological applications are reported in this review and in the accompanying supplementary information. The check of the literature revealed that, Thiosemicarbazone is a important group for designing implicit bioactive agents, and its derivations were reported to retain broad- area of anticonvulsant and other natural activity. Further we can conclude that numerous other derivatives of Thiosemicarbazone and their metal complexes can be synthesized will be anticipated to show potent pharmacological activity.

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An overview of the mixed schiff base ligand metal complexes

Vijayanand D. Ingale
Department of Chemistry, Arts & Commerce College, Warwat Bakal, Buldhana (M.S.) India-444202.
And
Nilesh S. Shelke
Department of Chemistry, Arts & Commerce College, Warwat Bakal, Buldhana (M.S.) India-444202.

ABSTRACT

A studies of some Schiff base Mixed Ligands with metal complexes like Nd(III), Sm(III), Gd (III), Tb(III) and Dy(III) were derived by the reaction of Salicyaldehyde, with 4-Methoxyphenylamine, in alcoholic medium forming 2-((E)-(4-methoxyphenylimino) methyl) phenol (L^1) and o-vanillin with 4-Methoxyphenylamine in a alcoholic medium forming 2-((E)-(4-methoxyphenylimino) methyl)-6-methoxyphenol (L^2) have been synthesized by starring at room temperature. The ligand & its metal complexes were synthesized and characterized based on elemental analysis, FTIR, ^{1}H-NMR, UV-Visible. These analytical and spectral data revealed that ligand coordinates to the central Ln(III) ions by its two imines nitrogen atoms and two phenolic oxygen atoms. The general formula of the complex is$[LnL^1\&L^2(H_2O)_2NO_3]$.The ligand metal complex obtained by (1:1:1) molar ratio. The ligands and Inner transition metal complexes were screened of antibacterial activity against Staphylococcus aureus& Bacillus substilis, and Antifungal activity against Aspergillus niger, Fusarium oxysporum.

Keywords: Ln (III) metal salts, Schiff base ligand, alcohol.

1) Introduction

Generally, Schiff base present in oxygen, nitrogen these are electron donating ligands they are able to coordinate metal through imines nitrogen Several studies showed that the presence of lone pair of electrons in an SP^2 hybridized orbital of nitrogen atom of the azoamine (-N=CH-) group is of considerable chemical and biological, analytical and Industrial important. Chelating ligands Containing O and N donor atoms shows broad biological activity and are of special interest because of the variety of ways in which they are bonded to metal ions [1,2].Coordination complex consist of a cationic, anionic or neutral complex, containing a central atom or ion and molecules or ion, coordinated with it. Those substance, whose molecule contains a central atom, connected with ligands. Can be considered as coordination [3]. Aromatic hydroxy aldehydes form stable complexes and the presence of a phenolic hydroxyl group at their o-position imparts an additional donor site in the molecule making it bidentate. Such a molecule coordinates with the metal ion through the carbonyl oxygen and deprotonated hydroxyl group. The chelating properties of Schiff bases derived from o-hydroxyaldehyde and Ketenes are well established.

In view of the coordinating ability of Schiff bases derived from o-hydroxyaromatic aldehyde along with their biological activity. We have synthesized and characterized the two aryl Schiff bases 1) N-(o-vanillinidene 4-Methoxyphenylamine (o-VPAH) and 2) N(salicyaldehyde)- 4-Methoxyphenylamine (SPAH) Schiff bases are used.

2) Instrumentation

Melting points were determined on a MelTemp melting point apparatus & are uncorrected. ^{1}H &$^{13}CNMR$ spectra were obtained on Bruker Avance -400(400MHz, ^{1}H; 100MHz, ^{13}C) spectrometers. All spectra were taken in d_6-DMSO& The chemical shifts are given in parts per million (ppm) with respect to tetramethylsilane (TMS) used as internal standard.

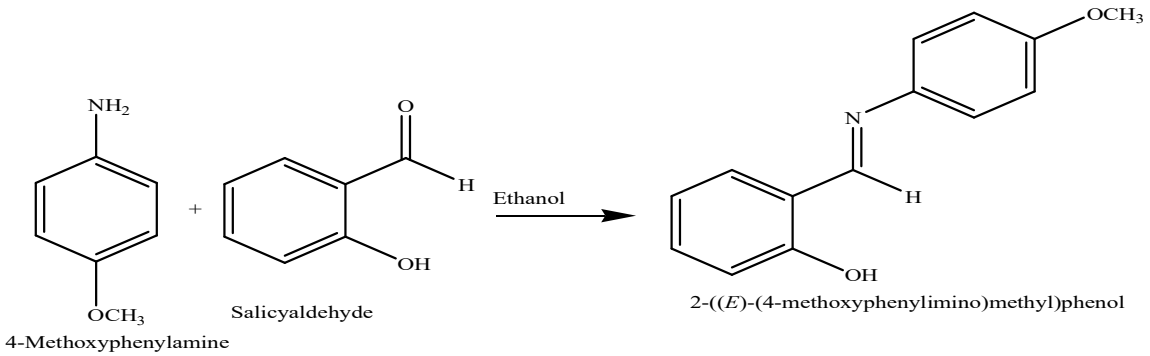
2.1 Materials &Methods

All chemicals and solvents used were of analytical grade purchased from Aldrich Chemical Company and were used without further purification unless mentioned $[Nd(NO_3)_3.6H_2O]$, $[Sm(NO_3)_3.6H_2O]$, $[Gd(NO_3)3.6H_2O]$, $[Tb(NO_3)_3.6H_2O]$& $[Dy(NO_3)_3.6H_2O]$were purchased from sigma Aldrich chemical company and as received salicyaldehyde, o-vanillin and p-anisidine were purchased from Alfa alser Company ltd.

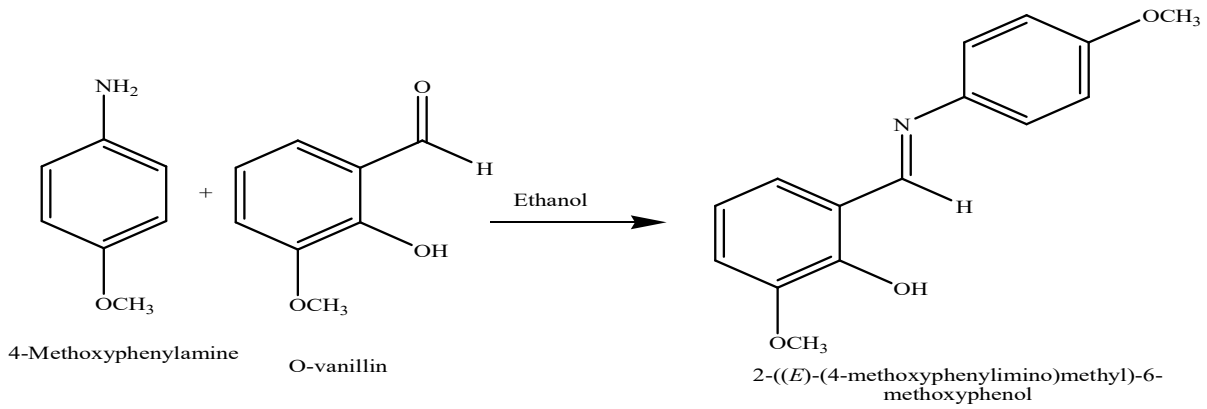
The ligand and metal complexes analyses were performed using a vireo. EL elemental analyzer (C, N, H) Infrared range spectra[4000cm-1 1000 cm-1) were obtained with KBR discs on a Jusco FTIR model 470 spectrophotometer ^{1}H-NMR spectra of Ligand and metal complexes were recorded on a Bruker ANANCE-400 MHz NMR Spectrometer spectra were taken in deuterated DMSO or $CDCl_3$ usingTMS on an internal reference. UV-VIS Spectra were recorded in DMF solution Concentration of 106m, at 25°C and wavelength was reported in (nm) using a UV-VIS Spectrophotometer.

2.2 Synthesis of Schiff base ligand

The Schiff base ligand (L^1& L^2) was prepared by modification of reported method **[4].**In a 50 ml solution of 0.001 mol (salicyaldehyde (0.122g) of o-vanillin (0.152 g) and 4-Methoxyphenylamine (0.123 g) was stirring in super dry ethanol for about 3h. The color was obtained by gray & orange the collected filtration by using Buckner funnel, washed with ethanol and dried in the desiccators. The product was purification of recrystallized from hot ethanol. Yield was obtained by 90%



Scheme-I:Synthesis of Schiff base ligand (L^1)



Scheme-II:Synthesis of Schiff base ligand (L^2)

2.3 Synthesis of metal complexes

To a hot solution of ligands (L^1& L^2) in (0.01mol) in ethanol, methanol (25ml) of metal nitrate salt (0.01mol) was added under constant stirring for 3h at room temperature. The precipitated complexes were filtered off, washed with ethanol, diethyl ether and dried under vacuum over anhydrous calcium chloride ($Cacl_2$). Yield obtained was 82% & decomposition point was greater than 200^0c.The synthetic route for the Schiff bases ligands (L^1&L^2) and its respective Ln complexes are shown in scheme I& II. Schiff base ligands N-(o-VPAH) and N-(SPAH) was prepared metal complexes in 1:1:1 molar ratio Eight Schiff bases (L^1& L^2) rear earth metal complexes were synthesized by treating lanthanide nitrate hydrate with the ligand in ethanol, methanol solution at room temperature. Which yield a series of complexes correspond to the formula of [LnL^1/L^2 (H_2O) 2] NO_3.

3) Biological Activity

3.1. Antibacterial activity

In the antibacterial activity of schiff base ligand and metal complexes was tested in vitro against bacteria such as Staphylococcus aureus and Bacillus substilis. by paper disc plate method (Sari et al.,2006).The compounds were tested at the concentration 250 ppm & 500 ppm in DMF and compared with known antibiotic ciprofloxin given in (**Table-1**) The result obtained were compared with known antibiotic ,ciprofloxin. From the results obtained, it clear that the antibacterial activity of metal salts is negligible small. Inhibition by metal complexes is found to be higher than that of a free ligand and corresponding metal salts against the same organism under experimental conditions. This is similar to earlier observations (Badwaik&Aswar, 2007). The metals salt used for the synthesis of complexes exhibit negligibly small antimicrobial activity[5, 6]. The remarkable enhancement of activity of ligand after chelation can be explained on the basis of Overtones concept and Tweed's concept. According to this concept, chelation tends to make a

ligand more potential bacterial agent. The increased activity upon chelaton is attributed to the positive charge of metal partially shared with donor atoms present on ligand and possible π-electron delocalization over the whole chelate ring .[27] This, in turn, increases the bacterial membranes resulting in interference with normal process. Inhibition was found to increasing concentration of metal complex [7].

Table-1. Antibacterial activity and Antifungal activity of ligands &metal complexes (Diameter of inhibition Zone in (mm)

Compounds	Antibacterial activity				Antifungal activity			
	S.aureus		Bacillus substilis		Aspergillus niger		Fusarium Oxysporum	
	250 ppm	500 ppm	250 ppm	500 ppm	250 ppm	500 ppm	250 ppm	500 ppm
$C_{14}H_{13}NO_2(L^1)$	0	14	0	16	0	11	16	19
$C_{15}H_{15}NO_3(L^2)$	0	16	0	17	16	16	15	18
$Nd(L^1\&L^2)(H_2O)_2NO_3$	14	14	11	15	18	20	19	14
$Sm(L^1\&L^2)(H_2O)_2NO_3$	12	16	14	15	21	16	26	19
$Gd(L^1\&L^2)(H_2O)_2NO_3$	16	15	-	16	22	22	24	22
$Tb(L^1\&L^2)(H_2O)2NO_3$	11	16	17	15	24	14	17	-
$Dy(L^1\&L^2)(H_2O)_2NO_3$	14	14	21	15	23	18	15	-

4) Result and discussion

4.1. ^{1}H-NMR spectra of ligands

The ^{1}H-NMR spectra of mixed ligands ($L^1\&L^2$) in $CDCl_3$ at room temperature shows in the first scheme(L^1) following signals 10.85 (s,1H,phenolic OH), 7.5-9.3 (m 7H,Ar-H),7.4 (s, 1H,N=C-H),3.94 (s 3H,OCH_3). Second scheme(L^2) shows the following signals 13.91(s,1H,phenolic OH),6.8-7.3(m 7H, Ar-H),8.6 (s,1H,N=C-H),3.8-3.9(s,6H,OCH_3). It should be noted that the phenolic proton has always given a singlet in off-set at high δ values, thus confirming its involvement in an intramolecular hydrogen bond with the neighboring nitrogen atom [8].

4.2. Elemental analysis

Table-2& 3a list the elemental analysis, yield, melting point molecular weight and molar conductance of the ligands ($L^1\&L^2$) and its metal complexes. All the Ln (III) complexes are stable in air, on-hydroscopic powder with different color of the Ln(III) ions soluble in DMSO, DMF, DCM ,$CHCl_3$ and $CDCl_3$ but slightly soluble in methanol,ethanol,ethyl acetate, benzene and in soluble in water and diethyl ether.

Table-2. Analytical data of ligands.

Ligands	M.wt.	Colour	M.P	Yield (%)	Elemental analysis (%) found (cal.)			
					C	H	N	O
$C_{14}H_{13}NO_2(L^1)$	227.25	Gray	85^0c	90	73.02 (73.30)	5.77 (5.71)	6.16 (6.11)	14.08 (14.00)
$C_{15}H_{15}NO_3(L^2)$	257.28	Orange red	90^0c	85	70.02 (70.11)	5.88 (5.52)	5.44 (5.40)	18.66 (18.60)

Table-3. Physical characterization, analytical data of metal complexes

Ligands/ Complexes	M.Wt.	M.P/ Dec Temp (°C)	Colors	Yield (%)	Elemental analysis found (calculated)				
					C	H	N	O	M(Ln)
$Nd(L^1,L^2)(H_2O)_2NO_3$	726.81	205	Orange	57	52.47 (52.60)	4.71 (4.59)	4.22 (4.23)	16.87 (16.91)	21.73 (21.56)
$Sm(L^1,L^2)(H_2O)_2NO_3$	732.93	210	Yellow	55	51.99 (51.94)	4.66 (4.69)	4.18 (4.22)	16.72 (16.65)	22.44 (22.85)
$Gd(L^1,L^2)(H_2O)_2NO_3$	739.82	203	Orange	60	51.46 (51.77)	4.62 (4.49)	4.14 (4.43)	16.55 (16.46)	23.23 (23.39)
$Tb(L^1,L^2)(H_2O)_2NO_3$	714.49	≥250	Red	60	51.34 (51.93)	4.61 (4.88)	4.13 (4.41)	16.51 (16.42)	23.42 (23.45)
$Dy(L^1,L^2)(H_2O)_2NO_3$	745.07	200	Orange	57	51.07 (51.00)	4.58 (4.38)	4.11 (4.09)	16.42 (16.71)	23.82 (23.50)

4.3. Molar conductance

Molar conductivity data for all the complexes in DMF solution at room temperature are in range 11-129 cm2 mol-1 reported for 1:1 electrolyte [9].

4.4. IR Studies

The chemical shifts of the ligands L^1&L^2 and its Ln metal complexes are summarized in Table-4.The IR spectra of the La complexes displayed the ligand characteristic bands with the appropriate shifts due to complex formation It was found that the ν(-C=N-) of the azomethine groups occur at 1655 $cm^{-1}(L^1)$& 1613 $cm^{-1}(L^2)$ in the free Schiff base After complexation these bands are shifted to higher wave number by 14 cm^{-1} indicates a stronger double bonds character of the imines bonds and a coordination other azomethine nitrogen atoms to the Ln(III) ion [10,11].

In the FT-IR study of free Schiff base ligand & metal complexes to find out the way of chelation of ligand to the central metal atom. The Schiff base ligand shows strong bands around at 1602 and 1613 cm^{-1} which indicate the presence of azomethine (νC=N) and the phenolic –OH

indicate in the presence of Ph-OH(ν_{OH}) group respectively 1244 and 1243 cm^{-1} In the mixed ligands complexes both peaks are shifted towards lower frequency at 1507-1569-,1243-1244 cm^{-1} respectivelyi.e.,azomethine-N and deprotonated O atom indicating both are involved in the chelation [12].All the mixed ligands complexes show an additional peak in the region 2835-3604, 816-848, and 727-787 due to νOH stretching, rocking and wagging mode of coordinated water molecules respectively.The absence of a weak broad band in 3200-3400cm-1 region, in the spectra ofthe metal complexes suggests deprotonation of the intramolecular hydrogen bonded OH group on complexation and subsequent coordination of phenolic oxygen to the metal ion. This is further supported by upward shift in υ C-O (phenolic) tothe extent of 25-50 cm^{-1}[13]. On complexation, the υ (C=N) band is shifted to lower wave number with respect to free ligand, denoting that the nitrogen of the azomethine group is coordinated to the metal ion. This is supported by upward shift in υ (C-N)to the extent of 10-35 cm^{-1}[14].The IR spectra of metal chelate showed new bands in 500-550 and 400-450 cm-1 regions which can be assigned to υ (M-O) and (M-N) vibrations respectively[15]. The IR spectra show a strong band in 3200-3600 cm^{-1}region, suggesting the presence of coordinated water in these metal complexes[16].

Table-4. Infrared spectral data for the Schiff base ligands & $[Ln(L^1\&L^2)(H_2O)_2NO_3$ complexes(cm^{-1})

Ligands/Complexes	C-H Aromatic	ν(C=N)	ν(Ar-o)	ν(M-O)	ν(M-N)	ν(C=C)	ν(C-O)	νNo_3^-
$C_{14}H_{13}NO_2(L^1)$	2841	1602	1244	-	-	1490	1150	-
$C_{15}H_{15}NO_3(L^2)$	2835	1613	1243	-	-	1466	1194	-
$Nd(L^1\&L^2)(H_2O)_2NO_3$	3060	1636	1255	610	574	1480	1147	1462
$Gd(L^1\&L^2)(H_2O)_2NO_3$	2979	1636	1255	638	611	1482	1147	1462
$Sm(L^1\&L^2)(H_2O)_2NO_3$	2979	1636	1256	638	575	1481	1148	1347
$Tb(L^1\&L^2)(H_2O)_2NO_3$	2979	1636	1257	638	576	1479	1172	1445
$Dy(L^1\&L^2)(H_2O)_2NO_3$	3058	1623	1256	638	550	1482	1147	1462

4.5. Electronic Spectra:

UV-Vis absorption of the ligands &metal complexes were carried out in DMSOsolvent at room Temperature.The UV-Vis spectra values of the maximum absorption wavelengthand absorbance for the mixed ligands and its Ln(III) complexes (Nd,Sm,Gd,Tb&Dy) arelisted in **Table-5**. The electronic spectrum of mixed ligands exhibits two bands at 429,459 nm which can be attributed to n⟶π^*transition respectively. The sensitized absorption emission spectra ofcomplexes $[NdL^1\&L^2(H_2O)_2NO_3]$ show four main bands at 213, 215,348& 749 nm corresponding to the $^4I_{9/2}\longrightarrow{}^2P_{1/2}$,$^4I_{9/2}\longrightarrow{}^4G_{9/2}$,$^4I_{9/2}\longrightarrow{}^2G_{9/2}$,$^4I_{9/2}\longrightarrow{}^2S_{3/2}$[17]. It has been observed that on complexation theelectronic spectral bands of Pr(III), Nd(III) and Sm(III) shift to lower energy side.. The slight shift in the bands have been attributed by Jorgenson to the effect of crystal fields

upon the inter electronic [18,19]. The Nd(III), Gd(III) and Dy(III) complex show bands at 30,000cm^{-1} and 40.000cm^{-1} corresponding to n⟶$\pi^{\star}$and π⟶$\pi^{\star}$ n⟶$\pi^{\star}$transition respectively [20].

Table-5. Magnetic susceptibility &the absorbance (Abs.) of the ligands & Electronic transition of ligands and its Metal complexes in DMSO solution at room temperature.

Compounds	Magnetic Moment (B.M.)	Absorption Maxima			Transition Assignment
		nm	cm^{-1}	Abs.	
$C_{14}H_{13}NO_2(L^1)$	-	429	23,310	0.002	n⟶$\pi^{\star}$
$C_{15}H_{15}NO_3(L^2)$	-	459	21,786	0.012	n⟶$\pi^{\star}$
$Nd(L^1\&L^2)(H_2O)_2NO_3$	3.92	348 749	28,735 13,351	4.000 0.006	π⟶$\pi^{\star}$ n⟶$\pi^{\star}$
$Gd(L^1\&L^2)(H_2O)_2NO_3$	7.94	335 357	29,850 28,011	3.338 4.000	π⟶$\pi^{\star}$ n⟶$\pi^{\star}$
$Sm(L^1\&L^2)(H_2O)_2NO_3$	1.45	293 333	34,129 30,030	1.825 4.000	π⟶$\pi^{\star}$ π⟶$\pi^{\star}$
$Tb(L^1\&L^2)(H_2O)_2NO_3$	9.25	443 445	22,573 22,471	0.036 0.036	n⟶$\pi^{\star}$ n⟶$\pi^{\star}$
$Dy(L^1\&L^2)(H_2O)_2NO_3$	10.56	332 440	30,120 22,727	4.000 0.038	π⟶$\pi^{\star}$ n⟶$\pi^{\star}$

4.6. Magnetic measurement:

The magnetic susceptibility for the mixed ligands metal complexes was recorded in solid state nature of complexes at 298 absolute temperatures by using Gouey balance method in emu/moie units.All the complexes have Ln(III) ions.Lande calculation for Ln^{3+} ions.

1)Gd^{3+} =$4f^7$,S =7/2 L =0 ,J =L+s =0 +7/2 =7/2 ⟶$^8S_{7/2}$

However, the magnetic moment considerable form the spin only values because of strong spin orbit coupling. magnetic moment of 2.17 B.M. was recorded for Ce^{3+} complex due to presence of one electron.In Gd^{3+} complex a magnetic moment of 8.11 B.M. was recorded which suggest a maximum number of unpaired electrons is 7 with all the electrons have parallel spin.

Conclusions

It has been suggested that the antibacterial activity of the Schiff base metal complexes increased upon coordination with the metal complexes. The chelating process reduces the polarity of metal ion by coordinating with ligand, which increases the lipophilic nature of the metals. This lipophilic nature of the metal enhanced its penetration through the lipoid layer of cell membrane of the microorganism.The synthesized Schiff base ligand having O, N pharmacophores site played an important role to increased antibacterial activity.

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Hydroxybenziodoxolone Reagent: Synthesis, Mechanistic Insights, and Synthetic Utility

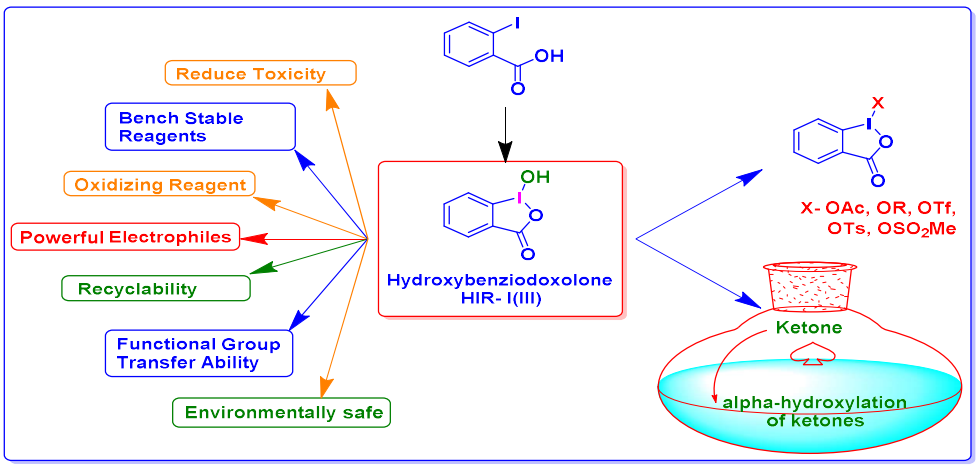
N. K. Dhurve
Shri Pundlik Maharaj Mahavidyalaya Nandura Rly, Buldhana 443404 Maharashtra
And
T. S. Shrirame
Shri Pundlik Maharaj Mahavidyalaya Nandura Rly, Buldhana 443404 Maharashtra
And
S. S. Kale
Shri Shivaji Science College and Arts College Chikhli, Buldhana 443201 Maharashtra

ABSTRACT

In the area of organic synthesis, significant advancement has been made with hypervalent iodine chemistry. Many researchers have explored the introduction of versatile and environmentally friendly hypervalent iodine reagents as oxidizing agents. Of these, hydroxybenziodoxolone has become noteworthy due to its reactivity and structural features, offering a broad scope in synthetic chemistry. This review provides a comprehensive study of hydroxybenziodoxolone, focusing on its structural features, stability, and synthetic utility. It also explores the various organic transformations facilitated by hydroxybenziodoxolone, including α-hydroxylation, halogenation, and decarboxylative alkynylation reactions. Additionally, the catalytic potential of hydroxybenziodoxolone and its derivatives is discussed in detail. This study of recent developments and emerging trends aims to stimulate further exploration of hydroxybenziodoxolone in hypervalent iodine chemistry.

Keywords: Hydroxybenziodoxolone, hypervalent iodine reagent, oxidizing agents, ecofriendly, catalysis, oxidation.

Graphical ABSTRACT



1. Introduction

The domain of organic chemistry has undergone a revolutionary progression with the introduction of hypervalent iodine reagents, which have emerged as highly versatile and environmentally benign oxidizing reagents[1][2][3][4]. Hypervalent iodine reagents have demonstrated the potential to serve as replacements for toxic metal-based reagents in a diverse array of organic transformations, including oxidation, coupling, α-functionalization, cyclization, decarboxylative alkynylation, oxyalkenylationand halogenation reactions. These reagents exhibit advantageous properties such as high stability, remarkable selectivity, excellent recyclability, straightforward experimental procedures, environmentally benign property and reduced toxicity, making them attractive alternatives for synthetic chemists[5][1][6]. Within this promising class of reagents, hydroxybenziodoxolone has gained particular prominence as promising reagent, owing to their distinctive structural features and exceptional reactivity. This cyclic iodonium compound, characterized by the incorporation of a hydroxyl group, offer a unique combination of electrophilicity and nucleophilicity that empowers them to engage in a diverse array of oxidative transformations, from fundamental bond activations to intricate molecular constructions[2][7]. Hydroxybenziodoxolones further distinguish themselves through their ease of preparation, functional group tolerance, and ability to overcome the limitations often associated with traditional oxidants.

The synthetic utility of hydroxybenziodoxolones has been extensively explored in recent years, with a focus on harnessing their potential in late-stage functionalization of complex molecules[8]. These reagents have demonstrated their versatility in a broad range of oxidative reactions, among others, asymmetric intramolecular α-cyclopropanation[9], decarboxylative alkynylation[10], halogenations, trifluoromethylations[11], azidations[12], and dehydrogenations. Importantly, the advancement of visible-light-enabled photoredox catalysis has further expanded the synthetic scope of hydroxybenziodoxolones, allowing for the activation of inert chemical bonds under mild conditions[8]. The ability of these reagents to engage in single-electron transfer processes has facilitated the exploration of novel reaction pathways, opening new avenues for the late-stage functionalization of biologically relevant molecules.

This comprehensive review examines the rapidly evolving field of hydroxybenziodoxolone chemistry. It delves into the structural characteristics, synthetic approaches, and mechanistic underpinnings that govern the reactivity of these compounds. Additionally, the review explores their diverse applications in synthetic transformations, underscoring their transformative potential across various domains of organic chemistry. By critically analyzing the existing literature and identifying emerging trends, this work aims to catalyze and inspire future research and development in this exciting and dynamic area of study.

2. Structural Characterization and Stability of Hydroxybenziodoxolone

Hydroxybenziodoxolone is a stable, cyclic hypervalent iodine reagent. The cyclic structure of these reagents affords greater stability in comparison to acyclic hypervalent iodine compounds,

facilitating the preparation of a more diverse array of ligands[13]. The increased stability is attributed to the five-membered ring's ability to bridge the axial and equatorial positions, as well as the enhanced overlap between the iodine's lone pairs and the aromatic ring's π-system[14]. The reactivity of hypervalent iodine species stems from a 3c-4e bond formed by the overlap of the $5p_z$ orbital of iodine and the valence electrons of its ligands. This bonding arrangement fills both bonding and non-bonding molecular orbitals, with the nodal plane of the non-bonding orbitals generating partial positive charges that confer electrophilic character to the iodine atom (**Figure 1**).Like non-cyclic hypervalent iodanes, cyclic hypervalent iodanes exhibit a distorted T-shaped structure**(Figure 2)**.Cyclic λ^3-iodanes like hydroxybenziodoxolone have a similar reaction mechanism with nucleophiles as non-cyclic λ^3-iodanes, involving ionic or radical pathways[15][16]. However, the cyclic structure provides greater stability, allowing for direct, simpler transformations using the desired ligands. In instances where a cyclic λ^3-iodane species is unstable and cannot be obtained as an isolated compound, one-pot synthetic procedures can be employed, making use of a "transient" ligand mechanism similar to that observed with non-cyclic λ^3-iodane reagents.

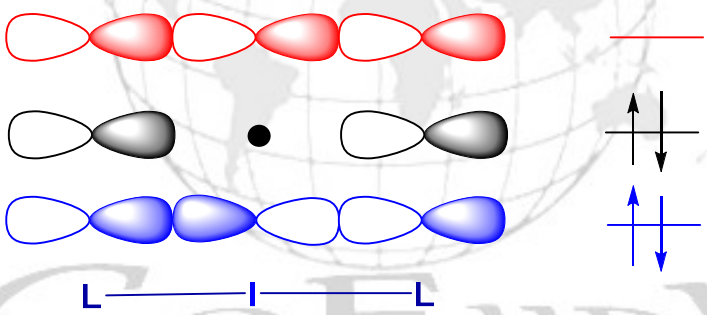


Figure 1: Schematic molecular orbital diagram for L-I-L i.e., 3c-4e bond

Structural analysis of the hydroxybenziodoxolone compound using X-ray crystallography reveals a significant degree of distortion in the five-membered ring (**Figure 2**), with the two electronegative substituents arranged in an almost linear configuration[17]. The observed bond distances and angles, including an abnormally short intermolecular I-O distance and an endocyclic C-I-O angle of approximately 80°, suggest that the iodine atom exhibits pronounced Lewis acidic behaviour and deviates significantly from the typical T-shaped geometry typically associated with hypervalent iodine compounds. This distorted structure likely arises from the strain introduced by the cyclic arrangement and the electronic requirements of the substituents, resulting in a more linear configuration around the iodine centre.Ongoing research has been dedicated to the development of a wide range of novel and diverse hypervalent iodine-based reagents, which exhibit enhanced properties, reactivity, and utility in organic synthesis.

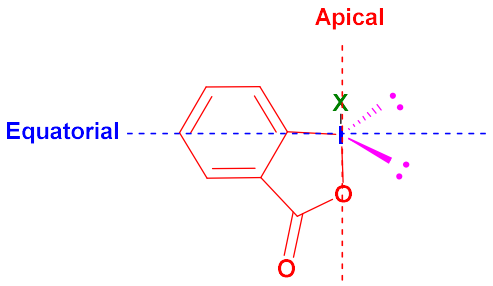
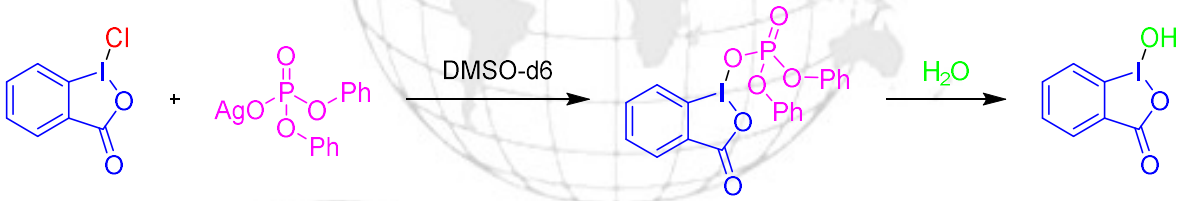


Figure 2: Distorted T-shape structure of benziodoxolone reagent

3. Synthesis of Hydroxybenziodoxolone Reagents

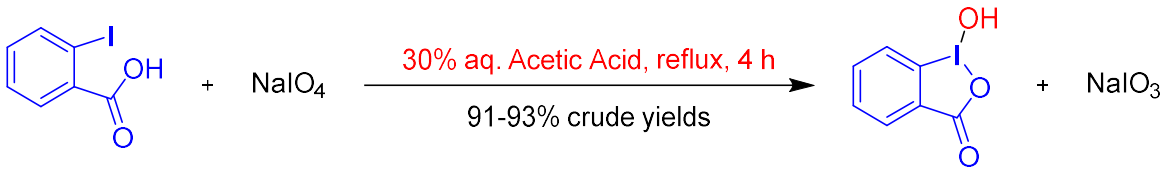
This section focuses solely on the synthesis of the hydroxybenziodoxolone reagent. The synthesis of benziodoxolones from the readily available 2-iodobenzoic acid is a straightforward and scalable process. The majority of the syntheses begin with an oxidation step using sodium periodate, which yields the hydroxybenziodoxolone compound.

Prior investigations have revealed that phosphate benziodoxolone, an inherently unstable species, can be produced from chlorobenziodoxolone in a DMSO-d6 medium, as reported by Moss and co-workers. Significantly, phosphate benziodoxolone exhibited exceptional sensitivity to water when dissolved in DMSO, resulting in the generation of the more stablehydroxybenziodoxolone derivative[18](**Scheme 1**).



Scheme 1: Synthesis of hydroxybenziodoxolone from chlorobenziodoxolone

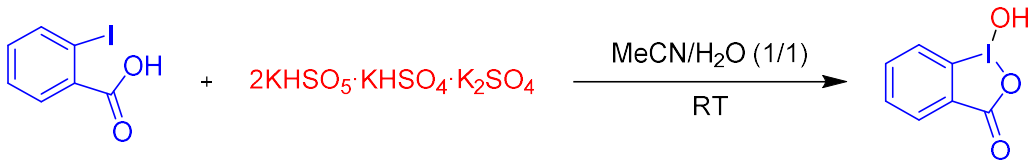
Kraszkiewicz and Skulski reported that 2-iodobenzoic acid underwent oxidation when treated with sodium periodate in a 30% aqueous acetic acid solution. The reaction mixture was heated to reflux conditions at a temperature of 120 °C for a duration of 4 hours. Following the addition of ice-cold water, a precipitate was formed, which was subsequently isolated through filtration, washing, and drying, resulting in the production of hydroxybenziodoxolone as a white solid with a 98% yield[19] (**Scheme 2**).



Scheme 2: Synthesis of hydroxybenziodoxolone from iodobenzoic acid

H. China et al. reported a selective synthetic procedure for the preparation of hydroxybenziodoxolone by investigating the influence of solvents on the oxidation of 2-iodobenzoic acid. Employing 1.0 molar equivalent of Oxone® under gentle reaction conditions, they successfully mitigated the formation of the hazardous 2-iodoxybenzoic acid. The researchers

combined Oxone® and water with a solution of 2-iodobenzoic acid in acetonitrile, agitated the mixture at ambient temperature, and then isolated the desired hydroxybenziodoxolone product via filtration and washing[20] (**Scheme 3**).



Scheme 3: Synthesis of hydroxybenziodoxolone from iodobenzoic acid using Oxone®

4. **Applications of Hydroxybenziodoxolone in Synthetic Chemistry**

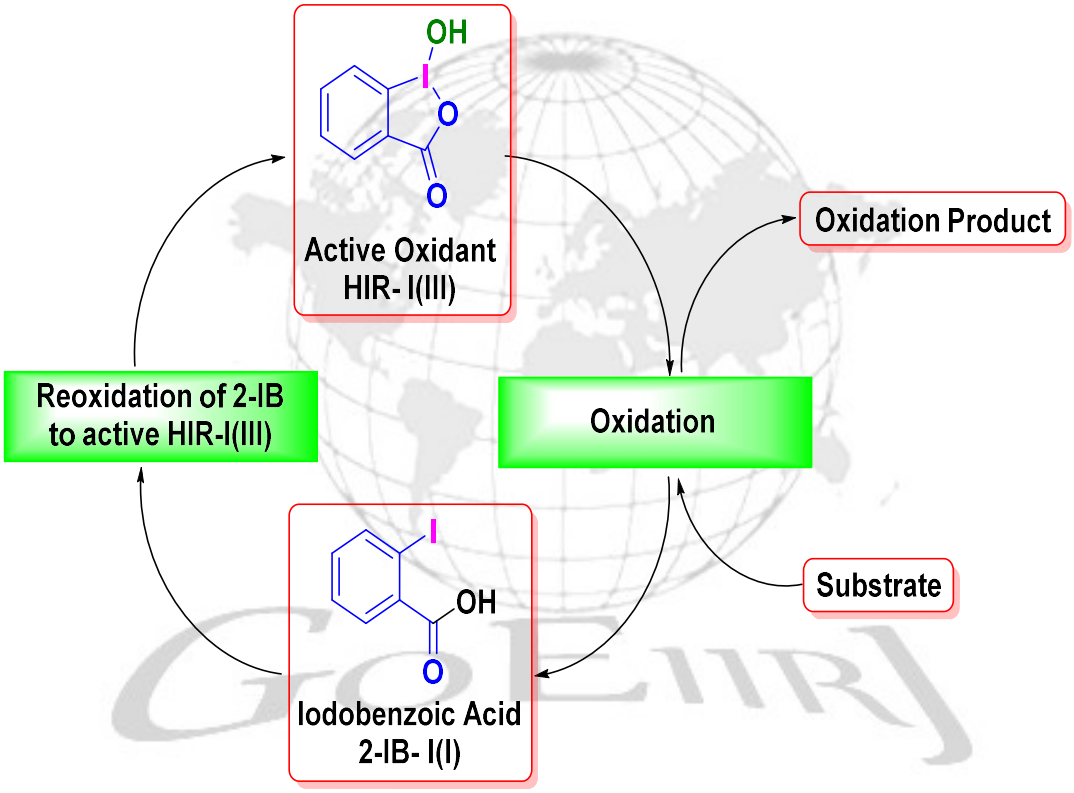


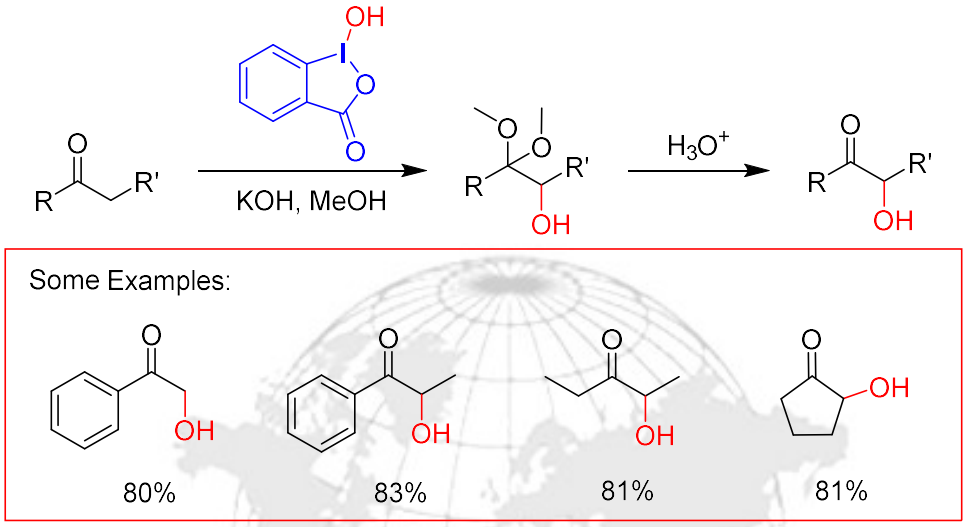
Figure 3: Catalytic utilization of hydroxybenziodoxolone reagent

Hydroxybenziodoxolone reagents have been widely used in synthetic chemistry since their discovery in the mid-1980s. However, stoichiometric quantities have been necessary for their application primarily. Thus, one very desirable goal is to develop catalytic procedures employing hydroxybenziodoxolone reagents. The typical catalytic cycle of hypervalent iodine reagent is shown in

Figure 3, with emphasis on the oxidation phases. The effective reoxidation of resultant iodobenzoic acid to iodine(III) in situ would allow for the catalytic use of hydroxybenziodoxolone reagents.

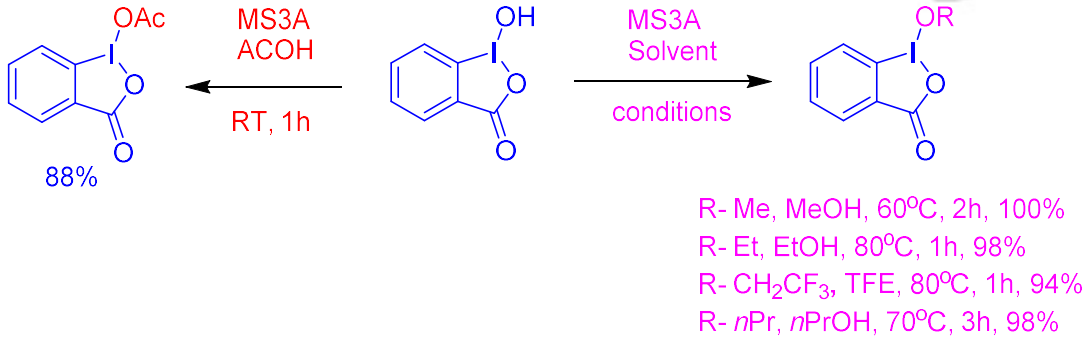
The α-hydroxylation of ketones using hydroxybenziodoxolone[21]. The reaction proceeds through a nucleophilic addition mechanism, resulting in the formation of α-

hydroxydimethylacetals. The use of hydroxybenziodoxolonereagent is advantageous due to its solubility under basic conditions, facilitating product isolation. The α-hydroxydimethylacetals can be further hydrolysed to α-hydroxyketones (**Scheme 4**). In comparison, (diacetoxyiodo)benzene yields lower product yields and requires a more complex work-up.



Scheme 4: α-hydroxylation of ketones using hydroxybenziodoxolone

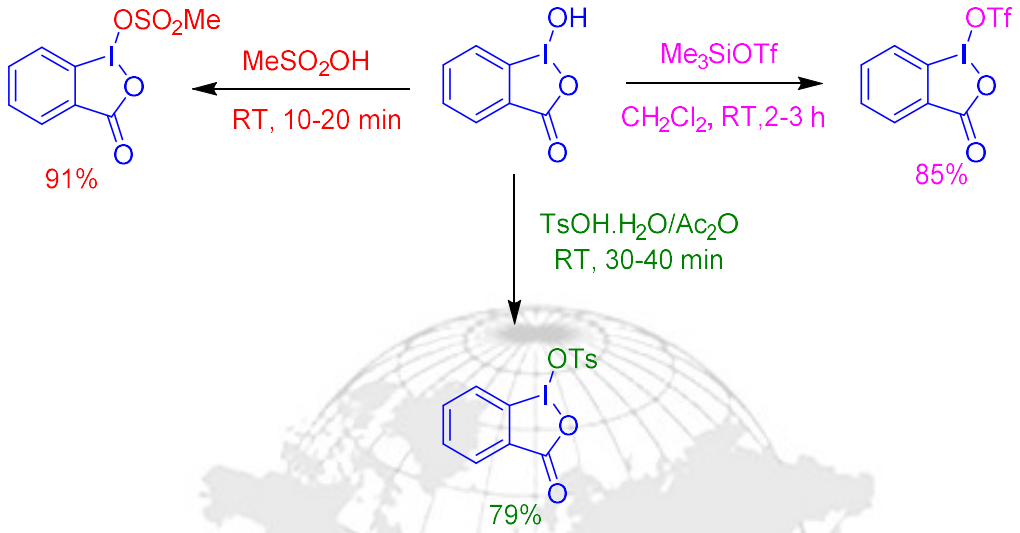
The solvolytic transformation of hydroxybenziodoxolone into benziodoxolone acetates and alkoxides has been successfully accomplished[20]. A simple ligand exchange reaction with acetic acid (AcOH) at room temperature in an AcOH solvent afforded benziodoxolone acetate in good yield (Scheme 5). Moreover, the synthesis of hydroxybenziodoxolone in aqueous alcoholic solutions resulted in the formation of alkoxy-substituted derivatives as byproducts due to the substitution of the hydroxyl ligand (**Scheme 5**). This observation suggests the potential for mild solvolytic ligand exchange of hydroxybenziodoxolone, expanding its applicability in organic synthesis.



Scheme 5: Solvolytic conversion of hydroxybenziodoxolone into benziodoxolone acetates and alkoxides.

Sulfonate derivatives can be readily prepared in a single-step process using hydroxybenziodoxolone and the corresponding sulfonic acids or trimethylsilyl triflate as starting materials[22][23]. These sulfonates were produced as crystalline solids that were thermally stable but rather hygroscopic. Tosylates showed the best moisture stability among them, while triflates

and mesylates were more hygroscopic and could only be separated as crystallohydrates. These more hygroscopic compounds can nevertheless be used in situ for further processes with good results (**Scheme 6**).



Scheme 6: Synthesis of Sulfonate Derivatives from Hydroxybenziodoxolone in a One-Step Procedure

5. Conclusion:

Hydroxybenziodoxolone has emerged as a valuable tool in organic synthesis, offering a wide range of applications due to its unique combination of electrophilic and nucleophilic properties. The stability and versatility of this reagent, coupled with its ability to facilitate complex transformations under mild conditions, underscore its significance in synthetic chemistry. The development of efficient synthetic methods for hydroxybenziodoxolone and its derivatives, along with the potential for catalytic utilization, have opened up new avenues for innovation in this field. Ongoing research focused on expanding the scope of hydroxybenziodoxolone applications, refining its catalytic capabilities, and uncovering novel modes of reactivity will likely continue to enhance its impact on organic synthesis, paving the way for more sustainable and efficient chemical processes. Unlocking the full potential of this versatile reagent holds promise for advancing the field of organic synthesis and enabling the development of innovative molecular transformations.

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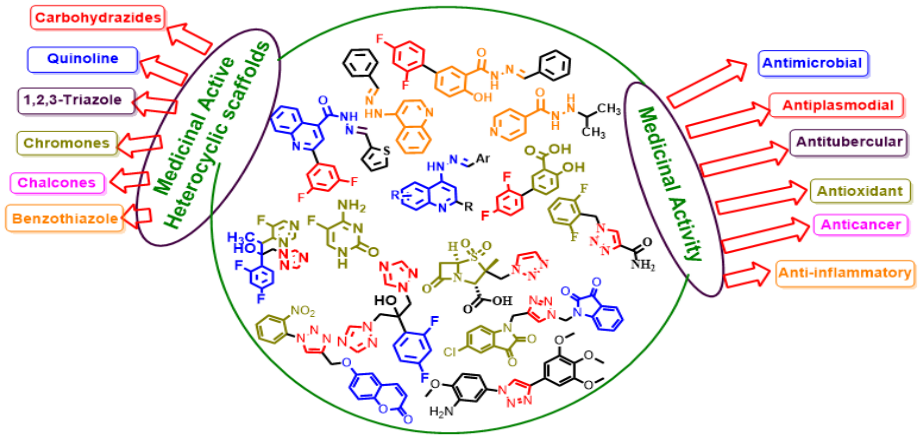
A review of the biological and therapeutic impact of heterocyclic compounds

Amol S. Nipate
Department of Chemistry, Shri Pundlik Maharaj Mahavidyalaya,Nandura Rly, Dist. Buldana-443404
And
Mr. Sunil J. Chavan
Department of Chemistry, Shri Pundlik Maharaj Mahavidyalaya,Nandura Rly, Dist. Buldana-443404
And
Dr. Mahesh B. Muluk
Department of Chemistry, Shri Pundlik Maharaj Mahavidyalaya,Nandura Rly, Dist. Buldana-443404
And
Mr. Nilkesh K. Dhurve
Department of Chemistry, Shri Pundlik Maharaj Mahavidyalaya,Nandura Rly, Dist. Buldana-443404

Graphical ABSTRACT



ABSTRACT

Heterocyclic compounds have attracted much interest due to their many important therapeutic and biological applications. The broad synthetic investigation and functional application of heterocyclic molecules are driving up research interest. They are present in more than 90% of innovative medications and bridge the gap between biology and chemistry, where much scientific discovery and application takes place. Heterocycles have applications in various domains, including pharmaceutical chemistry, biochemistry, and others. The primary applications of heterocyclic compounds are drugs, agrochemicals, and veterinary products. In this overview, we cover the majority of different therapeutic active heterocycles such as quinolines carbohydrazide triazoles benzothiazoles chromones chalcones, synthesis methods, medicinal applications, different types of therapeutic uses like antibacterial, antiviral, anti-inflammatory, anti-tubercular, antihypertensive, anti-malarial, antioxidant, antifungal, anti-plasmodial anticancer, and along with other possible therapeutic compounds with diverse applications.

Keywords: Heterocyclic Compounds, Conventional method, Biological Application.

Introduction

In the field of medicinal chemistry heterocyclic compounds with common structural motifs. Heterocycles obtain significance as more than 90% of clinically used drugs are having heterocyclic scaffolds[1]

1. Quinolines

Benzene fused pyridine moiety having a double ring structure is called quinoline. Benzo[b]pyridine is used as an alternative name for quinoline. Among all heterocycles quinoline is one of the well-known and most important scaffolds with a potential for industrial and medicinal applications[2].In the beginning of 1963 quinolines use as an antibacterial agent. Generally, the quinoline nucleus is a core structure found in a large variety of pharmacologically active natural products and is also used as chemical synthons bearing physiochemical activities, pharmaceuticals, and agrochemicals. In the literature several approaches have been described for the synthesis of quinoline scaffolds among them, Well-known classical synthesis protocols include Gould-Jacob, Friedländer, Pfitzinger, Skraup, Doebner-von Miller, and Conrad-Limpach [3]. Recently quinoline and synthetic derivatives incorporating a quinoline scaffold have shown the most significance due to exhibiting a wide range of biological activities [4]such as antifungal, anti-inflammatory, anticancer, and antitubercular [5,6] The following are some examples of new pharmaceutically and physiologically active quinolines.**Figure 1.1**.

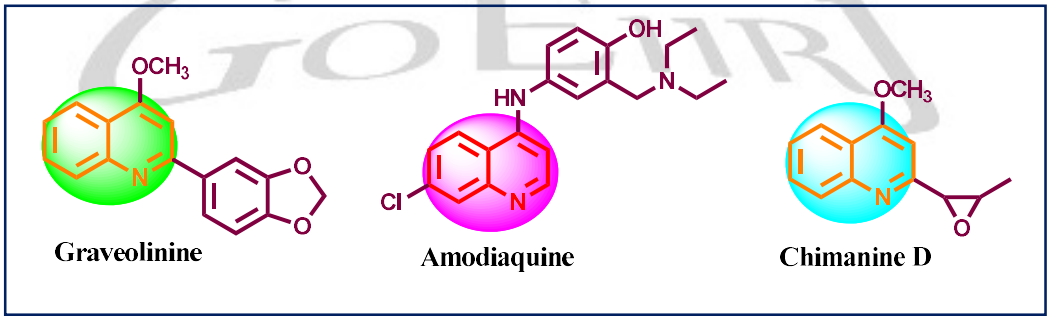


Figure 1.1 Bioactive compounds obtained from natural sources

Some of the several quinoline-containing marketed clinical drugs such as dibucaine used as local anaesthetics [7], brexpipra-zole used as an antipsychotic drug in medicinal chemistry [8], and montelukast treat persistent asthma in patients aged greater than 6 years also for treatment of allergic rhinitis [9]. Quinoline scaffold consists of pyridine as a pharmacophore for antimalarial (quinine) antibacterial (clioquinol) and anticancer (camptothecin) activity [10].

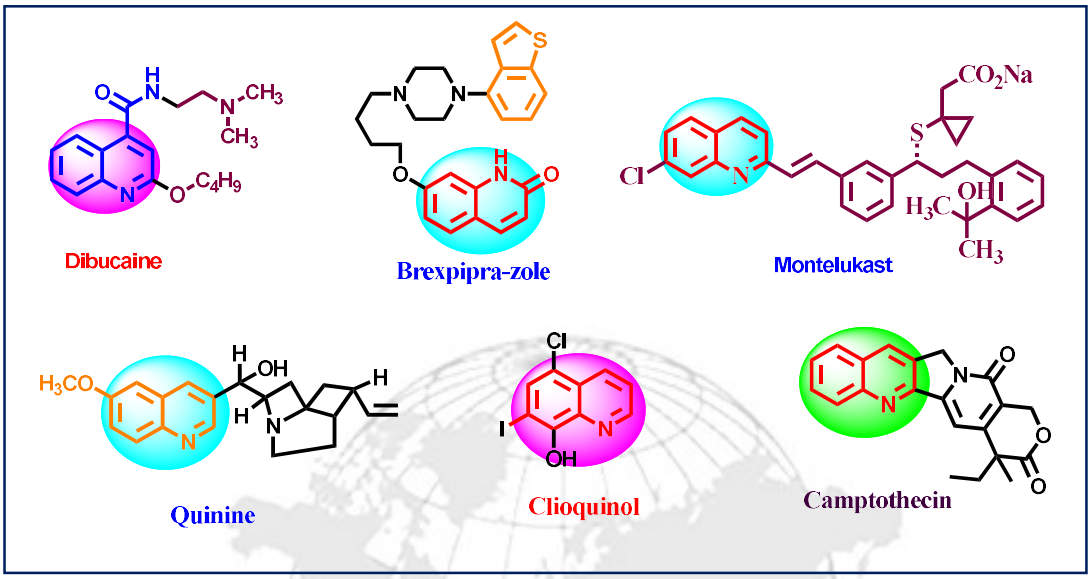


Figure 1.2 Quinoline incorporated drugs.

2. Carbohydrazides

Carbohydrazide (Schiff base) also known as 'Azomethines', or 'Imines' is a functional group that contains a carbon-nitrogen double bond. Schiff bases are formed when any primary amine combines with an aldehyde or a ketone under particular conditions [11]. This was named after the first-time preparation of imines which was reported by Schiff (1864) [12]. Carbohydrazide (hydrazides) compounds are useful building blocks for the synthesis of so many heterocyclic rings [13]. Carbohydrazides-based compounds represent a significant, pharmacophoric group in numerous classes of medicinally active heterocyclic scaffolds[14]. In literature, some of the carbohydrazides have been described as antimicrobial, anticancer, antioxidant, anti-inflammatory, analgesic, antitubercular activities,[15,16] etc. Carbohydrazide containing procarbazine shown to be useful in the treatment of Hodgkin's lymphoma disease. [17] Isocarboxazid drug used in schizophreial [18]. Fonturacetam hydrazide has been utilised to treat various neurostimulant diseases. Some of the marketed available drugs such as furazolidone, nituroxide, nitofurantoin, nitrofurazone, negamycin and aminosalicyclic acid hydrazide has display potent antibacterial activity [19].

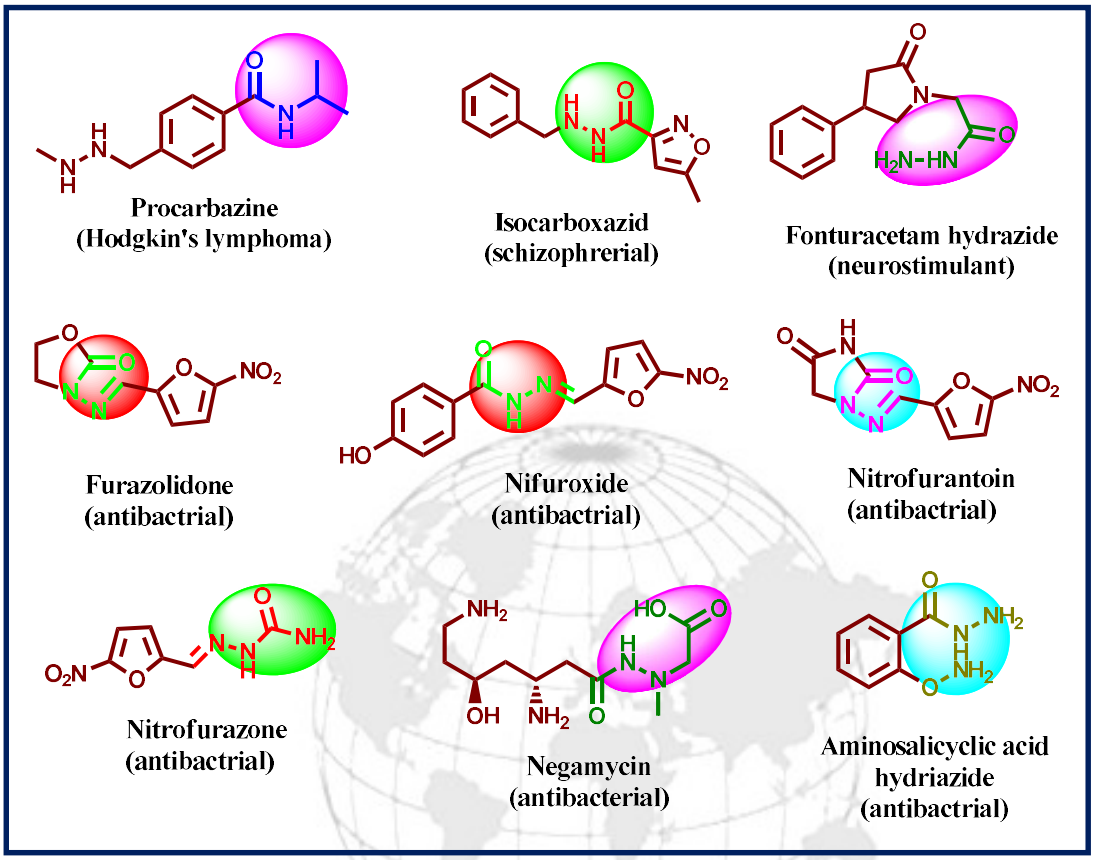


Figure 2.1 Some of example of marketed available drugs contains carbohydrazide scaffolds

3. Triazoles

Azoles are five membered heterocycles containing nitrogenatom and at least one other non-carbon atom i.e. nitrogen, sulphur or oxygen as a part of the ring.The parent five membered azole is hetero aromatic and has two double bonds. The numbering of ring atom in azoles starts with the heteroatom that is not part of double bond and then proceeds towards other hetero atoms.[20] Imidazole, triazole, tetrazole, pyrazole, oxazole, isoxazole, oxadiazole, thiazole, and thiadiazole are the azole ring systems which are extensively studied andtherapeutic evaluationof their derivativeshas also been systematically carried.[21]Most of the derivatives of these ring systems have displayed remarkable bioactivities and become core scaffolds of the clinically practised medicaments. Therapeutic activities, possessed by azoles are attributed to their unique lipophilicity and pharmacokinetic index.[22]Triazole ring is a remarkable aromatic five membered heterocycle contains three nitrogen atoms, with electron-rich system. This type of anomalous structure provides triazole derivatives rapidly bind with a multiple of receptors and enzymes in biological system via weak interactions of the same kind as hydrogen bonds, hydrophobic effect, ion dipole, vander Waals force, π-π staking and so on, and hence triazole display an extensive rangeof biological activates.[23]Additionally triazole aromatic ring can be used as an engaging linker to connect various pharmacophore fragments to form sophisticated bifunctional drug molecules, giving appropriate and beneficial pathway to prepare various bioactive molecules.[24,25] A large

number of triazole contains derivatives have been thoroughly prepared and explored for their biological activities, Most of the triazole derivatives, with excellent pharmacological activity, less adverse effects, fever multi-drug resistances, low toxicity, good pharmacokinetics property, broad spectrum etc. Some of the example of triazole-based marketed antifungal agent such as, fluconazole, itraconazole, voriconazole, and ketoconazole are all commonly used to treat fungal infections.[26]

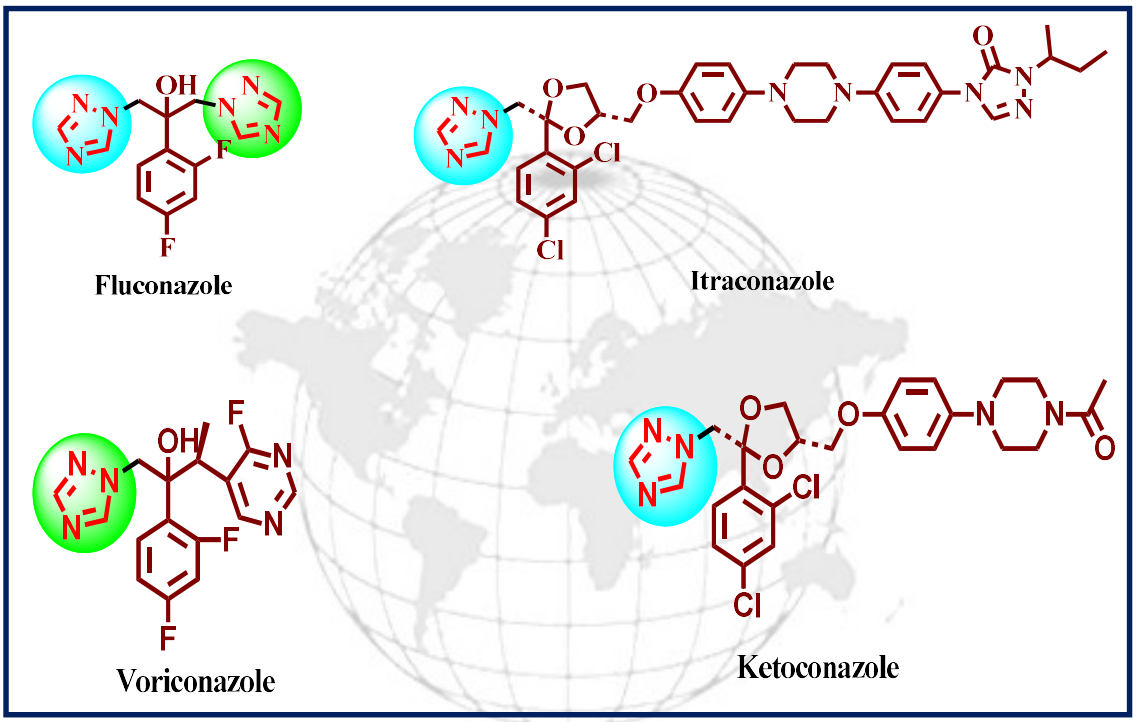


Figure 3.1 Marketed available drugs molecule contains triazole moiety.

The 1,2,3-triazoles having very good bioactivity compare to 1,2,4-triazole. Among nitrogen-containing heterocycles, the 1,2,3-triazole ring is a significant pharmacophore system. These five-membered heterocyclic motifs with three nitrogen heteroatoms are easily produced utilizing 'click' chemistry using azide-alkyne cycloaddition processes catalysed by copper or ruthenium.Huisgen discovered 1,3-dipolar cycloaddition reaction of organic azides together with terminal alkynes is the classical and extensively used approach to the synthesis of 1,2,3-triazoles.[27] However, major problem associated with this methodology is low regioselectivity, and the reaction leads to the mixture of 1,4- and 1,5-regioisomers, K.B Sharpless and M. Meldal groups independently investigated the Huisgen's 1,3-dipolar cycloaddition and improved the regioselectivity of reaction by Cu(I)-catalyzed ligation of organic azides and terminal alkynes (the CuAAC reaction) offers great promise in this regard. The CuAAC methodology, a so-called "click" reaction.[28]The salient features of this reaction are exclusive formation of 1,4 regioisomeric product, mild reaction conditions, wide substrate scope, and effective catalytic system with high yields.Recently, the 'linker' feature of 1,2,3-triazoles was established, and a novel

class of 1,2,3-triazole-containing hybrids and conjugates were synthesised and tested as lead compounds for a variety of biological targets. These lead compounds have been shown to have anticancer, antibacterial, anti-tubercular antiviral,antidiabetic, antimalarial,anti-leishmanial, and neuroprotective[29] properties. Some of the significant drugs available in the market having 1,2,3-triazole scaffold-like tazobactum, cefatrizine, carboxyamidotriazole, rufinamide, imatinib, an anticancer agent used for leukemia treatment, migrastatin.[30]

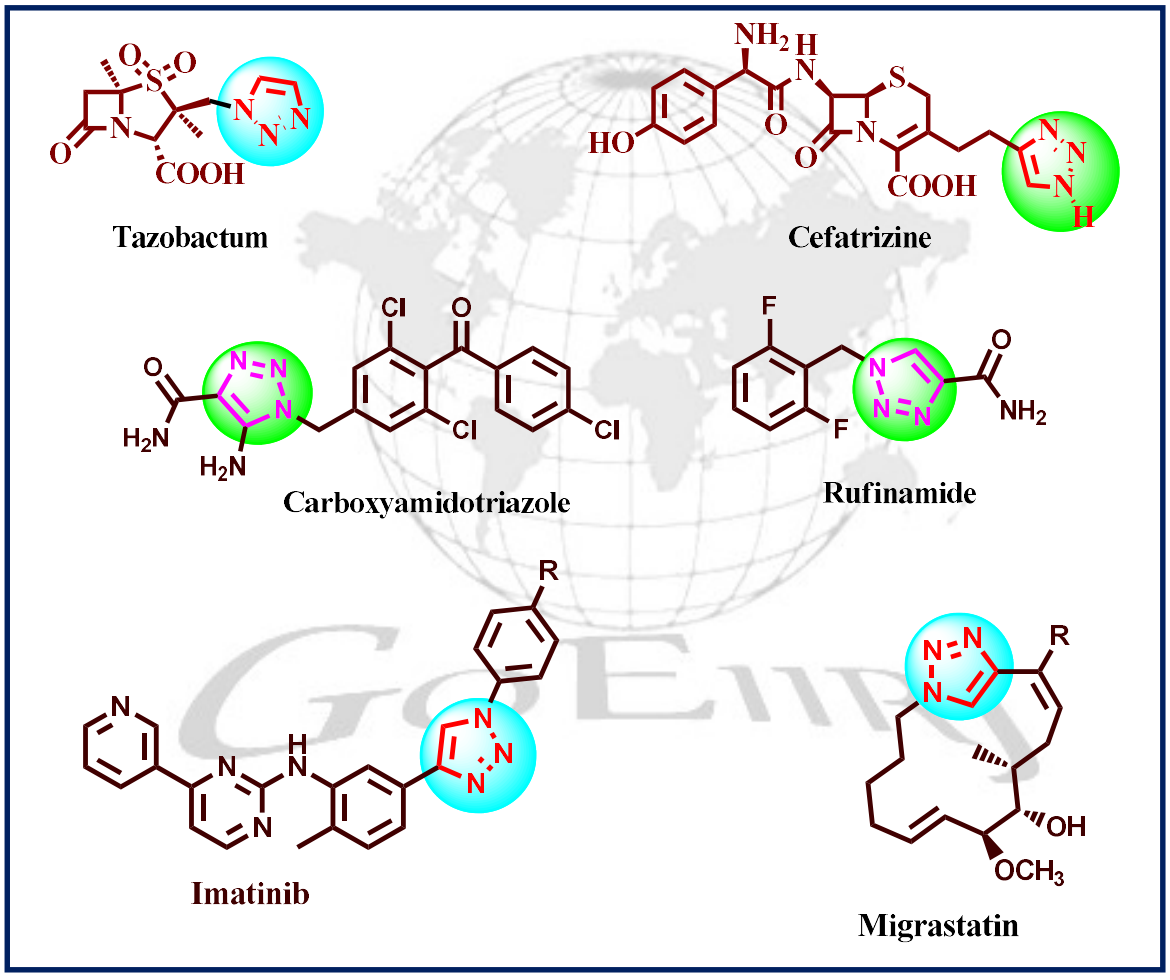


Figure 3.2 Some examples of significant drugs containing 1,2,3-triazoles nucleus

4.Benzothiazoles

Benzothiazole is a fused heterocyclic compound that includes the heteroatoms sulphur and nitrogen. Owing to its natural affinity for various biological receptors, benzothiazoles have become an important scaffold for the discovery of new drugs.[31] Because of the extensive range of pharmacological effects associated with benzothiazole-containing compounds, they are gaining enormous importance. Numerous therapeutic agents have benzothiazole scaffolds. Marine and natural products are also having this core ring system.The structural diversity of benzothiazole and its derivatives has proven valuable in the search for new therapeutic possibilities.[32]

Benzothiazoles have been discovered to have a several type of medicinal activities such as anticancer,[33] antimicrobial, anti-tubercular, anticonvulsant, antifungal,[34]anti-inflammatory, analgesic, and antiviral.[35] Riluzoleis found to be helpfulin the treatment of amyotrophic lateral asclerosis.[36]2-(4-Aminophenyl) benzothiazole has shown significant and specific antitumor action against colon, breast, ovarian, and kidney cell lines.[37]Pramipexoleis used toeffective treatment of Restless Leg Syndrome.[38] Ethoxzolamide drugused as Zarontin capsules manufactured by Pfizer.[39]Benzothiazole containing methabenzthiazuron is used as fungicide and its derivatives have been used in treating various neurodegenerative diseases and have histamine H_2antagonist property.

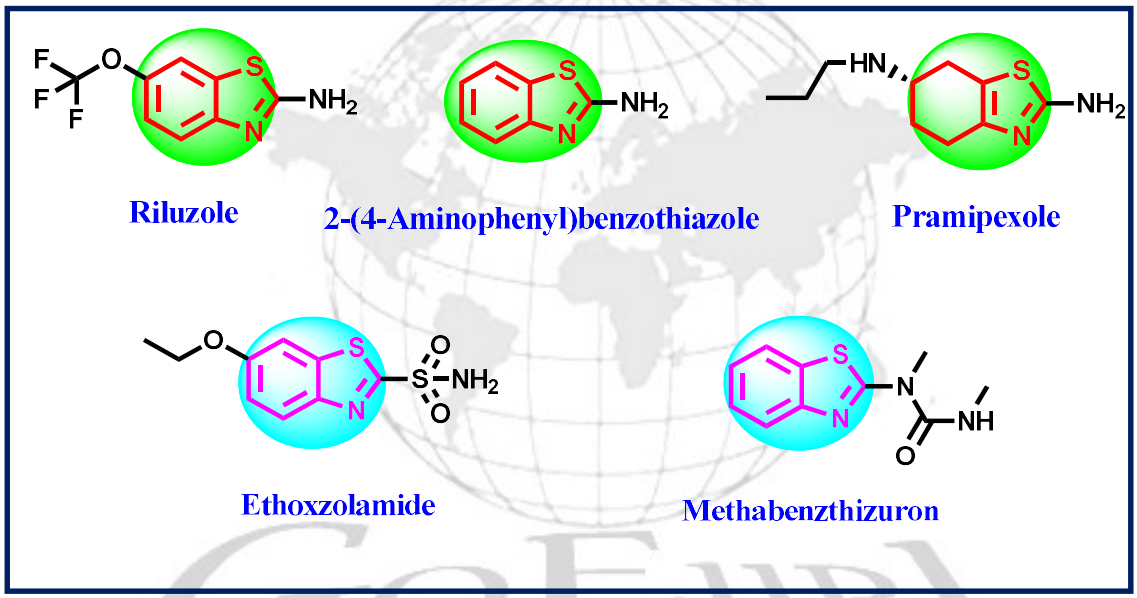


Figure 4.1 Structures of Benzothiazole containing drugs.

5 Chromones

Chromones are a class of naturally occurring benzopyrone substances that are found all across nature, particularly in plants. Chromones are benzoannelated -pyrone-ringed heterocyclic compounds that include oxygen (4*H*-chromen-4-one, 4*H*-1-benzopyran-4-one). Since ancient times, chromones have been employed in therapy.[40]Chromones scaffolds and derivatives of chromones show the wide range of medicinal activities[41] such as antimalarial,antimicrobial, antimalarial, antioxidant, anti-proliferation, antitumor,anti-inflammatory, and neuroprotection.[42] Some examples of chromone derivatives that have been employed as medicinal drugs include cromolyn, which is used as a mast cell stabiliser in allergic rhinitis, asthma, and allergic conjunctivitis.[43]Khellin, a furanochromone manufactured from the seeds of the plant Ammi visnaga, is one of the most alluring instances of natural chromones used in clinical

practise.[44]However, the effect was too transient to be clinically helpful when chromone-2-carboxylic acid was employed to suppress bronchial spasms brought on by antigens.[45]Disodium cromoglycate is a chromone that was widely used to treat bronchial asthma.[46]

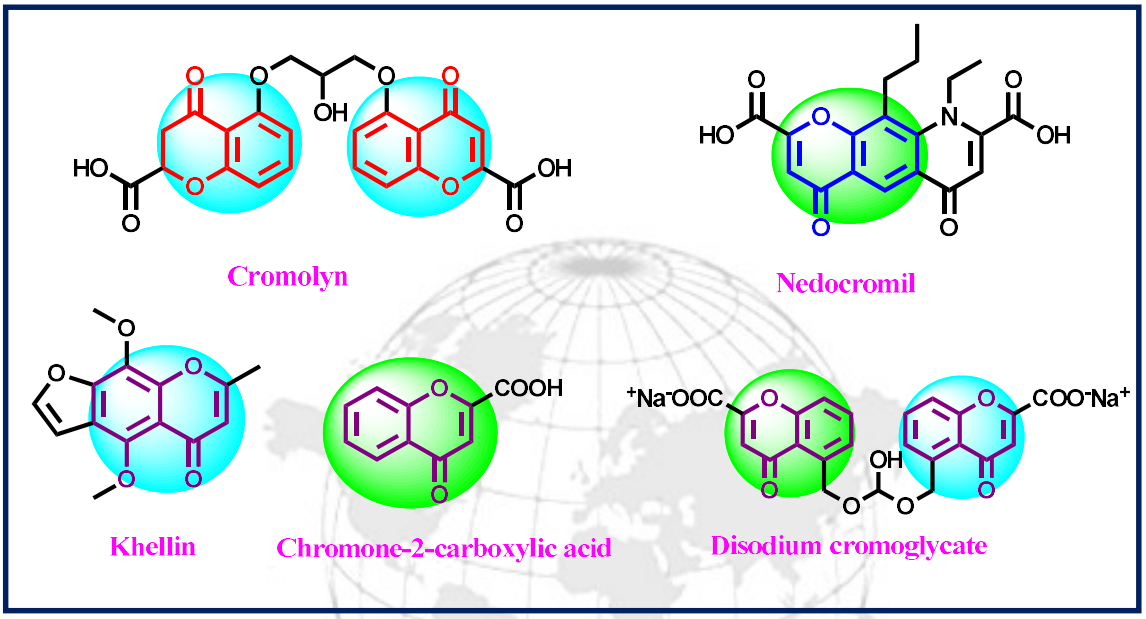


Figure 5.1 Naturally existing physiologically active chromone derivatives.

6. Chalcones

Chalcones, which have been speculated to be the precursors of flavonoids and isoflavonoids, are a prominent class of natural compounds that exist in fruits, vegetables, spices, tea, and soy-based foods.[8] The term Chalcone is derived from the Greek word Chalcos, which means bronze. Naturally occurring chalcones and their synthesized substitutes have a wide variety of therapeutic actions.[47] Chalcone and its derivatives exhibit a wide range of therapeutic actions including antimalarial, antibacterial, antifilarial, antioxidant, anti-inflammatory, and antiproliferative. [48] Several chalcone-based market available drugs such as pinostrobin chalcone act as potent inhibitor of triglyceride accumulation, and anti-obesity effect through the inhibition of adipogenesis. Metochalcone, choleretic drugs, and an anti-ulcer, mucoprotective agent, have been used to treat a variety of disorders.Sappanchalcone drug used as bone protective and anti-inflammatory agent. Some of the chalcone scaffolds containing drugs like 3-Deoxysappanchalcone, broussochalcone A and xanthoangelol acts as potent anticancer agent[48–50].

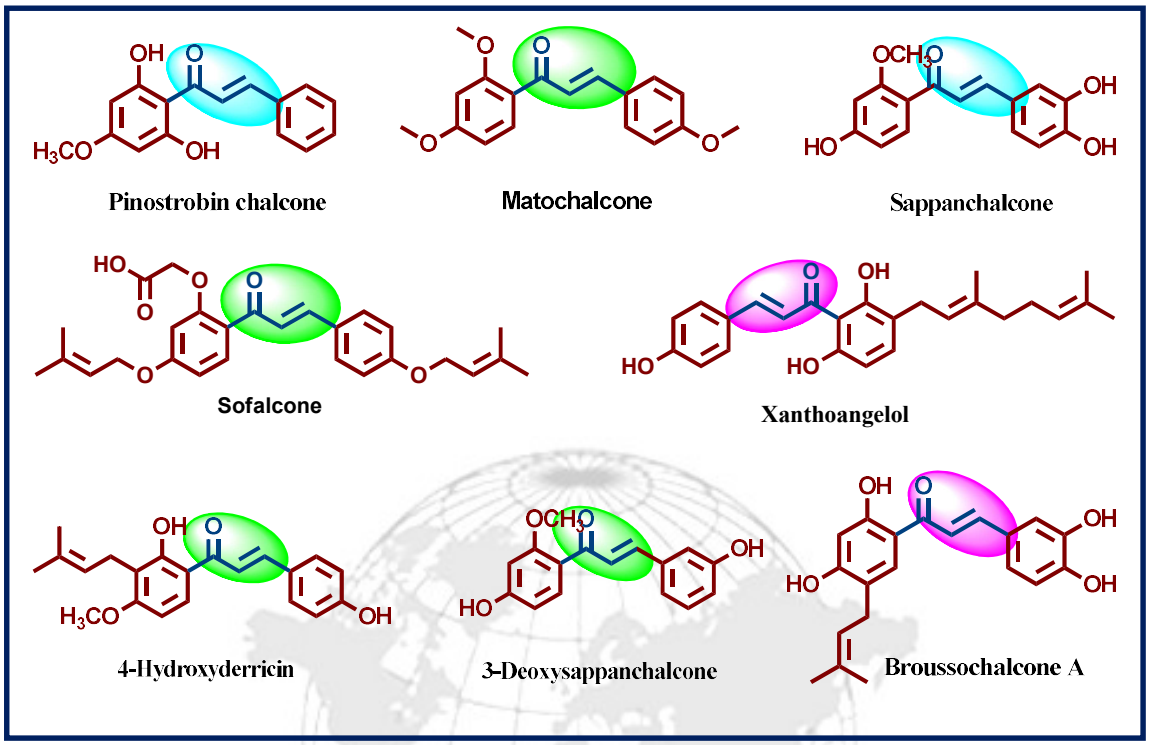


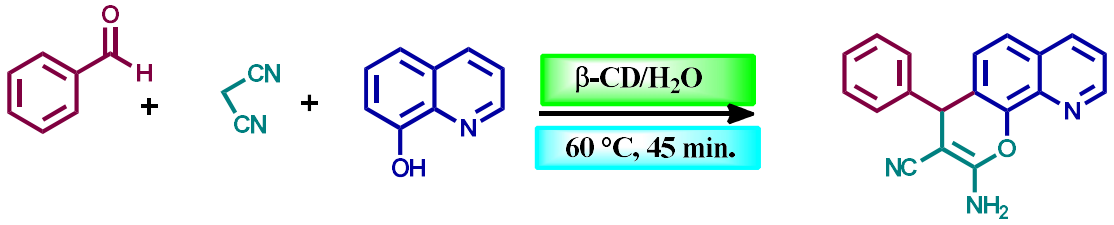
Figure 6.1 Structures of marketed drugs containing chalcone moiety.

Heterocyclic scaffolds are the important structural unit in the fields of organic agrochemical, industrial, pharmaceuticals and medicinal chemistry. Owing these application the synthesis of medicinally active heterocyclic scaffolds has been a hot topic. To develop and the synthesis of novel methodologies using greener approach has been developed, some of technique mentioned below.

Conventional method

The conventional method is one of the widely used methods for the synthesis of various medicinally important heterocyclic molecules with large molecular complexity. Conventional methods have easy handling, comparatively simple and large-scale production especially for industry purpose. Conventional methods for organic synthesis are exceptionally well documented and practiced. Some of the organic transformations using conventional approach to the synthesis of heterocycles are mentioned below.

Jadhav*et al.*[51] employed the β-cyclodextrin (β-CD) as expedient, green, highly efficient, rapid, and facile catalyst one-pot multicomponent formation of 2-amino-4*H*pyranoquinolines derivatives (**Scheme 1**) from hetero/aromatic aldehydes cyanoacetate and hydroxyquinoline.

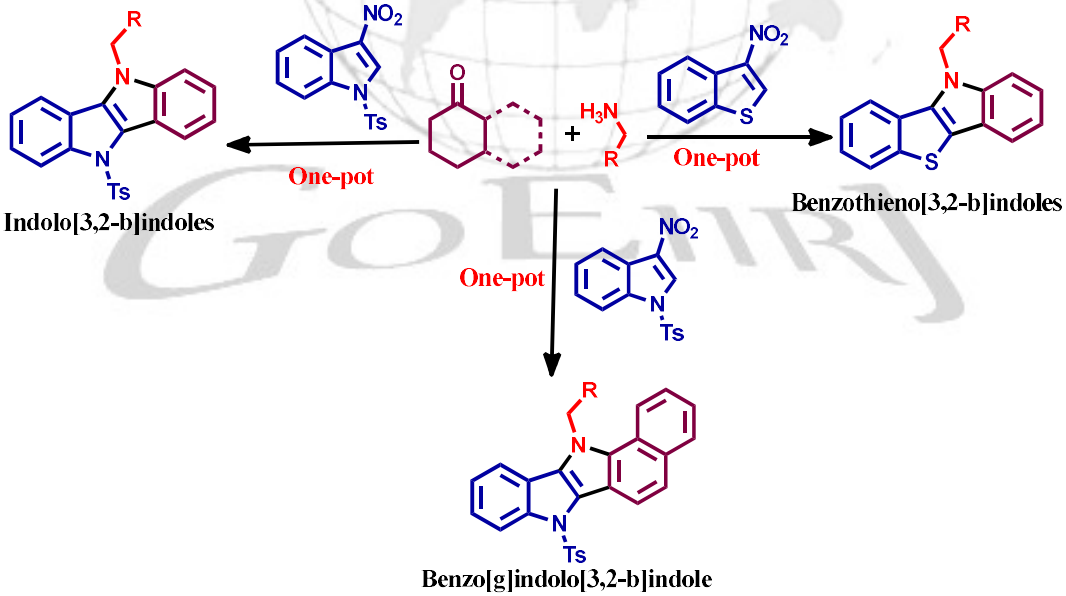


Scheme 1

Deng *et al.*[52]developed chemo-selective synthesis of *N*-thiomethyl benzimidazoles (**Scheme 2**) using o-phenylenediamine, p-substitutedthiol, and paraformaldehyde in the presence of 4-amino diphenylamine &1,1,1,2-tetrachloroethane (TCE):H_2O mixture at high temperature.

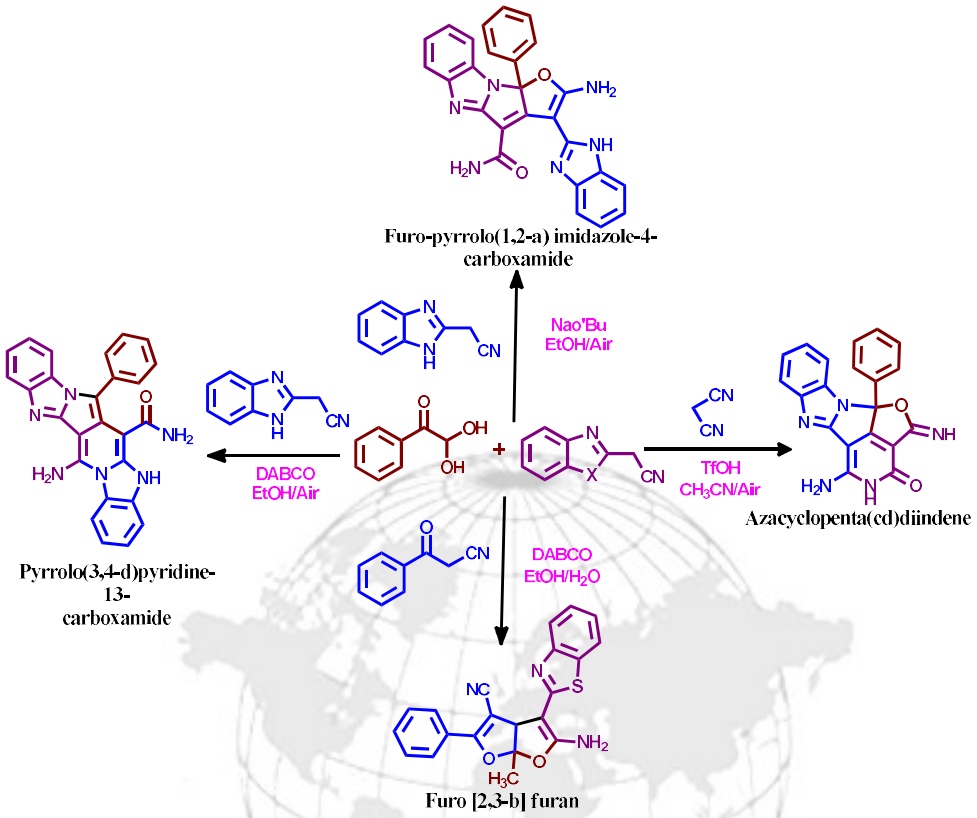
Scheme 2

Santhini and co-worker[53]described a simple, convenient one pot multi-compounds reaction of aliphatic primary amine, *N*-tosyl-3-nitroindole and cyclohexanone followed by an oxidation form indole-fused heteroacenes **(Scheme 3)**.



Scheme 3

Pazhanivel*et al.*[54] developed selective synthesis ofcarboxamide fused polyheterocyclic compounds by using the various pair strategy. The method is metal-free, has a wide substrate scope, and produces excellent yields **(Scheme 4)**.



(Scheme 4).

Applications of heterocyclic compounds

The heterocyclic compounds are the largest group of chemical compounds in organic chemistry. In everyday life, heterocyclic compounds are extremely significant. They have a wide range of applications in medicinal chemistry, and agrochemical products, as developers, corrosion inhibitors, sanitizers, copolymers, antioxidants, and dye stuff chemistry.An effective approach for producing new heterocycle moiety is always important. Now, a review of the literature suggests that more than 85-95% of novel drugs incorporating heterocycles have a promising scientific potential in the biological system.

Medicinal Application:

In the recent years, many heterocyclic compounds were developed which having the several different types of therapeutic uses and applications like as antibacterial, antiviral, anti-inflammatory, anti-tubercular,antihypertensive, anti-malarial, antioxidant, antifungal, anti-plasmodial anticancer, and along with other possible therapeutic compounds with diverse applications in pathology and diagnostics. Heterocycle derivatives occupy a unique position in the field of medicinal chemistry. Many important naturally occurring substances include the heterocyclic moiety, including histamine, purine, nucleic acid, and histidine.

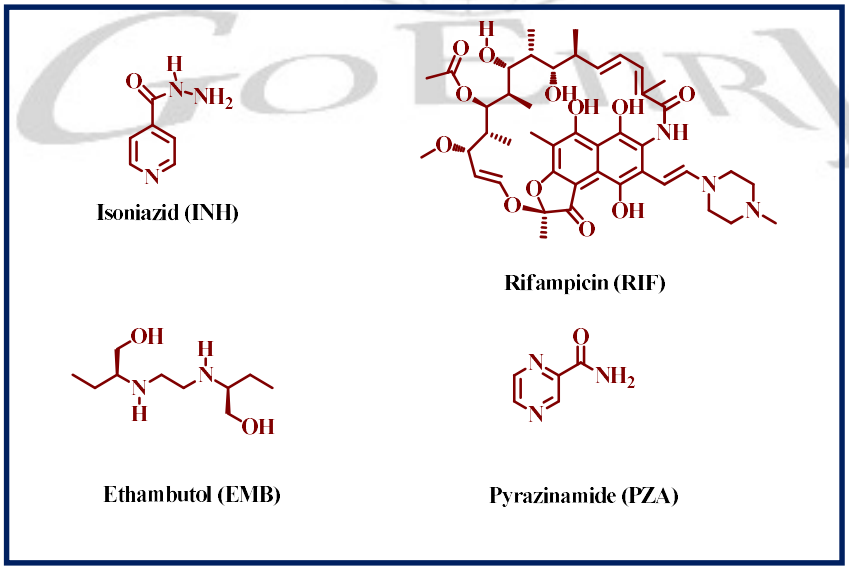
1] Antihypertensive activity:

Hypertension continues among the most prevalent chronic disease; it is the main one cause of life-threatening cardiovascular complications such as stroke, coronary artery disease, and heart failure. It is the main factor that leads to early mortality worldwide. Considering the availability of

various antihypertensive medication classes, successful hypertension therapy with minimal side effects is conceivable. Blood pressure regulation necessitates a continual adjustment of cardiac output and peripheral vascular resistance. Antihypertensive drugs are an instance of drug used to treat hypertension in medicine and pharmacology. Trichloromethiazide and polythiazide are regarded to reduce peripheral vascular resistance by lowering blood return to the heart and consequently cardiac output.[55]

2] Anti-tubercular activity:

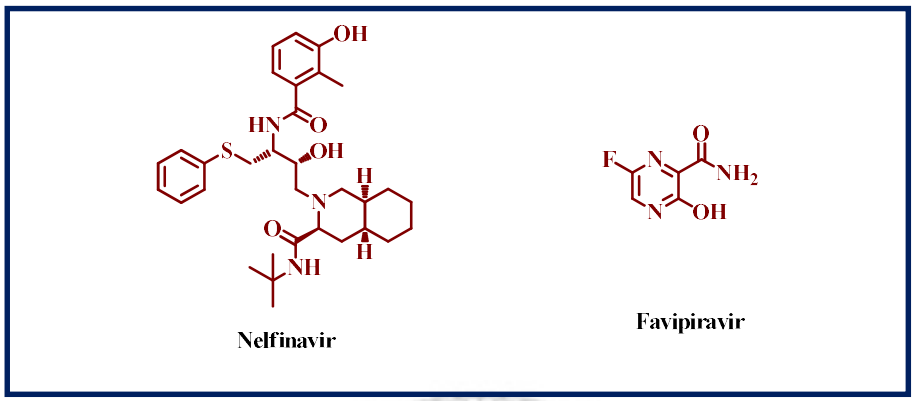
Tuberculosis (TB) is an airborne, contagious and insidious disease, caused by Mycobacterium tuberculosis. In 1882, Robert Koch identified the tuberculosis-causing Mycobacterium as a strain that caused tubercular illness for the first time. In 1906, Albert Calmette and Guerin discovered the first known instance of the BCG vaccine.Isoniazid (INH), rifampicin (RIF), pyrazinamide (PZA), and ethambutol (ETM) are antitubercular drugs used in the chemotherapy of tuberculosis.[56]



3] Antiviral activity:

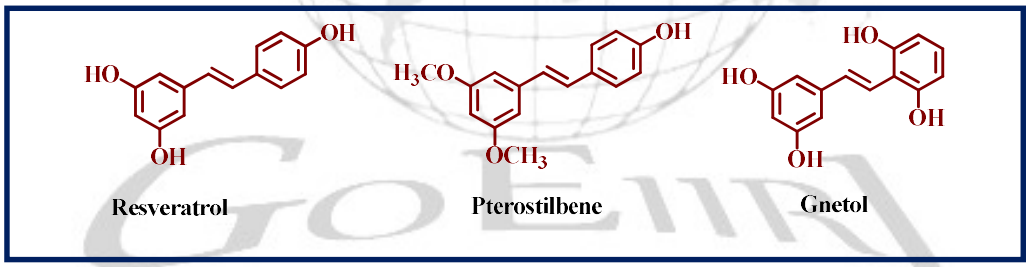
Viral is disease that can cause due to infections or spreading of certain viruses in your body. Antivirals are medicine used to help the immune system protect against specific viruses and may protect you against suffering viral infections.[57]In 1990s, discovered antiviral drug used to treat human immunodeficiency virus (HIV) infection are nelfinavirm and Favipiravir drug used for

influenza virus.[58]



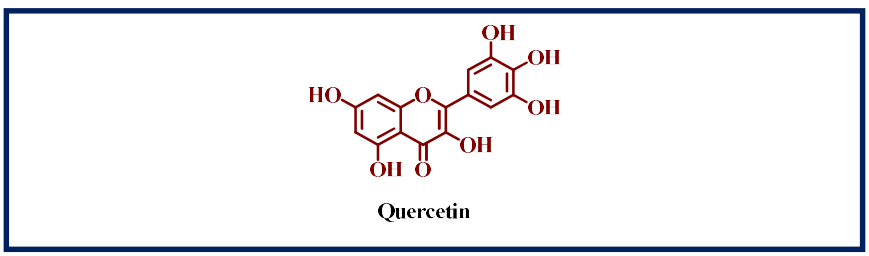
4] Anti-inflammatory activity:

Inflammation is a multifaceted physiological reaction of vascular tissues to aggressive stimulation such as pathogens, irritants, or damaged cells.Inflammation is a defensive mechanism used by the human body to eliminate stimuli that are harmful.[59] Anti-inflammatory can be an effective substance which reduces inflammation by relieving pain and does not affect the central nervous system. Some examples of natural products like resveratrol pterostilbene, and gnetol are well-known anti-inflammatory compounds with significant activity *in vitro* as well as *in vivo*.[60]



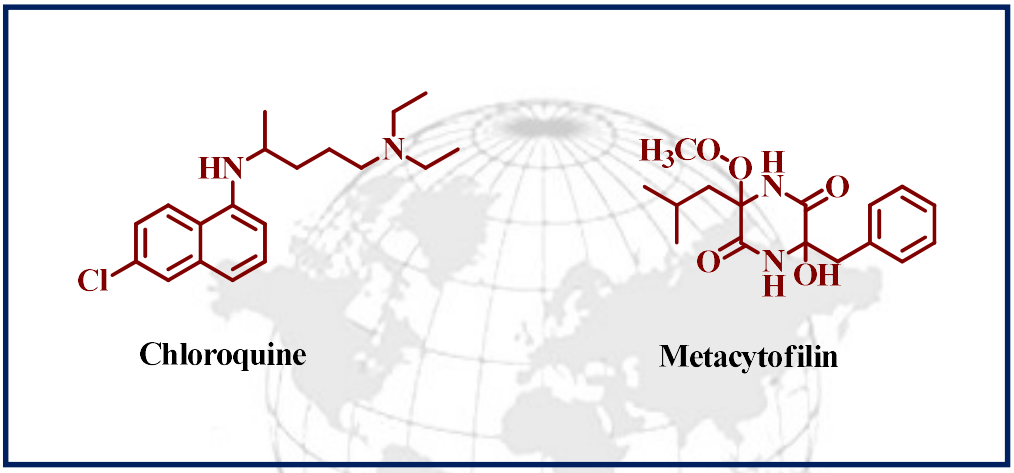
5] Antibacterial activity:

Anti-bacterial agents are the most significant infectious drug which is used for the medical treatment and prevention or kill bacteria, or bacteriostatic, which slow down the growth of bacteria. During the last few decade, some promising results with flavonoids' antibacterial activity have been obtained.[61]For examples, quercetin showed significant antibacterial properties against several kinds of bacterium strains, including *S. aureus,* methicillin-resistant *S. aureus* (MRSA), and *Staphylococcus epidermidis*.[62]



6] Anti-malarial activity:

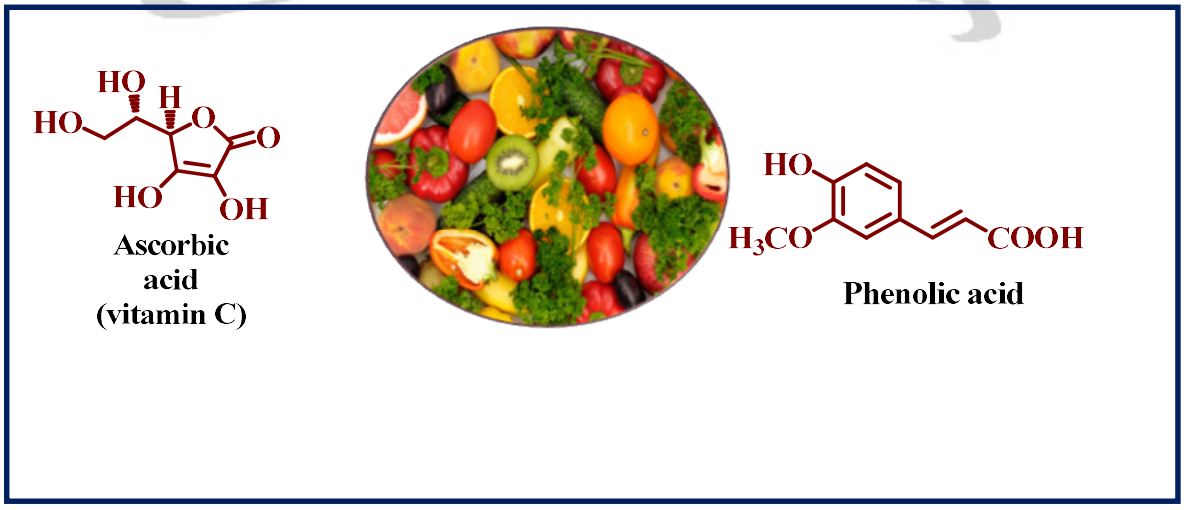
Malaria is world-wide a disease caused by the plasmodium type of parasitic protozoans. Humans come into contact to the parasite through the bites of infected mosquitoes.People suffering from malaria typically experience severe illness, including a high fever and trembling chills. There are several antimalarial agents such as Chloroquine, Metacytofilin etc are used both for treatment and prevention of malaria infection.[63]



7]

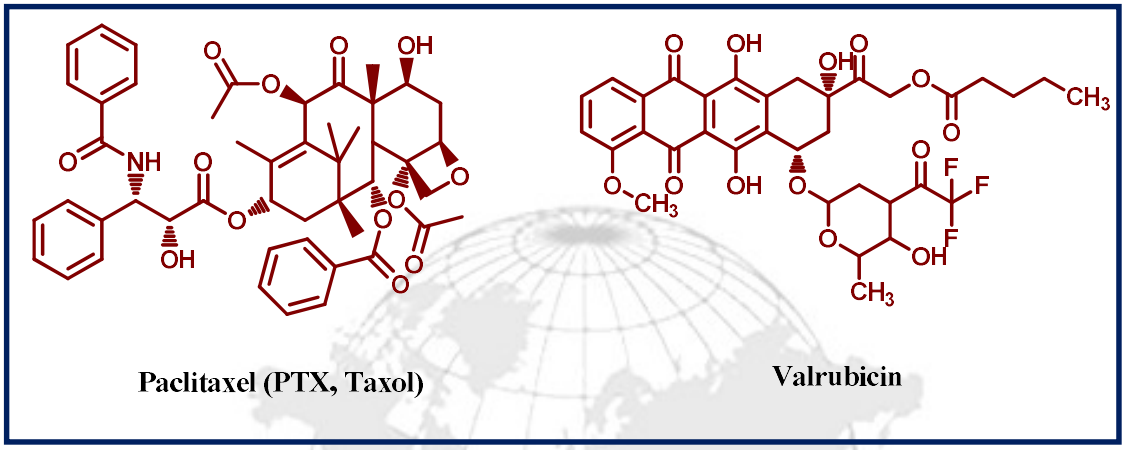
Antioxidant activity

Antioxidants agent used to prevent the threat of chronic diseases including cancer and heart disease. Naturally occurring sources of antioxidant are grains, fruits and vegetables like ascorbic acid (vitamin C), vitamin E, carotenes, phenolic acid etc. reduce disease risk.[64]



8] Anti-Cancer activity:

Cancer, is life threatening & one of the most dreadful diseases caused due to abnormal cell proliferation seems uncontrolled, rapid, and pathological.Paclitaxel (Taxol) has oxygen based key drugs used in cancer therapy. Valrubicin was found potent against bladder cancer.[65].



Conclusion:

Heterocyclic compounds are widely used in medicinal chemistry and are important in biological processes. Many heterocycles' compounds used as drugs to treat various diseases and injuries. The potential applications of heterocycles asantibacterial, antiviral, anti-inflammatory, anti-tubercular, antihypertensive, anti-malarial, antioxidant, antifungal, anti-plasmodial anticancer etc. Surprisingly, a growing number of heterocycles have been identified as possible therapeutic candidates in ongoing research.

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An Efficient Synthesis of 2-Aryl-2,3-Dihydroquinolin-4(1H)-One Using SnO_2/SiO_2 Nanocomposite Catalyst

Chandrashekhar G. Devkate
Indraraj Arts, Commerce and Science College, Sillod,
Chh. Sambajinagar-431112
And
Ajay M. Patil
Pratishthan Arts, Comm. & Science College, Paithan.,
Chh. Sambajinagar -431107
And
Satish S. Kola
M.G. Arts, Science and Late N.P Commerce College, Armori,
Maharashtra, India 441208
And
Vinod A. Shelke
Indraraj Arts, Commerce and Science College, Sillod,
Chh. Sambajinagar-431112

ABSTRACT

A SnO_2/SiO_2 catalysed synthesis of 2-aryl-2,3-dihydroquinolin-4(1H)-one from 2-aminoacetophenone and substituted benzaldehydes the synthesis highlights a synthesis and use of SnO_2/SiO_2 nanocomposite heterogeneous catalyst and its reusability. The method is cost effective and eco-friendly. And use of ethanol as a solvent makes the method greener and more efficient. The method has simple workup procedure and the products are obtained in good to moderate yields.

Keywords: 2-aryl-2,3-dihydroquinolin-4(1H)-one, 2-aminoacetophenone, Substitutedbenzaldehydes and SnO_2/SiO_2

Introduction:

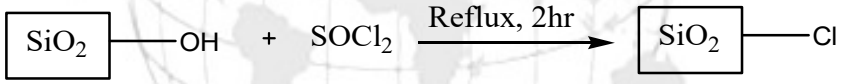
The 2-Aryl-2,3-dihydroquinolin-4(1H)-one and derivatives have variety of therapeutic properties as antibiotic, antitumor agent, anticancer and further biological activities [1-4]. Biological and therapeutic properties of 2-aryl-2,3-dihydroquinolin-4(1H)-one derivatives investigators developed numerousways by using some catalysts like transition metals or metal triflates, ionic liquids or bifunctional thiourea [5]. The researchers have synthesizedby using o-aminoacetophenone and aromatic aldehydes by means oforganocatalyst [6], microwave irradiation by solid support [7]. The mentionedapproaches having disadvantages such as the need for strongly acidic condition [8], toxic solvents, long reaction time and important quantity of catalyst [9]. The objective of emerging environmentally friendly reaction situations and media for organic reactions

with exceptionalproductivity, thus to overcome the challenge the use of easily available, reusable solid acid catalyst, silica chloride there are many applications of solid supported catalyst as safety in handling, rate enhancement and easy workup procedures [10 -12].In continuation to our previous work on ultrasound irradiated synthesis which is important technique in synthetic organic chemistry. It has been used as an important energy source for the organic reactions. Simple experimental procedure, increased selectivity, very high yields, and clean reaction [13 -15].

Experimental Section:

Procedure for Optimization of reaction conditions for the synthesis of 2-aryl2,3-dihydroquilino-4(1H)-one.

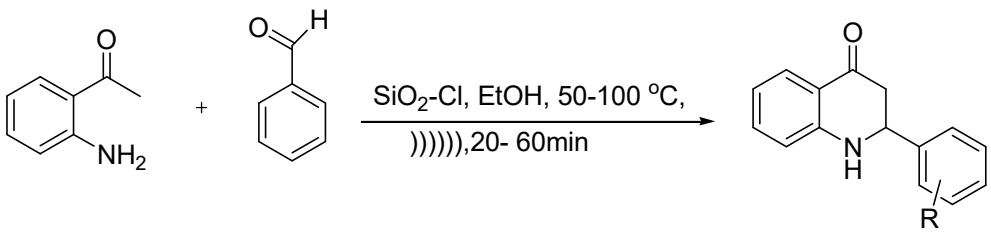
The model reaction between 2-aminoacetophenone (1 mmol), benzaldehyde (1 mmol) **2d** (1.2 mmol) (Scheme)catalyzed by silica chloride (SiO_2-Cl) and optimization using different mol percentage for the reaction which was carried out under ultrasound irradiation. The results are summarized in **Table 1**. Using (SiO_2-Cl) (15 mol %) (entry 10) with solvent free conditions at 50 - 100 ^oC for 35 min gave excellent yield as compared to other. And for our further synthesis of all other 2-aryl2,3-dihydroquilino-4(1H)-one'sderivatives we have chosen (SiO_2-Cl) (15 mol %) at under ultrasound irradiation.



Scheme 1: Synthesis of silica chloride

Procedure for the synthesis 2-aryl-2,3-dihydroquilino-4(1H)-one (3a-h).

A mixture of 2-aminoacetophenone (1 mmol), benzaldehyde (1 mmol) **2d** (1.2 mmol) in ethanol to that (SiO_2-Cl) (15 mol %) was addedand the reaction mixture was kept in the ultrasonic bath and was irradiated at 50- 100^oC for about 20-60 min. (the reaction was monitored by TLC) separately as indicated in (**Table 2**). After the reaction was completed the reaction mass was poured on crushed ice. The obtained solid was filtered, washed with water and dried. The crude compound was crystallized using DMF-Ethanol.



Scheme 2. Synthesis of 2-aryl-2,3-dihydroquilino-4(1H)-one from aminoacetophenone and benzaldehyde.

Table 1: Optimization of reaction conditions for the synthesis of2-aryl-2,3-dihydroquilino-4(1H)-one using ultrasound irradiation.

Entry	Catalyst/ mol (%)	Solvent	Time (min)	Yield[a] (%)
1	-	EtOH	90	5[b]
2	SiO_2-Cl (5)	THF	65	40
3	SiO_2-Cl (10)	THF	60	55
4	SiO_2-Cl (5)	MeCN	60	50
5	SiO_2-Cl (10)	MeCN	60	53
6	SiO_2-Cl (5)	Toluene	60	40
7	SiO_2-Cl (10)	Toluene	60	48
8	SiO_2-Cl (5)	EtOH	40	62
9	SiO_2-Cl (10)	EtOH	40	77
10	SiO_2-Cl (15)	EtOH	40	92
[a]Isolated yields. [b]Not completed				

Table 2 Synthesis of 2-aryl-2,3-dihydroquilino-4(1H)-one

Entry	**R-**	**Time (min)**	**Yield (%)**
a	4-ClC_6H_4	35	94
b	2-BrC_6H_4	40	86
c	2-ClC_6H_4	40	92
d	4-MeC_6H_4	40	90
e	4-NO2C_6H_4	60	30
f	2- MeC_6H_4	40	88
g	4-$MeOC_6H_4$	35	90
h	4-FC_6H_4	40	85
*Reaction condition: 2-aminoacetophenone (1 mmol), benzaldehyde (1 mmol) **2d** (1.2 mmol) in ethanol to that (SiO_2-Cl) (15 mol %) in the ultrasonic bath, irradiated at 50-100^oC for 20-60 min			

Table 3 : Recyclability and reusability of catalyst SiO_2-Cl.

Number of Runs	Yield (%)[a]	Catalyst recovery (%)[b]
1	94	95
2	89	90
3	85	88
4	78	80
[a]Isolated yields. [b]SiO_2-Cl was recovered and for number of runs.		

Spectral data for representative compound:

(**Table 2**, entry b) 2-(4-Chlorophenyl)-2,3-dihydroquinolin-4 (1H)-one Mp: 165-167°C. IR: 3344, 3209, 2982, 1664, 1583, 1223, 1152, 753 cm-1 . 1H NMR (600 MHz, CDCl3): δ 7.83 (dd, J = 7.9, 1.1 Hz, 1 H), 7.33-7.31 (m, 5 H), 6.76 (t, J = 7.2 Hz, 1 H), 6.71 (d, J = 7.3 Hz, 1 H), 4.65 (dd, J = 14.3, 4.1 Hz, 1 H), 4.51 (s, 1 H, NH), 2.73 (dd, J = 17.1, 14.2 Hz, 1 H), 2.71 (dd, J = 17.3, 4.2 Hz, 1 H). 13C NMR (150 MHz, CDCl3): δ 192.5, 151.3, 131.4, 131.4, 131.1, 122.2, 123.8, 123.5, 114.2, 115.7, 116.9, 55.8, 45.3. MS (EI): m/z = 257.07 [M+].

(**Table 2**, entry k) 2-(4-Bromophenyl)-2,3-dihydroquinolin-4 (1H)-one Mp: 167-169°C. IR (KBr): 3325, 3054, 1655, 1497, 1324, 1109, 755 cm-1. 1H NMR (300 MHz, CDCl3): δ 7.82 (dd, J = 7.7, 1.3 Hz, 1 H), 7.54-7.46 (m, 2 H), 7.34-7.32 (m, 3 H), 6.81-6.74 (m, 1 H), 6.72 (d, J = 8.1 Hz, 1 H), 4.70 (dd, J = 17.4, 4.8 Hz, 1 H), 4.41 (s, 1 H, NH), 2.85-2.72 (m, 1 H), 2.75-2.69 (m, 1 H). 13C NMR (75 MHz, CDCl3): δ 192.7, 152.3, 141.3, 136.9, 132.3, 128.5, 127.8, 123.4, 119.2, 118.8, 117.1, 58.1, 47.1. MS (EI): m/z = 301.02 [M+].

Result and Discussion:

A mixture of 2-aminoacetophenone (1 mmol), benzaldehyde (1 mmol) **2d** (1.2 mmol) in ethanol to that (SiO_2-Cl) (15 mol %) was addedand the reaction mixture was kept in the ultrasonic bath and was irradiated at 50- 100°C for about 20-60 min. (**a-h**) as given in (**Table 2**). We have screened various percentage silica chloride (SiO_2-Cl) and optimization using different mol percentage for the reaction which was carried out under ultrasound irradiation. The results obtained are given in **Table 1**.

Here good yields were obtained for (SiO_2-Cl) (15 mol %) (entry 10) with ethanol as solvent at 80 - 100 °C for 40 min. And thus, the reaction was optimized and the method was used for further synthesis derivatives and the results obtained are given in **Table 2**. All the reaction (**a-h**) is repeated with recovery of catalyst for three to four times the loss of catalyst was 2-5 % with good yield which is appreciable **Table 3**.

Conclusion:

An effective and environment friendly methodology hasbeen developed for the preparation of 2-aryl-2,3-dihydroquilino-4(1H)-one by using ethanol to that (SiO_2-Cl) and ultrasonic bath. The main benefits of our methodare good yield of product, environment friendly reaction condition, use of ethanol as solvent,easy to work-up and most important no use of anyhazardous metal catalyst and solvents.The products and application of this methodology to other interesting2-aryl-2,3-dihydroquilino-4(1H)-onederivatives are ongoing in our laboratory.

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Recent advances on synthesis and physico-chemical properties of aurones derivatives

P. A. Gotmare
Department of Chemistry, Shri Shivaji Arts, Commerce and Science College, Akot, Dist.Akola-444101, (Maharashtra), India
And
G. B. Ingle
Department of Chemistry, Shri Shivaji Arts, Commerce and Science College, Akot, Dist.Akola-444101, (Maharashtra), India
And
Dr. S. V. Kolhe
Department of Chemistry, Shri Shivaji Arts, Commerce and Science College, Akot, Dist.Akola-444101, (Maharashtra), India

ABSTRACT

Chalcone was used to synthesize the heterocyclic aurone derivative, and TLC was used to verify its purity. The aurones derivative was characterized using mass spectrometer, infrared, and H-NMR. Heterocyclic aurones derivative's physico-chemical characteristics, such as density, viscosity, and refractive index, have been investigated at various solvent concentrations, temperatures, and other conditions.

Key word: Aurons, viscosity, density, ultrasonic velocity etc.

1. INTRODUCTION:

Aurones are a subclass of naturally occurring compounds that give some flower petals their lovely colors. They are biogenetically related to chalcones and structurally isomeric to flavones [1-4]. These substances have intriguing biological properties, sometimes even more potent than flavones and chalcones, according to recent studies [5-7].

The enzyme aureusidin synthase aids in the oxidation, cyclization, and rearrangement of chalcones in plants to produce aurones [8]. The majority of biological activity is displayed by aurones, including anticancer [9-11], antimicrobial [12], and antioxidant [13] qualities. In addition, they have the ability to inhibit or induce enzyme activity [14-16]. Specifically, the studies listed below included insect anti-feedant [17], herbicidal [18], anti-HIV [19-20], anti-HCV (hepatis C virus) [21-22], anti-malarial [23-24], ChE inhibitory [25-26], and MAO inhibitory [27] activities. Kayser and Kiderlen (1999) first reported the antileishmanial activity of a series of aurones [28].

Properties such as viscosity, density, refractive index, and ultrasonic velocity are crucial in determining the parameters of thermochemistry. When creating new medications and insecticides, physico-chemical properties come in handy.Therefore, the goal of the current work is to create a new aurones derivative and investigate its physicochemical characteristics in a range of solvents,

concentrations, and temperatures, including density, viscosity, refractive index, and acoustic parameter.

2. EXPERIMENTAL:

2.1. Materials and Methods

Reactions were carried out using driedlassware and heated menthal. Thin-layer chromatography was used to monitor the reactions on silica gel plates (60 F254), and iodine spray or ultraviolet light were used for visualization. On silica gel (230–400 mesh), flash chromatography was carried out using dichloromethane, ethyl acetate, and distilled hexane.Using500 MHz spectrometers, 1H nuclear magnetic resonance (NMR) was measured in dimethyl sulfoxide (DMSO)-d6 solution. Proton chemical shifts (δ) are expressed in parts per million and are compared to the internal standard of experimental tetramethylsilane (δ=0.00). Together with b (broad), spin multiplicities are listed as s (singlet), d (doublet), t (triplet), and m (multiplet). The units of the coupling constants (J) are hertz. The melting points are uncorrected and were calculated with a melting point apparatus. Using a mass spectrometer, mass spectrum (MS) spectra were obtained.

2.2. General Procedure for synthesis of Aurones derivatives:

Chalcone was the starting point for the general process of preparing aurones. In this synthesis, the starting materials is 2-hydroxy chalcone which is prepared from equimolar mixture 2-hydroxy acetophenone and benzaldehyde derivatives. The chalcone undergoes cyclization in presence of mercuric acetate with suitable solvent to gives coumaran-3-one derivative. The solvent like DMSO and pyridine showed good yield of aurones [29-31].

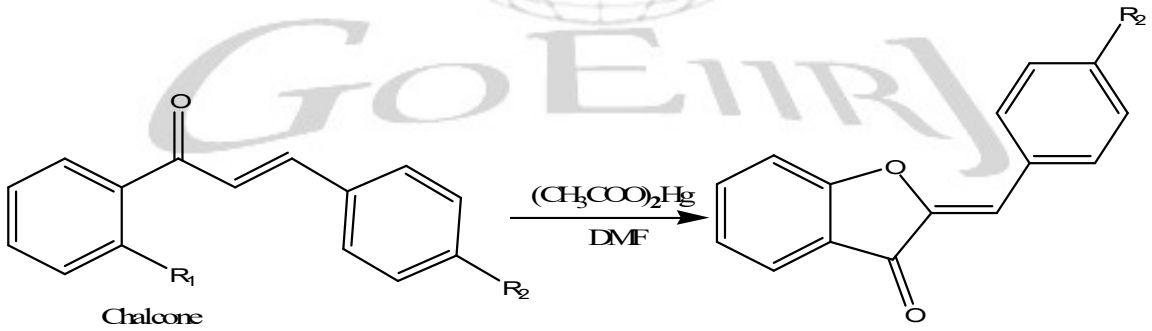


Table:1

Compound	R_1	R_2	Molecular formula	Molecular weight	Yield
Aurones	OH	OCH3	$C_{16}H_{12}O_3$	252	78%

SPECTRAL DATA :**IR (KBr cm-1)** 1720 (C=O cyclic), 1618.64(C=C Unsaturated with kotone), 1460 (C=C aromatic), 1220(C-O furane), **1H-NMR (500 MHz, DMSO)** ^{1}H NMR: δ 3.80 (3H, s), 7.08-7.38 (5H, 7.12 (ddd, *J* = 8.3, 1.2, 0.5 Hz), 7.22 (ddd, *J* = 8.8, 1.2, 0.4 Hz), 7.34 (ddd, *J* = 8.0, 7.6, 1.2 Hz), 7.32 (s)), 7.38 (1H, ddd, *J* = 8.0, 1.4, 0.5 Hz), **ES-MS [M+H]+** Calculated for C16H12O3: *m/z* was found 252.03 , 253.04.

3. PHYSICO-CHEMICAL PROPERTIES:

In this experiment, the physico-chemical parameters were examined in a variety of solvents, temperatures, and concentrations because these characteristics are crucial markers utilized in hazard, exposure, and risk assessments.

3.1 DENSITY AND VISCOSITY

Temperature affects density and viscosity. It suggests that for any given fluid, an increase in temperature causes the particles within it to separate, lowering the fluid's density and, consequently, the viscosity or viscosity value. Different solvents, such as DMSO and DMF, with varying concentrations and temperatures, were used to measure the density and viscosity. The following formula was used to measure the viscosity using an Ostwald viscometer and the density using a Pycnometer.

$$\eta_y = \eta_w \frac{d_y t_y}{d_w t_w}$$

η_y = *Viscosity of tested liquid* d_y = density of liquid

η_w = *Viscosity of water* d_w = density of water

t_y = *timing of run of liquid* t_w = *timing of run of water*

3.2 ULTRASONIC VELOCITY

The frequency of the ultrasonic waves and their measured wavelength value in a particular solution are used to calculate the ultrasonic velocity. Density and the liquid's time flow are used to calculate the solution's viscosity. A great deal of knowledge regarding molecular behavior and intermolecular interactions can be gained from ultrasonic studies. One can compute the ultrasonic velocity as

$$V = f \lambda$$

Where "f" is the frequency of the ultrasonic waves and " λ" is the measured wavelength value of ultrasonic waves in a given solution..

3.3 REFRACTIVE INDEX

A fundamental constant that characterizes the relationship between light and material is the refractive index. The refractive index of aurone in various solvents can be found using an Abbe refractometer. The temperature uncertainty was found to be ± 0.10C, while the refractive index uncertainty was 0.0005.

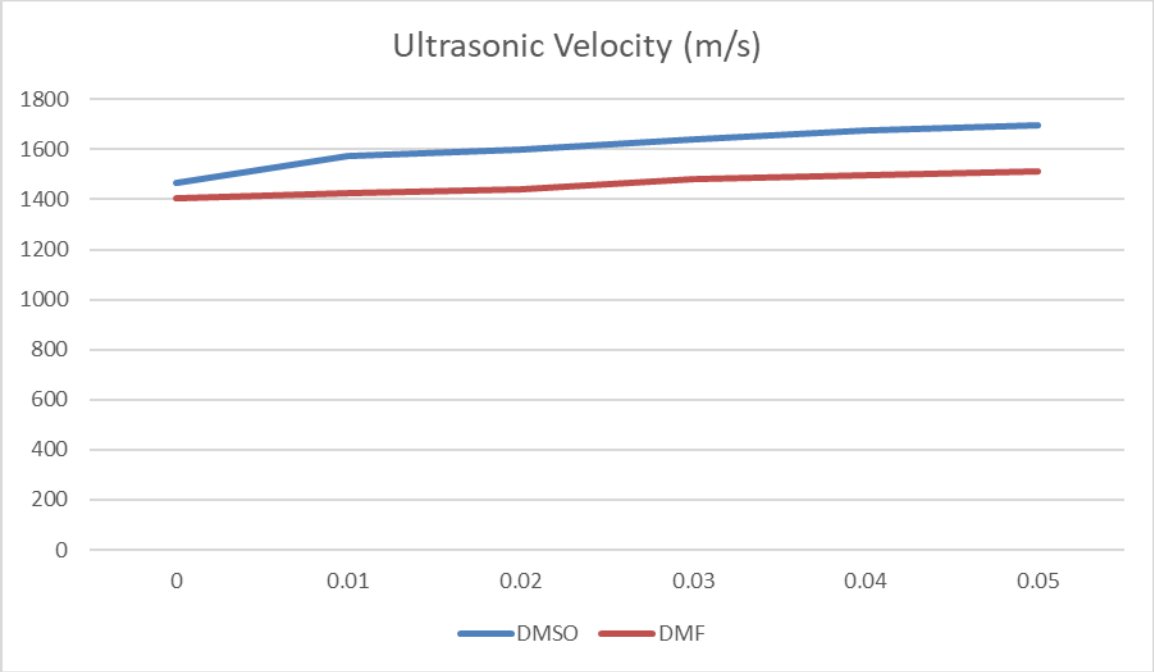
4. RESULTS AND DISCUSSION:

Density, Viscosity and ultrasonic velocity of aurones *derivative* at 25^0 C. in different

solvent and at different concentration.

Table-2

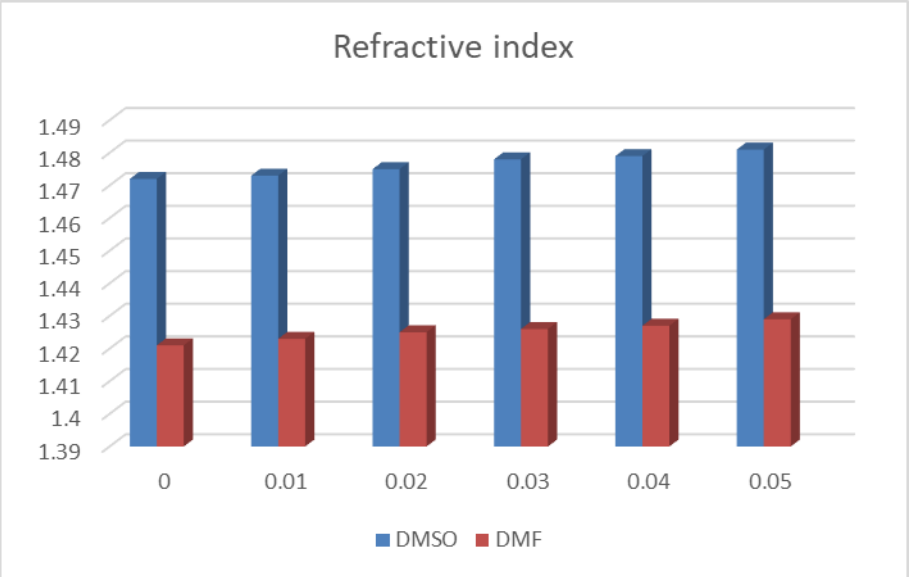
Conc. (M).	DMSO Solvent			DMF Solvent		
	Density (ρ)(kg/m^3)	Viscosity ($\eta.10^{-3}$) NSM^{-2}	Velocity m/s	Density (ρ)(kg/m^3)	Viscosity (η)$\times10^{-3}$NSM^{-2}	Velocity m/s
0.00	1112.46	1.45428	1466.74	957.628	0.70773	1402.71
0.01	1117.62	1.49840	1574.68	963.852	0.7786	1424.76
0.02	1118.24	1.56262	1598.20	964.320	0.79576	1440.57
0.03	1119.06	1.7025	1641.30	965.774	0.81102	1482.87
0.04	1120.62	1.7371	1676.32	966.087	0.83484	1498.47
0.05	1122.34	1.8574	1696.88	967.845	0.85742	1510.12



The interaction between the solute and solvent is indicated by an increase in ultrasonic velocity with concentration. It demonstrates that as concentration rises, the solution's density, viscosity, and ultrasonic velocity all increase. A rise in cohesive forces due to strong molecular interactions is confirmed by the linear increases in ρ, η, and υ with concentration. The solution contains ultrasonic waves, which cause the molecules to move. Motiles that have been disturbed return to their equilibrium positions because of the medium's slight elasticity.

Concentration affects the refractive index as well. The refractive index will somewhat rise if concentration rises. It demonstrates how well solute and solvent molecules interact.

Conc. (M)	DMSO R.I.	DMF R.I.
0.00	1.472	1.421
0.01	1.473	1.423
0.02	1.475	1.425
0.03	1.478	1.426
0.04	1.479	1.427
0.05	1.481	1.429



5. CONCLUSION:

This work involves checking the physico-chemical properties and synthesizing an aurone derivative. It is concluded that the type of solvent and concentration affect a compound's physicochemical properties. The interaction between solute and solvent molecules at different concentrations was measured using the acoustic parameter. Furthermore, the process is carried out with operational simplicity and simple work-up procedures.These features place this protocol at an advantage to the existing processes.

Conflicts of interest

The authors declare there is no conflict of interest.

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Evaluation of Viscosity and Density of 1-Phenyl-3-[4-(2-Ethylimino-4-Phenylimino-1,3,5-Dithiazino) Amino- Phenyl]Prop-2-Ene-1-One In Ethanol-Water Mixture

S. S. Padhen
Department of Chemistry,
Rajyashree Shahu Science College, Chandur Railway
And
P. C. Sawarkar
Department of Chemistry,
Rajyashree Shahu Science College, Chandur Railway
And
P. R. Kute
Department of Chemistry,
Rajyashree Shahu Science College, Chandur Railway

ABSTRACT

Chalcone-based heterocyclic compounds, particularly those featuring a 1,3,5-dithiazino nucleus, are notable for their wide-ranging applications across medicinal, biochemical, biotechnological, and pharmaceutical fields. The evaluation of density and viscometric study of 1-phenyl-3-[4-(2-ethylimino-4-phenylimino-1,3,5-dithiazino)aminophenyl]prop-2-ene-1-one was recently carried out in our laboratory. In this research work evaluation done at different temperatures by keeping the constant concentration. The experimental data determine the effect of dilution of the solvent and the solute-solvent interaction of drug in current times. Results showed that relative viscosity decreases with increasing temperature, reflecting enhanced solvation effects. This research offers valuable insights into the physicochemical behavior of chalcone derivatives, contributing to the development of more effective pharmaceutical products and advancing drug science.

Keywords: Solute-solvent interaction, Temperature Effects, Density Measurements, Solvation Effects, 1,3,5-Dithiazino etc.

INTRODUCTION

Chalcone-based heterocyclic compounds are prevalent in nature and have garnered considerable interest across various scientific disciplines due to their diverse applications and biological activities. Chalcones are a class of organic compounds characterized by their α,β-unsaturated carbonyl structure, which is a key feature in their chemical reactivity and biological activity. These compounds serve as the core structure for a wide range of heterocyclic derivatives, which are found in many natural products and synthetic compounds. Heterocyclic molecule having

1,3,5-dithiazino nucleus is widely used in medicinal, biochemical, biotechnological and pharmaceutical science. (Bansal R.K., 2012) (Jakhar A. and Makrand J.K., 2010) Heterocyclic molecules containing sulfur and nitrogen are essential to living things. These substances, which come in a range of ring configurations, are essential to many biological systems and activities. These rings have distinct chemical characteristics and reactivity profiles due to the presence of nitrogen and sulfur atoms, which are necessary for their biological activities. (Solanki A. and Thakur I, 2007) (Saleem F, 2008)1,3,5-Dithiazines are also utilized in lubricating oil and are efficient against copper corrosion.(Hu G.Q., Xie S.Q., Huang W.L. and Zhang H.B., Chin. Chem.Lett. 2005)(Scendo M., Poddebnick D. And Malyszko J.,2003) Dithiazines are found to be effective in the treatment of cancer. These compounds also demonstrated anti-HIV and anti-helminthic, antifungal, antiviral, antibacterial, and anti-tuberculostatic properties. (Wan Z.Y., Shi H.X. and Shi H.J., 2001) (Zhang Y., Qiao R.Z. and Zhang Z.Y, 2002) viscosity measurements play a crucial role. A basic physical characteristic of liquids that characterizes their resistance to flow is called viscosity. It is a measurement of a liquid's resistance to the layers moving in relation to one another. The internal friction that occurs as the molecules of the liquid move and interact with one another causes this resistance.(Bhat B.A., 2008)There are interactions between the solute and the solvent in both aqueous and non-aqueous solutions.Viscometric parameter measurements yield this crucial information. Measurements of a drug's viscosity and interactions with solvents in the human body will directly influence its behavior, including absorption, transmission, and effects. (Vibhute Y.B. and Basser M.A., 2008)

The complicated dynamics of water and alcohol mixtures, which are caused by the existence of hydrophobic groups and hydrogen bonds, make them interesting systems as well.Additionally, the significance of these mixes comes from their broad, since they are used as solvents and are therefore the focus of extensive theoretical and experimental research.Numerous factors, including temperature, size, molecular weight, intermolecular interactions, and the presence of contaminants, can influence a liquid's viscosity. Understanding the molecular interactions and characteristics of binary and ternary liquid systems is made easier by the evaluation of viscosity. Note that these systems' viscosity may rise as a result of favorable interactions.Understanding density is crucial because it makes it possible to predict whether a material will float or sink in a liquid. More specifically, materials whose densities are lower than that of the liquid will float in it. Furthermore, it is a crucial physical characteristic that is utilized to determine a substance's acoustic and physical characteristics, including its boiling temperature, dipole moment, molar refraction, and surface tension. (Padmanaban, R., Gayathri, A., Gopalan A.I., Lee D.E.,Venkatramanan K., 2023)

According to a review of the literature, chalcone derivatives have a variety of pharmacological and biochemical properties, including those of antiviral, antibacterial, anti-inflammatory, anesthetizing, and mydriatic agents. The heterocyclic compound featuring a 1,3,5-dithiazino nucleus is extensively utilized across medicinal, biochemical, biotechnological, and

pharmaceutical fields. (Solanki A. and Thakur I, 2007) (Saleem F, 2008) (Bhat B.A., 2008). These compounds exhibit anti-helminthic, antifungal, antiviral, antibacterial, and anti-tuberculostatic activities (Vibhute Y.B. and Basser M.A., 2008). Additionally, dithiazines have proven effective in cancer treatment. (Wan Z.Y., 2005). Given these considerations, it is highly relevant to conduct viscometric measurements of 1-phenyl-3-[4-(2-ethylimino-4-t-butylimino-1,3,5-dithiazino)aminophenyl]prop-2-ene-1-one at different temperatures. (Jakhar A. and Makrand J.K.,2010) Overall, such research contributes to the development of more effective and reliable pharmaceutical products, ultimately enhancing patient outcomes and advancing the field of drug science. (Zhang L.X., Zhang A.J., 2003) (Solanki A. and Thakur I, 2007) (Saleem F, 2008).

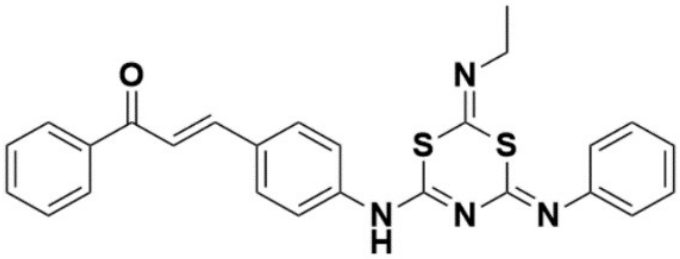

Fig. 1-PHENYL-3-[4-(2-ETHYLIMINO-4-PHENYLIMINO-1,3,5-DITHIAZINO)AMINO- PHENYL]PROP-2-ENE-1-ONE

EXPERIMENTAL

Analytical grade (A.R.) chemicals and double distilled water were utilized in all studies. A MechanikiZektadyPrecyzyjnej Gdansk balance with a precision of ±0.001 grams was used to measure the compound weights. Using an Elite thermostatic water bath to maintain a constant temperature of 29°C (±0.1°C), an Ostwald viscometer was used to measure the viscosity of liquids. A 1 mm internal diameter bicapillary tube was used for the density measurements. Before taking any measurements, the viscometer and the water bath were given enough time to attain thermal equilibrium In the present study, 1-phenyl-3-[4-(2-ethylimino-4-phenylimino-1,3,5-dithiazino) aminophenyl]prop-2-ene-1-one was studied viscometrically at 0.1M concentration in a 60% ethanol-water system separately at different temperatures. The evaluation was conducted using freshly developed solutions. Readings of viscometry were obtained in accordance with the literature.

OBSERVATIONS AND CALCULATIONS

Utilizing the data acquired from our investigation, molecular interactions are calculated in terms of the solute's β-coefficient. Table No. 1 presents the results that were obtained. At varying temperatures, with a concentration of 0.1 M, $(\eta r-1)/\sqrt{C} = A+B\sqrt{C}$, as per Jone's-Dole equation. The computed values of the A and β-coefficients are listed in Table No. 2.

TABLE No.1

MEASUREMENTS OF VISCOSITY AT CONSTANT CONCENTRATIONS AND THE IDENTIFICATION OF RELATIVE AND SPECIFIC VISCOSITIES AT VARIOUS TEMPERATURES AT 0.1 MILLIMETERS

MEDIUM - 60% ETHANOL-WATER							
Conc.	**Temp. (°C)**	**√C**	**Time (sec.)**	**Density ρx10^3 (kg.cm^{-3})**	**ή$_r$**	**ή$_{sp}$=ή$_r$-1**	**(ή$_r$-1)/√C (pa$^-$s)**
0.1 M	22	0.314	61	1.0913	0.069341	-0.930659	-2.9638
	24	0.314	54	1.0893	0.067329	-0.932671	-2.9702
	28	0.314	49	1.0676	0.05920	-0.9408	-2.9961
	30	0.314	36	1.0565	0.06453	-0.93547	-2.9792

TABLE No.– 2

Co-efficient values of A and β for 60% as shown in the graphs. Regarding 1-PHENYL-3-[4-(2-ETHYLIMINO-4-PHENYLIMINO-1,3,5-DITHIAZINO)AMINO- PHENYL]ENE-1-ONE PROP-2-ONE

W-E Mixture (%)	Temp° C	Mean "A"	β (Slope "m")
60	24	-2.9702	0.0073

RESULT AND DISCUSSION

The following formula was used to determine the relative viscosity.

η_r= Ds x ts / Dw x tw.

While the relative viscosities were analyzed using Jone's-Doles equation,

$(\eta r-1)/\sqrt{C} = A+B\sqrt{C}$

Where,

A = Falkenhagen coefficient

B = Jones-Dole coefficient

C = concentration of solutions

Falkenhagen coefficient (A) was used to measure the solute-solute interaction, whereasJones-Dole coefficient (B) was used to measure the solute-solvent interaction.Plotting of the graph is done between $(\eta r-1)/\sqrt{C}$ and √C. Each system's graph displayed a linear straight line with a β-coefficient value.

Conclusions

The density and relative viscosity in the current work monitor decrease as temperature rises. The fact that the solute-solvent interaction increases with temperature, leading to an increase in the solvation effect, supports this. The study of a drug's pharmacodynamics and pharmacokinetics is beneficial research and educational for society.

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Synthesis, Characterization Antimicrobial Screening of Some Novel 5-OxoThiazolidine Derivatives Blended with Benzofuran and Pyrazole Entities.

Satish Kola
Department of Chemistry,
M. G. Arts, science and late N.P commerce college Armori-441208 (Maharashtra), India.
And
Chandrashekhar Devkate
Department of Chemistry,
Indraraj Arts, Commerce and Science College Sillod Aurangabad-(Maharashtra), India.

Abstract:

In present work we have reported efficient method to synthesizenovel series 4-thiazolidinone (4a-d) derivative by cyclocondensation reaction of N'-(arylidene)-2-(5-(5-(benzofuran-2-yl)-1-phenyl-1H-pyrazol-3-yl)-1, 3, 4-oxadiazol-2-ylthio) acetohydrazide(3a-d) with thioglycolic acid in DMF.The intermediate acetohydrazide (3a-d) derivative were obtained by reaction of 2-(5-(5-(benzofuran-2-yl)-1-phenyl-1H-pyrazol-3-yl)-1,3,4-oxadiazol-2-ylthio)acetohydrazide (1)with various substituted aromatic aldehydes(2a-d) in ethanol. The structures of newly synthesized thiazolidinone derivative (4a-d) were corroborated through spectral investigation such as elemental analysis and spectral studies like IR, C^{13}NMR, Mass spectra and ^{1}H NMR. The compounds were assessed for their in-vitro antimicrobial activity with pathogenic microbecomprising Gram positive bacterial strains, S. aureus and Gram negative strains E. coli, P.vulgaris, and S. typhi at different concentration. The consequence of bioassay is compared with standard drug Chloramphenicol.

Keywords: acetohydrazide, thiazolidinone, benzofuran, pyrazol, antimicrobial screening,

Introduction:

Heterocyclic compounds are prominent among pharmacologically active molecules; thus, they open up new avenues for drug development by incorporating advances in well-organized and simple methods for the synthesis of multiple heterocyclic rings with pharmacological activity. Thiazolidinone heterocycles are one of the most extensively studied five-membered heterocyclic compounds, with three carbon atoms and a carbonyl group at the fourth position, as well as one sulfur and one nitrogen in the ring. 4-Thiazolidinone has been regarded as a magical moiety that functions as a physiologically preferred scaffold[1]. This fact has piqued the interest of many researchers in discovering this skeleton as a many potential biologically active motif. A thorough literature review found that the main moiety of 4-thiazolidinones has potential biological activity profiles such as Antibacterial[2], Anticancer[3], antimalarials[4], anti-inflammatory[5], Anti-HIV Agents[6], anticonvulsant activity[7], antiviral[8], antiparkinsonian agents[9], cytotoxic[10], Free Radical Scavenging[11], antitubercular[12] Analgesic[13], Antifungal[14], Moreover, benzofuran is a flexible

nucleus with a wide range of pharmacological activities. Benzofuran exhibits improved biological activities and becomes a potent antifungal and antibacterial agent upon fusion with various heterocyclic compounds[15]. One additional heterocycle Pyrazoles have also been shown in literature to possess a broad range of medicinal properties, including insecticidal, antidiabetic, CB1 receptor antagonistic, enzyme inhibitory, anticorrosion, and antitubercular properties[16-17]. Encouraged by these observations, a review of the literature showed that even a small alteration to the bioactive compound's pharmacophore group can have a significant impact on the molecule's ability to treat disease. In the current investigation, we have synthesized a 4-oxo thiazolidinone derivative integrated with benzofuran, pyrazole, and oxadiazole moiety in reflection of the aforementioned facts and in continuing of our attempts to produce a novel medication.

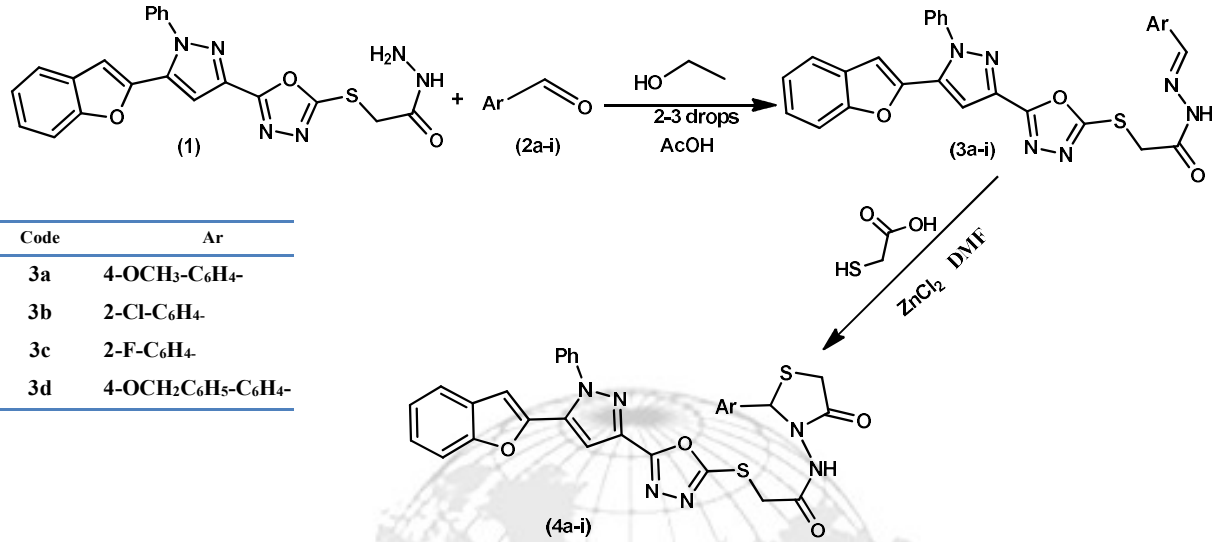
Material and methods

Chemicals used for the synthesis were of AR grade of Merck, S.D. Fine and Aldrich. The reactions were examined by E. Merck TLC aluminum sheet silica $gel_{60}F_{254}$ and visualizing the spot in UV Cabinet and iodine chamber.The melting points were note down in open capillary in paraffin bath and are uncorrected. ^{1}H NMR spectra are logged on a Bruker AM 400 instrument (400 MHz) using tetramethylsilane (TMS) as an internal reference and DMSO-*d6*as solvent. Chemical Shifts are specified in parts per million (ppm). Positive-ion Electro Spray Ionization (ESI) mass spectra were acquired with a Waters Micromass Q–TOF Micro, Mass Spectrophotometer. IR spectra were recorded on a Shimadzu IR Spectrophotometer (KBr, υ_{max}in cm^{-1}).The compounds are purified by using column chromatography on silica gel (60-120 mesh).Elemental (CHN) examination was done using Thermo Scientific (Flash-2000), the compounds were investigated for carbon, hydrogen and nitrogen and the results found are in good agreement with the calculated values.

Experimental Section

Procedurefor the Synthesis of *N′*-(arylidene)-2-(5-(5-(benzofuran-2-yl)-1-phenyl-1H-pyrazol-3-yl)-1,3,4-oxadiazol-2-ylthio) acetohydrazide(3a-d): Equimolar mixture 2-(5-(5-(benzofuran-2-yl)-1-phenyl-1H-pyrazol-3-yl)-1,3,4-oxadiazol-2-ylthio)acetohydrazide[37](**1**, 4.34g, 10mmol), and 4-methoxybenzaldehyde (**2a**,1.21ml, 10mmol) were taken in absolute ethanol (25ml),and 2-3 drops of acetic acid was added as a catalyst, the reaction mixture was refluxed for 2h. Resulting mass was allow to cool, filtered and the product was recrystallized from absolute ethanol to get **3a** similarly **3b-d** were also synthesized from **1** and **2b-d** by following the same procedure of **3a**. Their structure was confirmed by ^{1}H NMR, physical data, mass, IR and elemental analysis.

General Reaction Scheme: - Synthesis of compounds 3a-3d/4a-4d



Code	Ar
3a	4-OCH_3-C_6H_4-
3b	2-Cl-C_6H_4-
3c	2-F-C_6H_4-
3d	4-$OCH_2C_6H_5$-C_6H_4-

***N'*-(4-methoxybenzylidene)-2-(5-(5-(benzofuran-2-yl)-1-phenyl-1*H*-pyrazol-3-yl)-1,3,4-oxadiazol-2-ylthio) acetohydrazide (3a):**White amorphous solid m.p.,198°C; yield, 72%;M.F.$C_{29}H_{22}N_6O_4S$;IR(KBr, υ_{max} in cm^{-1}): 3187, 3493(N-Hstr.),3070(C-H,str.,aromatic),2996,2936(C-Hasym.str.,aliphatic),2836(C-Hsym.str.,aliphatic), 1501, 1483(C=C str., aromatic), 1107,1102(C-H i.p. def., aromatic), 835(C-H o.o.p. def., aromatic), 1678(C=O str. ,CONH), 1605(C=N str.),1254(C-O-C sym. str.),1031(C-O-C asym.str.),1461(C-H asym. def. ,CH_2 and CH_3), 1372(C-H sym. def. , CH_2 and CH_3),744,776, 697(C-S-C str.), 640(C-S str.). ^{1}H NMR δ ppm (DMSO-d_6): 3.77 (s,3H, -OCH_3 attached to aromatic ring), 4.65(s, 2H, hetero aryl, -S-$\underline{CH_2}$CONHN=CH-Ar), 11.69 (s, 1H, -N$\underline{H}$CO-), 8.15(s,1H,-C$\underline{H}$=N-), 6.67(s,1H, at C_4-carbon of pyrazole), 6.69-7.98(m,14H, aromatic + heteroaryl), LCMS(*m/z),* 551$[M+1]^+$, 574$[M+Na]^+$, 575$[M+Na+H]^+$ Elemental Anal. Calcd. For $C_{29}H_{22}N_6O_4S$; calculated: C, 63.26; H, 4.03; N, 15.26; S, 5.82 Found: C, 64.67; H, 4.62; N, 14.80,S, 5.65.

***N'*-(2-chlorobenzylidene)-2-(5-(5-(benzofuran-2-yl)-1-phenyl-1*H*-pyrazol-3-yl)-1,3,4-oxadiazol-2-ylthio)aceto- hydrazide (3b):** White amorphous solid m.p. 207°C; yield, 74%; M.F.$C_{28}H_{19}ClN_6O_3S$; IR(KBr, υ_{max} in cm^{-1}): 3100, 3485 (N-H str.), 3050 (C-H str., aromatic), 2975, 2930(C-H asym. str., aliphatic), 2830 (C-H sym. str., aliphatic), 1521, 1453(C=C str., aromatic),1100,1120(C-H i.p. def, aromatic), 845(-C-H o.o.p. def, aromatic, 1680(C=O str. ,CONH), 1630(C=N str.), 1260(C-O-C sym. str.),1050 (C-O-C asym. str.), 1458 (C-H asym.def ,CH_2 and CH_3),1362(C-H sym. def. , CH_2 and CH_3),750, 770, 690(C-S-C str.), 640(C-S str.).^{1}H NMR δ ppm (DMSO-d_6): 4.51(s, 2H, hetero aryl, -S-$\underline{CH_2}$CONHN=CH-Ar), 11.65 (s, 1H, -N$\underline{H}$CO), 8.12(s,1H,-C$\underline{H}$=N-), 6.62(s,1H, at C_4-carbon of pyrazole), 6.7-7.6(m,14H, aromatic+ heteroaryl).LCMS(*m/z),*556$[M+1]^+$, 579$[M+Na]^+$, 580$[M+Na+H]^+$ Elemental Anal. Calcd. For $C_{28}H_{19}ClN_6O_3S$; calculated: C, 60.59; H, 3.45; N, 15.14; S, 5.78 Found: C, 60.68; H, 3.49;N, 15.04; S, 5.74.

***N'*-(2-fluorobenzylidene)-2-(5-(5-(benzofuran-2-yl)-1-phenyl-1*H*-pyrazol-3-yl)-1,3,4-oxadiazol-2-ylthio)acetohydrazide (3c):**White amorphous solid; m.p., 205°C; yield, 76% ;

M.F.$C_{28}H_{19}FN_6O_3S$; IR(KBr, υ_{max} in cm^{-1}): 3105,3495 (N-H str.), 3050 (C-H str., aromatic), 2985, 2940 (C-H asym. str. aliphatic), 2830 (C-H sym. str., aliphatic), 1500,1463 (C=C str., aromatic), 1115,1125(C-H i.p. def., aromatic), 860(C-H o.o.p. def., aromatic),1688(C=O str. , CONH),1632(C=N str.),1263(C-O-C sym. str.), 1050(C-O-C asym.str.), 1460(C-H asym.def ,CH_2 and CH_3),1362(C-H sym. def. , CH_2 and CH_3),751,770,680 (C-S-C str.),652 (C-S str.).^{1}H NMR δ ppm (DMSO-d_6): 4.53(s, 2H, hetero aryl, -S-$\underline{CH_2}$CONHN=CH-Ar), 11.67(s, 1H, -N$\underline{H}$CO-), 8.13(s,1H,-C$\underline{H}$=N-), 6.65(s,1H, at C_4-carbon of pyrazole), 6.9-7.8(m,14H, aromatic+ heteroaryl)LCMS(*m/z),* 539$[M+1]^+$, 562$[M+Na]^+$, 563$[M+Na+H]^+$ Elemental Anal. Calcd. For $C_{28}H_{19}FN_6O_3S$; calculated: C, 62.45; H, 3.56; N, 15.60; S, 5.95 Found: C, 62.40; H, 3.51; N, 15.67; S, 5.99.

***N'*-(4-(benzyloxy)benzylidene)-2-(5-(5-(benzofuran-2-yl)-1-phenyl-1H-pyrazol-3-yl)-1,3,4-oxadiazol-2-ylthio)acetohydrazide (3d):** White amorphous solid mp,203°C; yield, 70%; M.F ; $C_{35}H_{26}N_6O_4S$; IR(KBr, υ_{max} in cm^{-1}): 3100,3485 (N-H str.),3050(C-H str., aromatic),2975,2930 (C-H asym. str. aliphatic), 2830(C-H sym. str., aliphatic), 1521,1453(C=C str., aromatic), 1100,1120 (C-H i.p.def, aromatic), 855 (C-H o.o.p.def, aromatic),1680(C=O str. ,CONH),1630(C=N str.),1260(C-O-C sym. str.), 1052(C-O-C asym.str.),1459(C-H asym.def ,CH_2 and CH_3),1364(C-H sym. def. , CH_2 and CH_3),750,770,690 (C-S-C str.), 640(C-S str.).^{1}H NMR δ ppm (DMSO-d_6): 5.20(s,2H, -O$\underline{CH_2}$-C_6H_5attached to aromatic ring), 4.64(s, 2H, hetero aryl, -S-$\underline{CH_2}$CONHN=CH-Ar), 11.67 (s, 1H, -N$\underline{H}$CO-), 8.14(s,1H,-C$\underline{H}$=N-), 6.65(s,1H, at C_4-carbon of pyrazole), 6.71-7.58(m,19H, aromatic + heteroaryl).LCMS(*m/z),* 627$[M+1]^+$, 650$[M+Na]^+$, 651$[M+Na+H]^+$ Elemental Anal. Calcd. For $C_{35}H_{26}N_6O_4S$; calculated: C, 67.08; H, 4.18; N, 13.41; S, 5.12. Found: C, 67.17; H, 4.20; N, 13.44; S, 5.06.

Procedure for theSynthesis of 2-(5-(5-(benzofuran-2-yl)-1-phenyl-1H-pyrazol-3-yl)-1, 3, 4-oxadiazol-2-ylthio)-N-(2-aryl-4-oxothiazolidin-3-yl) acetamide (4a-d): Equimolar mixture of **3a** (0.5g, 0.001M), and thioglycolic acid (0.092ml, 0.001M) was taken in DMF. Catalytic amount of fused $ZnCl_2$ was added in reaction mixture. The contents of round bottom flask were refluxed for eight hours, cool and poured in crushed ice. Resulting mass was allowed to cool, filtered and the product was recrystallized from absolute ethanol to get **4a**Similarly, **4b-d** were synthesised from **3b-d** by extending the same procedure followed for **4a** and their structure were corroborated by chemical transformation reaction, physical data, elemental analysis depicted in the following Table No.1.

2-(5-(5-(benzofuran-2-yl)-1-phenyl-1*H*-pyrazol-3-yl)-1,3,4-oxadiazol-2-ylthio)-*N*-(2-(4-methoxy phenyl)-4-oxothiazolidin-3-yl)acetamide (4a):IR(KBr, υ_{max} in cm^{-1}): 3556,3478(NH str., -CONH-), 3090-3030(C-H str., arom.), 2926, (C-H asym. str., aliph.), 2880-2860(C-H sym. str., aliph.), 1457(C-H asym.def., aliph.), 1385-1370(C-H sym.def., aliph.), 1480-1520(C=C str., arom.), 1089,1007(C-H i.p.def., arom.), 843, 804(C-H o.o.p.def., arom.), ,1200-1275, 1231(C-O-C asym. str., ether) 1089(C-O-C sym. str., ether), 1655(CO str., 4-thiazolidinone), 1597 (C=N str.), 696(C-S-C str.), 1183(C-N str.), 1655(CO str. in CONH). ^{1}H NMR (DMSO-d_6, 400 MHz): δ

(ppm)3.60(s, 3H, O$\underline{CH_3}$ attached to aromatic ring), 4.04(s, 2H, S-C$\underline{H_2}$-CO,thiazolidinone ring), 4.10(s, 2H, S-C$\underline{H_2}$-CONH-) 5.95 (s,1H ,C_2 of thiazolidinone ring), 6.13(s, 1H, C_4 of pyrazole ring),6.58-7.93(m, 14H, aromatic + Heteroaryl protons), 11.66(s, 1H, of CON$\underline{H}$ group). LCMS(*m/z),* 625$[M+1]^+$, 648$[M+Na]^+$, 649$[M+Na+H]^+$,Elemental Anal.Calcd.for $C_{31}H_{24}N_6O_5S_2$: C, 59.60; H, 3.87; N, 13.45; O, 12.81; S, 10.27 Found: C, 59.55; H, 3.92; N, 13.40; S, 10.32.

2-(5-(5-(benzofuran-2-yl)-1-phenyl-1*H*-pyrazol-3-yl)-1,3,4-oxadiazol-2-ylthio)-*N*-(2-(2-chlorophenyl)-4-oxothiazolidin-3-yl)acetamide(4b):-IR(KBr, υ_{max} in cm^{-1}): 3554,3475(NH str., -CONH-), 3092-3031(C-H str., arom.), 2924 (C-H asym. str., aliph.), 2882-2863(C-H sym. str., aliph.), 1459(C-H asym.def., aliph.), 1388-1371(C-H sym.def., aliph.), 1482-1524(C=C str., arom.), 1090,1009(C-H i.p.def., arom.), 845, 806(C-H o.o.p.def., arom.), ,1200-1276, 1235(C-O-C asym. str., ether) 1090(C-O-C sym. str., ether), 1658(CO str., 4-thiazolidinone), 1599(C=N str.), 697(C-S-C str.), 1185(C-N str.), 1657(CO str. in CONH). ^{1}H NMR (DMSO-d_6, 400 MHz): δ (ppm)4.1(s, 2H, S-C$\underline{H_2}$-CO,thiazolidinone ring), 4.09(s, 2H, S-C$\underline{H_2}$-CONH-) 5.96 (s,1H ,C_2 of thiazolidinone ring), 6.2(s, 1H, C_4 of pyrazole ring),6.58-7.93(m, 14H, aromatic + Heteroaryl protons), 11.65(s, 1H, of CON$\underline{H}$ group).LCMS(*m/z),* 630$[M+1]^+$, 653$[M+Na]^+$, 654$[M+Na+H]^+$,Elemental Anal.Calcd.For $C_{30}H_{21}ClN_6O_4S_2$: C, 57.27; H, 3.36; N, 13.36;S, 10.19 Found: C, 57.31; H, 3.30; N, 13.10; S, 10.05.

2-(5-(5-(benzofuran-2-yl)-1-phenyl-1*H*-pyrazol-3-yl)-1,3,4-oxadiazol-2-ylthio)-*N*-(2-(2-fluorophenyl)-4-oxothiazolidin-3-yl)acetamide(4c):-IR(KBr, υ_{max} in cm^{-1}): 3554,3477(NH str., -CONH-), 3093-3033(C-H str., arom.), 2927 (C-H asym. str., aliph.), 2882-2862(C-H sym. str., aliph.), 1456(C-H asym.def., aliph.), 1383-1371(C-H sym.def., aliph.), 1481-1523(C=C str., arom.), 1090,1009(C-H i.p.def., arom.), 845, 806(C-H o.o.p.def., arom.), ,1202-1271, 1235(C-O-C asym. str., ether) 1094(C-O-C sym. str., ether), 1654(CO str., 4-thiazolidinone), 1595 (C=N str.), 698(C-S-C str.), 1181(C-N str.), 1654(CO str. in CONH).^{1}H NMR (DMSO-d_6, 400 MHz): δ (ppm)4.12(s, 2H, S-C$\underline{H_2}$-CO,thiazolidinone ring), 4.05(s, 2H, S-C$\underline{H_2}$-CONH-) 5.94(s,1H ,C_2 of thiazolidinone ring), 6.4(s, 1H, C_4 of pyrazole ring),6.5-7.9(m, 14H, aromatic + Heteroaryl protons), 11.66(s, 1H, of CON$\underline{H}$ group)LCMS(*m/z),* 613$[M+1]^+$, 636$[M+Na]^+$,637$[M+Na+H]^+$,Elemental Anal.Calcd.for $C_{30}H_{21}FN_6O_4S_2$: C, 58.81; H, 3.45; N, 13.72; S, 10.47 Found: C, 58.95; H, 3.20; N, 13.70; S, 10.41.

2-(5-(5-(benzofuran-2-yl)-1-phenyl-1*H*-pyrazol-3-yl)-1,3,4-oxadiazol-2-ylthio)-*N*-(2-(4-(benzyloxy)phenyl)-4-oxothiazolidin-3-yl)acetamide(4d):-IR(KBr, υ_{max} in cm^{-1}): 3553,3477(NH str., -CONH-), 3091-3035(C-H str., arom.), 2922 (C-H asym. str., aliph.), 2876-2864(C-H sym. str., aliph.), 1459(C-H asym.def., aliph.), 1382-1369(C-H sym.def., aliph.), 1481-1523(C=C str., arom.), 1090,1009(C-H i.p.def., arom.), 842, 805(C-H o.o.p.def., arom.), ,1201-1277, 1233(C-O-C asym. str., ether) 1090(C-O-C sym. str., ether), 1658(CO str., 4-thiazolidinone), 1599(C=N str.), 699(C-S-C str.), 1185(C-N str.), 1655(CO str. in CONH).^{1}H NMR (DMSO-d_6, 400 MHz): δ (ppm)4.12(s, 2H, S-C$\underline{H_2}$-CO,thiazolidinone ring), 4.05(s, 2H, S-C$\underline{H_2}$-CONH-) 5.30(s,2H, -O$\underline{CH_2}$-C_6H_5 attached to aromatic ring), 5.90(s,1H ,C_2 of thiazolidinone ring), 6.5(s, 1H, C_4 of pyrazole

ring),6.5-7.5(m, 19H, aromatic + Heteroaryl protons), 11.65(s, 1H, of CONH group).LCMS(*m/z),* 701[M+1]$^+$, 724[M+Na]$^+$, 725[M+Na+H]$^+$,Elemental Anal.Calcd.For $C_{37}H_{28}N_6O_5S_2$: C, 63.41; H, 4.03; N, 11.99; S, 9.15 Found: C, 63.49; H, 3.95; N, 11.80; S, 9.10.

Results And Discussion

Initially, the reaction *N*'-(arylidene)-2-(5-(5-(benzofuran-2-yl)-1-phenyl-1H-pyrazol-3-yl)-1,3,4-oxadiazol-2-ylthio) acetohydrazide**3a-d** Derivatives were synthesized by reacting acetohydrazide **1**with substituted aryl aldehydes **2a-d** in alcohol in good yield.Which was subsequently cyclocondensation reaction with Thioglycolic acid in DMF to yield novel 4-oxo thiazolidine **4a-d** derivatives. The IR spectrum of **3a** showed strong band absorption bands at 3187 cm^{-1} and 3493 cm^{-1} due to -NH- stretch, while bands at 1605cm^{-1} and 1678 cm^{-1} were observed due to C=N and C=O stretch respectively. ^{1}H NMR of **3a**revealed asinglet signalat 3.77 ppm, owing to three protons of -OC$\underline{H}_3$ group attached to aromatic ring, one more singlet at δ 11.69 ppm confirm one proton of –N$\underline{H}$CO- group, it also shows singlet for azomethine proton at δ 8.15 ppm. A signal at aliphatic region at δ 4.65 validatesthe methylene attached to sulphur.ESI-MS Mass spectra also confirm the molecular ion at *(m/z)* value at 551[M+1]$^+$and further supported by elemental analysis which gives anticipated results with molecular formulae $C_{29}H_{22}N_6O_4S$. All above spectral data establishedstructure**3a.**IR spectrum of **4a** reveals distinct absorption band at 1655 cm^{-1} due to CO str. in thiazolidinone, and stretch at 696 cm^{-1} was observed for C-S-C group, which confirms the cyclisation of carbohydrazone to thiazolidinone. ^{1}H NMR spectrum of **4a**exhibited a singletat aliphatic region at δ 4.10 ppm due two proton attached -S-CH_2-CONH- group and another singlet signal at δ 11.66 ppm confirms one proton of –CONH- group, a singlet at δ 3.38 ppm confirms two protons of -CH_2- in S-CH_2-CO group, another noteworthy singlet at δ 5.95ppm due to ring one proton of C_2 in thiazolidinone ring.In ESI-MS spectra, of **4a** exhibited parent ion peak *(m/z)*at 625[M+H]$^+$ and further supported by elemental analysis data in obtained was found to be in good agreement with the molecular formula of $C_{31}H_{24}N_6O_5S_2$.

Table No.1: Physical data of the Synthesized 4-oxothiazolidine Derivative (4a-i)

Code	Ar	Colour	Recry. Solvent	M.F	m.pt .°C	% Yield	% Analysis Found (Calculated)			
C								H	N	S
4a	4-OCH_3-C_6H_4-	White	Ethanol	$C_{31}H_{24}N_6O_5S_2$	254	84	59.55 (59.60)	3.92 (3.87)	13.40 (11.75)	10.76 (10.70)
4b	2-Cl-C_6H_4-	White	Ethanol	$C_{31}H_{24}N_6O_5S_2$	263	80	57.31 (57.27)	3.30 (3.36)	13.10 (13.36)	10.05 (10.19)
4c	2-F-C_6H_4-	White	Ethanol	$C_{30}H_{21}FN_6O_4S_2$	269	82	58.75 (58.81)	(3.95) (4.03)	11.80 (11.99)	9.10 (9.15)
4d	4-OCH_2-C_6H_5-C_6H_4-	White	Ethanol	$C_{37}H_{28}N_6O_5S_2$	276	86	63.30 (63.41)	3.97 (4.03)	11.2 (11.9)	9.10 (9.15)

In vitro antibacterial activity

The entire novel synthesized heterocyclic compounds **4a-d** was screened for their *in-vitro*

antimicrobial activity using disc-diffusion method. Their activity was compared with wellknown commercial antibiotic Chloramphenicol.From the results it is clear that the compounds tested showed variable toxicity against different bacteria. Consequences of bioassay indicated that compound **4a, 4c, 4d,** showed excellent activity against *S. aureus* and *P.vulgaris* and *E.coli*.

Table No. 2: Antibacterial Activity of 4-Thiazolidinone Derivative (4a-d)

Compd. Code	Zone of Inhibition (mm)											
	Gram +ve *S. aureus*						Gram –ve *P.vulgaris*					
	Conc. (µg/mL)						Conc. (µg/mL)					
	1000	**500**	**250**	**125**	**63.5**	**31**	**1000**	**500**	**250**	**125**	**63.5**	**31**
4a	21	**22**	**21**	**20**	**17**	13	27	**24**	**21**	**18**	**17**	10
4b	23	21	**20**	18	16	**18**	25	22	19	16	14	09
4c	**25**	21	19	**20**	16	**15**	**28**	23	**21**	**17**	15	11
4d	23	22	**21**	**19**	**18**	15	27	24	**20**	**18**	**17**	12
DMSO	-	-	-	-	-	-	-	-	-	-	-	-
Std. Drug Chloramphenicol	**25**	**22**	**20**	**19**	**17**	**15**	**26**	**24**	**23**	**21**	**17**	**15**

Table No. 3: Antibacterial Activity of 4-Thiazolidinone Derivative (4a-d)

Compd. Code	Zone of Inhibition (mm)											
	Gram –ve *E. coli*						*S.typhi*					
	Conc. (µg/mL)						Conc. (µg/mL)					
	1000	**500**	**250**	**125**	**63.5**	**31**	**1000**	**500**	**250**	**125**	**63.5**	**31**
4a	**26**	**24**	22	**21**	16	12	16	15	**12**	**11**	**10**	**09**
4b	24	21	19	18	17	**16**	16	14	10	09	06	07
4c	25	24	20	17	16	**15**	**17**	16	11	**10**	**09**	**08**
4d	**26**	23	21	20	**17**	11	14	10	08	08	07	**09**
DMSO	-	-	-	-	-	-	-	-	-	-	-	-
Std. Drug Chloramphenicol	**26**	**24**	**23**	**21**	**17**	**14**	**17**	**15**	**12**	**11**	**09**	**08**

Remaining compounds exhibited reasonable activity against selected bacterial strains. This variation in toxicity it may attribute due to union of thiazolidinonewith Substituted benzofuran, pyrazole and altered substituted aldehyde attached to the core 4-oxo-thiazolidine which may enhances the biological activities of parent nucleus.

CONCLUSION

In summary, we have described here novel series of thiazolidinone **(4a-d)** derivative. The presented series of compounds were synthesized in decent yields. The structure and purity of newly synthesized compounds were established by spectroscopic investigation and chemical

examination. Among the synthesized compounds most of the compounds exhibited good to moderate activity against selected strains *S. aureus, P. vulgaris* and *E. coli* while poor activity was evaluated for *S. typhi*.

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Disclosure statement

The authors declare that they have no conflict of interest.

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1, 2, 3 Triazoles as Anticancer Agents: A Review

Sunil J. Chavan
Shri Pundlik Maharaj Mahavidyalaya Nandura (Rly)
And
Mahesh B. Muluk
Shri Pundlik Maharaj Mahavidyalaya Nandura (Rly)
And
Amol S. Nipate
Shri Pundlik Maharaj Mahavidyalaya Nandura (Rly)
And
Nilkesh K. Dhurve
Shri Pundlik Maharaj Mahavidyalaya Nandura (Rly)
And
Adinath D. Badar
Late Pushpadevi Patil Arts & Science College Risod

ABSTRACT

Despite notable progress in the creation of anticancer pharmaceuticals, there remains a pressing need for the formulation of more efficacious and safer anticancer agents, given that existing medications often induce undesirable side effects and a significant number of patients exhibit drug resistance. The 1,2,3-triazole class of compounds, recognized for their exceptional biological properties, has garnered substantial attention within the realm of drug discovery aimed at the development of anticancer therapeutics. This review article aims to provide a comprehensive overview of the recent progress concerning 1,2,3-triazole hybrids demonstrating anticancer efficacy over the past years, encompassing their chemical structures, structure-activity relationships, of notable 1,2,3 triazoles linked with carbohydrate, azoles hybrids, natural products hybrids, and other heterocyclic pharmacophore.

Key words: - 1, 2, 3-triazole, anticancer activity, structure-activity relationship.

1) Introduction: -

Cancer is characterized as a collective of diseases that affect various parts of the human body[1]. Following cardiovascular illnesses, cancer ranks as the second predominant cause of death worldwide, thus representing a significant public health challenge[2]. Despite the availability of numerous efficacious anticancer therapies, the presence of adverse effects, including the emergence of resistance to these drugs, the indistinction between cancerous and noncancerous cells, the constraints associated with radiotherapy, and the necessity for surgical intervention, underscores the pressing need for effective alternatives that operate through diverse mechanisms to achieve successful therapeutic outcomes[3]–[6].

Heterocycles have significantly contributed to the advancement of anticancer pharmacotherapy[7]. 1,2,3-Triazoles are nitrogenous heterocycles characterized by the presence of three nitrogen atoms within their cyclic structure. 1,2,3-Triazoles are recognized as stable entities that engage with biological targets through the formation of hydrogen bonds, thereby serving as crucial scaffolds in the domain of drug development[8]. The structural representation of pharmaceutical agents incorporating the 1,2,3-triazole scaffold is illustrated in **Figure** 4. Moreover, derivatives of 1,2,3-triazole exhibit a diverse array of pharmacological properties, including anticancer[9]–[11], anti-inflammatory[12], [13], antitubercular[14], antimicrobial[15], and antiviral activities[16].

These compounds exert their anticancer effects by inhibiting a range of enzymes, including carbonic anhydrases[17], tryptophan 2,3-dioxygenase[18], aromatase[19], thymidylate synthase[20], epidermal growth factor receptor[21], and vascular endothelial growth factor receptor[22], all of which are implicated in the pathogenesis of this formidable disease. The current manuscript provides an exhaustive examination of the chemical architecture, mechanisms of action, and structure-activity relationships of 1,2,3-triazole derivatives utilized as anticancer agents within the past years.

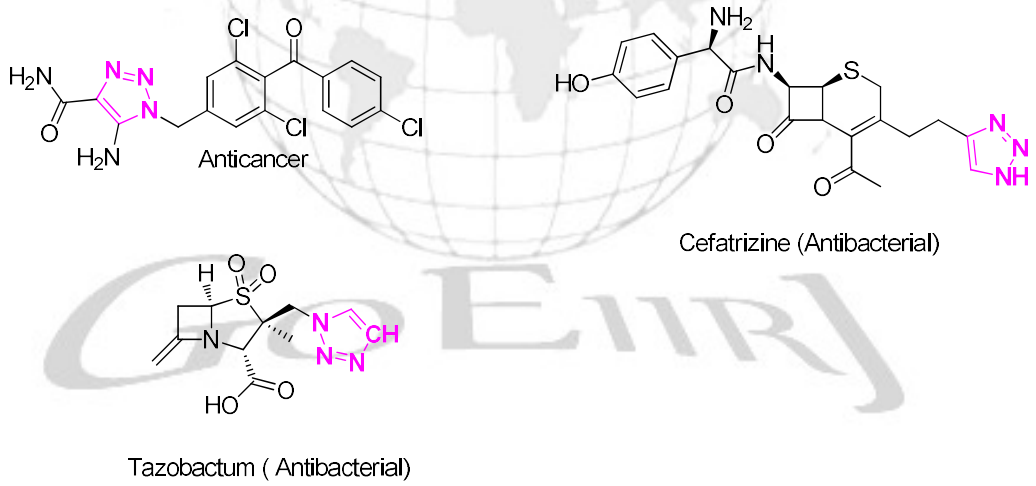

Figure 4 Biological active 1,2,3 Triazole compounds

1. Anticancer Activity of 1,2,3 Triazole derivatives

2.1 1,2,3 Triazoles-linked carbohydrate/nitrogenous base hybrids

1,2,3 Triazole-tethered 2,6-di-substituted purine 1 demonstrated significant anticancer activity, with IC_{50} values recorded at 0.08 and 0.4 µM against THP-1 and A-549 cell lines, respectively. In evaluation, the reference compound, 5-fluorouracil, exhibited IC_{50} values of 1 and 4.9 µM against the above-mentioned cell lines. It was observed that N-9-substituted triazole analogues displayed superior activity relative to their N-7-substituted counterparts. The presence of benzylamine at the C6 position of the hybrids also contributed to their potent biological activity. Moreover, variations in activity were noted based on the substitutions on the aromatic rings linked

to the 1,2,3 triazole ring at the N-9 position, arranged in the following order: H > F > Cl > Br > OCH_3[23].Compound **2** represents a non-natural ribofuranosyl-1,2,3-triazole C-nucleoside that demonstrated noteworthy IC_{50} values across a spectrum of nine distinct cancer cell lines. In the context of ovarian cancer, Compound 38 exhibited encouraging antitumor efficacy comparable to that of ribavirin, while simultaneously displaying reduced cytotoxicity in vitro on MeT-5A mesothelial cells and a lethal impact in vivo on mice[24].

1,2,3 – Triazole derivatives conjugated with carbohydrate moieties 3 exhibited a moderate level of cytotoxicity, demonstrated by IC_{50} values of 88.8 and 97.5 µM against human liver (HepG-2) and human breast adenocarcinoma (MCF-7) cell lines, respectively. The observed moderate anticancer efficacy of compound 35 may be ascribed to its relatively low binding affinity towards the biological targets under investigation[25]Figure 5**Error! Reference source not found.**.

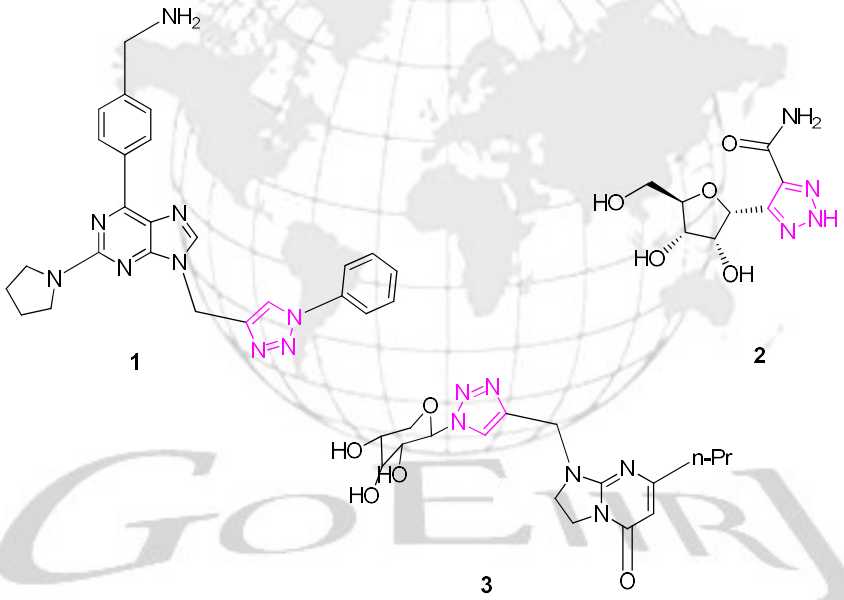

Figure 51,2,3 Triazoles-linked carbohydrate

2.2 1,2,3- Triazoles-linkedazoles hybrids

The hybrid compound 1,2,3-Triazole incorporating 1,2,4-triazole 4 demonstrated remarkable anticancer efficacy against the MCF-7 cell line, exhibiting an IC_{50} value of 0.31 µM, which is comparable to that of the reference drug, doxorubicin, with reported IC_{50} values of 0.65 and 5.17 µM [26].The imidazole-linked 1,2,3-triazole conjugates 5 and 6 exhibited IC_{50} values of 114.8 and 111.3 µg/ml, respectively, whereas the standard chemotherapeutic agent methotrexate displayed an IC_{50} value of 22 µg/ml against MCF-7 cells [27].The benzothiazole-bearing 1,2,3-triazole derivative 7 revealed promising anticancer properties, with IC_{50} values of 0.01, 0.015, 0.18, and 0.18 µM against the MCF-7, A549, Colo-205, and A2780 cell lines, respectively. Notably, a compound possessing 3,4,5-trimethoxy substituents on the phenyl ring of the 1,2,3-triazole exhibited the highest anticancer potency. At the same time, the presence of a mono-methoxy group in conjunction with an electron-withdrawing (4-nitro) moiety significantly

enhanced the anticancer activity[28]Figure 6..

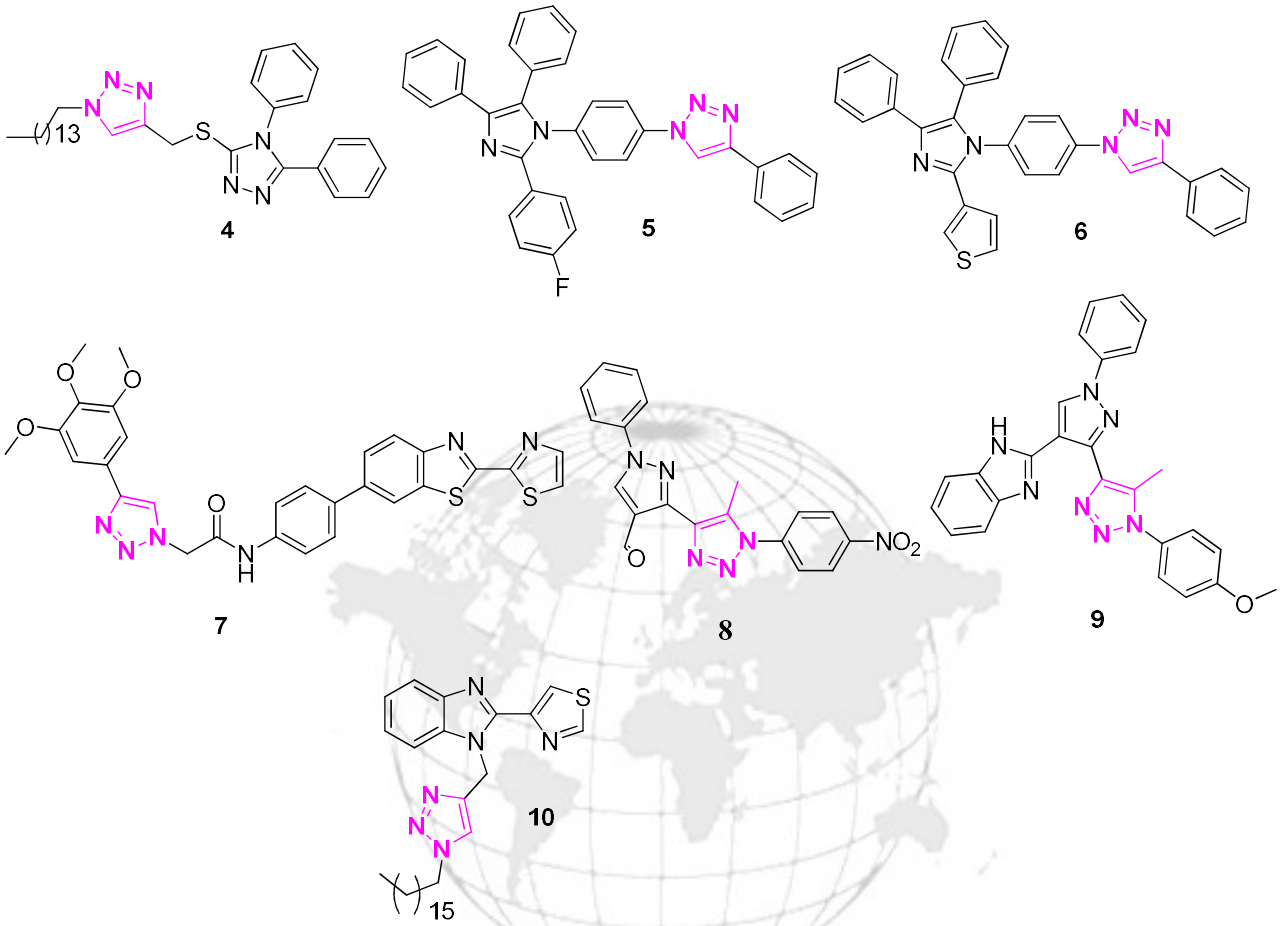

Figure 61,2,3-Triazoles-linked azoles hybrids

The pyrazole-linked 1,2,3-triazoles 8 and the corresponding benzimidazole derivative 9, which feature electron-withdrawing substituents, demonstrated substantial antiproliferative effects, with IC_{50} values of 0.097 and 0.110 µM against the C6 and MCF-7 cell lines, respectively, in comparison to the standard drug cisplatin (MCF-7: IC_{50} = 0.59 µM, C6: IC_{50} = 0.12 µM)[29].The thiabendazole-based 1,2,3-triazole derivative 10 exhibited notable activity, with IC_{50} values ranging from 1.28 µM to those of etoposide, which showed IC_{50} values of 2.11 µM (MCF-7) and 3.08 µM (A549). The presence of an electron-donating substituent on the phenyl ring attached to the 1,2,3-triazole conferred the highest activity, while electron-withdrawing groups resulted in moderate activity of the compounds across all evaluated cell lines [30]Figure 6.

2.3 1,2,3- Triazole-linked natural product hybrids

Novel coumarin-linked 1,2,3-triazole derivatives 11 exhibited substantial cytotoxic efficacy, with IC_{50} values of 3.12 and 2.77 µM against the MCF-7 and HeLa cancer cell lines, respectively, demonstrating comparability to the reference chemotherapeutic agent, doxorubicin. The incorporation of 7-hydroxy-4-methylcoumarin, 4-hydroxycoumarin, 8-hydroxyquinoline, 2-mercaptobenzothiazole, and 2-mercaptobenzoxazole derivatives at the fourth position of the 1,2,3-triazole moiety significantly augmented the cytotoxic potential. [31]In the case of novel 1,2,3-

triazole linked betulinic acid and diosgenin, compound 12 manifested selective cytotoxicity with an IC_{50} value of 6.5 µM against CEM cells while exhibiting minimal cytotoxicity towards the reference normal human fibroblast cell line, BJ. The observed limited cytotoxicity of the compound may be attributed to its potentially high polarity, which could hinder its cellular penetration capabilities[32].

The novel xanthone 1,2,3-triazole derivative 13 was identified as a potent cytotoxic agent, presenting an IC_{50} value of 32.4 µM against A549 cancer cells, which markedly elevated the expression levels of caspase 3, Bax, JNK, and p53, thereby inducing cell cycle arrest and apoptosis in cancerous cells. [33]The 1,2,3-triazole-containing chromene ring 14 demonstrated a broad spectrum of antiproliferative activity across six cancer cell lines, with IC_{50} values ranging from 1.02 to 74.28 µM.[34]The bis-[1,2,3]-triazole-daidzein hybrids, specifically compounds 15-17, exhibited significant activity, with a GI50 value approaching 0.14 µM against HeLa and MDA-MB-231 cell lines, in comparison to the standard therapeutic agent, nocodazole (GI50, 0.01)[35]**Figure 7**.

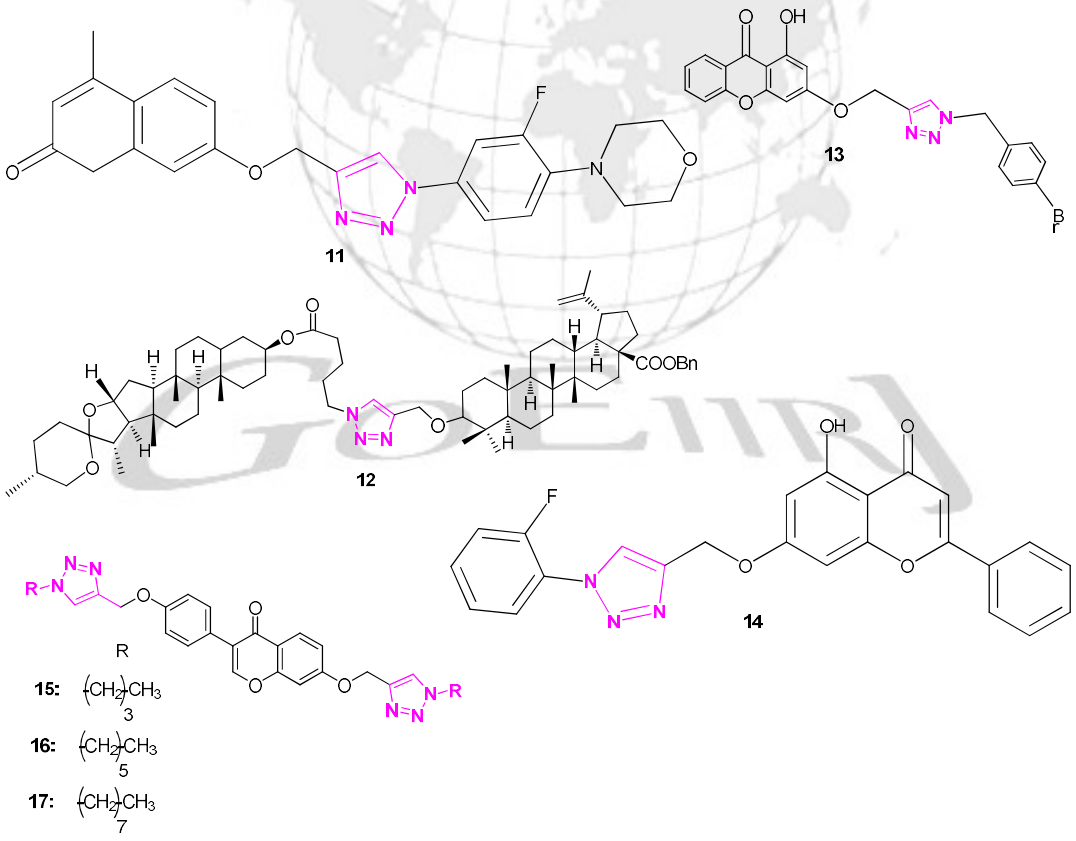

Figure 71,2,3- Triazole-linked natural product hybrids

2.4 1,2,3 Triazoles linked to other heterocyclic pharmacophore

1,2,3-Triazole-conjugated L-ascorbic acid derivatives 18 and 19 demonstrated selective cytotoxic properties, exhibiting IC_{50} values of 6.72 and 26.91 µM, respectively, against breast adenocarcinoma MCF-7 cells. The incorporation of electron-withdrawing bromine substituents on the 4-aryl-1,2,3-triazole moieties enhanced the cytotoxic activity, whereas electron-donating

substituents did not manifest any cytotoxic effects, with the exception of compound 19, which displayed a selective cytotoxic influence on MCF-7 cells. [36]1,2,3-Triazolyl-2-fluorobenimidazo[1,2-a]quinoline derivatives 20 (IC_{50} value of 0.5 µM) and 85 (IC_{50} value of 0.6 µM) exhibited significant growth-inhibitory effects on colon cancer (HCT116) cells. The triazolyl substituent located at the C-5 position of the tetracyclic framework, along with the 3-chloropropyl side chain in compound 21, was identified as the most efficacious aliphatic-substituted derivative, while 4-(p-pentylphenyl)- and p-bromophenyl-1,2,3-triazolyl derivatives exhibited moderate activity against all assessed cell lines [37]**Figure 8.**

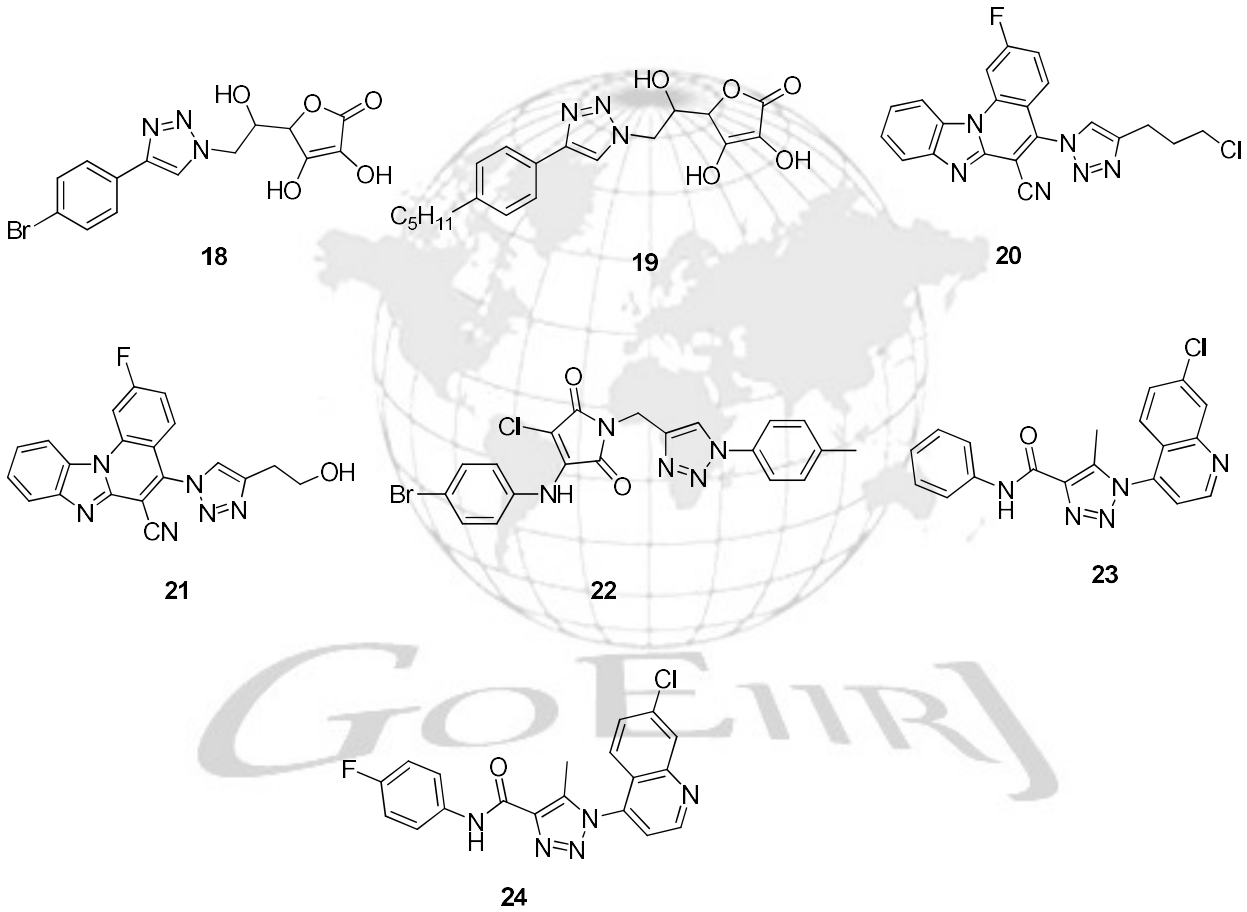

Figure 81,2,3 Triazoles-linked to other heterocyclic pharmacophore

Maleimide-linked 1,2,3-triazole hybrid 22 revealed substantial cytotoxicity, with IC_{50} values of 1.32 and 0.797 µM against HCT116 and T47D cell lines, respectively, which was lower than the inhibitory effect exerted by cisplatin, which impeded growth in both cancer cell lines at concentrations ranging from approximately 0.058 to 0.066 µM. It was noted that scaffolds incorporating a tolyl group attached to the triazole moiety constituted the most active compounds. The presence of the benzyl group on the triazole moiety, along with a chlorine atom or an aniline group on the maleimide moiety, exhibited promising bioactivity. [38]7-chloroquinoline-1,2,3-triazolyl-carboxamides 23 and 24 manifested antiproliferative and apoptotic effects in the human bladder carcinoma grade II (5637) cell line by downregulating the expression of the anti-apoptotic

protein Bcl-2 while concurrently upregulating the expression of the pro-apoptotic protein Box[39].**Figure 8.**

Conclusions

1,2,3-Triazole constitutes a significant heterocyclic entity within the domain of medicinal chemistry, with its derivatives demonstrating substantial anticancer efficacy. The compound 1,2,3-Triazole serves as a heterocyclic structure that encompasses diverse applications in both chemical and pharmaceutical fields. The current review elucidates a pathway for medicinal chemists to innovate novel and potent 1,2,3-triazole hybrids, aiming for enhanced efficacy while minimizing adverse side effects.

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Studies of Interaction of Lightwith Different Concentration of Ligandsin Various Media by Refractrometry

Ganesh D.Tambatkar
Department of Chemistry,
Shri.D.M.Burungale Science & Arts College, Shegaon – 444 203
Dist: Buldhana (Maharashtra) India
And
Reena J Deshmukh
Department of Chemistry,
Shri.D.M.Burungale Science & Arts College, Shegaon – 444 203
Dist: Buldhana (Maharashtra) India
And
Kanchan S Kandarkar
Department of Chemistry,
Shri.D.M.Burungale Science & Arts College, Shegaon – 444 203
Dist: Buldhana (Maharashtra) India
And
Sanskruti P. Hage
Department of Chemistry,
Shri.D.M.Burungale Science & Arts College, Shegaon – 444 203
Dist: Buldhana (Maharashtra) India
And
Vrushali M. Gari
Department of Chemistry,
Shri.D.M.Burungale Science & Arts College, Shegaon – 444 203
Dist: Buldhana (Maharashtra) India

ABSTRACT

The additive properties such as Refractive index, Molar polarizibility and molar refractivities of some heterocyclic drugs such as Chlorothalidon -2-chloro-5-(1-hydroxy-3-oxo-1,2-dihydroisoindol-1-yl)-benzenesulfonamide.. Doxycycline i.e. 4-(dimethyl amino) 1,4,4a,5,5a,6,11,12a octahydro 3,6,10,12,12a Pentahydroxyl-1,11-dioxo naphthacence-2-carboxamide .have been studied in DMSO, DMF and THF media at 27±0.1^{0}C temperature and concentration.

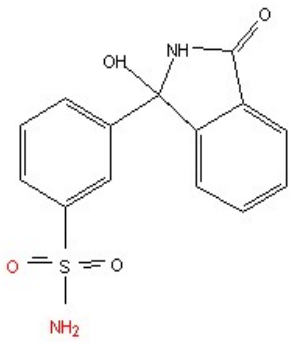
The values of molar refractivity(R) and molar polarizibility (α) are found to be decreased with decreasing the concentration of solute.

Key wards: Additive property, Doxycycline

INTRODUCTION-

Refractive index is one of the important additives properties of liquid. When a ray of light passes from one medium to another, it suffers to refraction, that is a change of direction. If it passes from less dense to more dense medium, it is reflected towards the normal to form angle of refraction (r) which is less then angle incidence (i).The refractive index is the ratio of the velocity of light in vacuum to that in the medium and it depends upon the temperature and wave length of light. The properties of liquid such as refractive index, viscosity and ultrasonic velocity of binary mixtures are studied by many workers[1-3]. Mahajan[4] has studied molar refraction and polarizability constant of 2-amino-5-chloro benzene sulphonic acid in different percentage of dioxane-water mixture. Burghate[5] and Agrawal[6] studied the refractive indices in mixed solvents. Oswalet al[7] have studied dielectric constants and refractive indices of binary mixtures.Ikhe[8] has studies molar refraction and polarisability constant of pyrazoles and isoxazoles in different percentage of dioxane-water mixtures. Meshram et al[36] studied the molar refraction and polarizibility constant of Al(III), Ce(III) and Fe(III) complexes with some substituted isoxazolines, pyrazole and pyrazolinerefractometrically.

However study of molar refractivity and molar polarizibility constant of novel compounds such as **Chlorothalidon**-2-chloro-5-(1-hydroxy-3-oxo-1,2-dihydroisoindol-1-yl)-benzenesulfonamide and **Idoquinol** -5.7 di-iodo-8 – quinolinol in non aquous solvent such as THF,DMF and DMSO under identical set of experimental conditions which could cover manifold aspect of solute-solvent interaction is scanty.



Chlorothalidon Doxycycline Therefore the present work is undertaken to make the systematic study of above novel compounds refractometrically at 27^0C temperature.

EXPERIMENTAL: Above novel compound are extensively used as drugs in pharmaceutical. These compounds provide the photographic material with good storage stability even at high temperature and high humidity. The compounds are synthesized by standard method and purity is checked by M.P, TLC, IR, and NMR.etc.

The solution of the compounds are prepared in different solvents (THF, DMF, DMSO etc.) by dissolving an appropriate amount by weight. All the weighing is made on MechanikiZactadyPrecyzying Gdansk balance made in Poland (±0.001gm).The accuracy of density measurements is within 0.1Kg/m^{-3}.

The refractive index of solvent and solutions are measure at different concentrations by Abbe's refractometer having accuracy with (±0.01unit) .The temperature of prism box maintained constant by circulating water form thermostat at 27± 0.1^0C.Refractometer is initially calibrated with glass piece (n=1.5220) provided with the instrument.

The molar refraction of solvent and solution mixtures are determined from

$$Rm = \left(\frac{n^2+1}{d}\right)\frac{M}{n^2-1}$$

$$Rm_{(solute)} = X_1Rm_1 + X_2Rm_2$$

Rm ⟶ molar refraction, n ⟶ refractive index, d ⟶ density of solution,

No ⟶ Avogadro's number, α ⟶ polarizibility constant,

Rm1 & Rm2 ⟶ molar refractivity of solvent and solute and

X1 & X2 ⟶ mole fraction of solvent and solute in solution.

The molar refraction represents actual or true volume of the substances molecules in mole.

The molar refraction of solute can be calculated as:

Rm (solute) =R (mixture)-R (solvent)

The refractive index of solvent and solution at different concentration are measured from Abbe's refractometer and the values of molar refraction and polaribility constants are evaluated and presented in tables 1 to 4 for different systems.

Table No:1

Molar refraction and polarizibility constant for Ligand 1 (Chlorothalidon) in DMF

Molarity (M)	R.I.	Rm (cm3 mole-1)	□□x 10-23 cm3
0.01	1.417	0.06509	0.002582
0.005	1.416	0.032591	0.001288
0.0025	1.414	0.016390	0.0006503
0.00125	1.4135	0.00820	0.0003252
0.000625	1.413	0.00408	0.0001618

Table No:2

Molar refraction and polarizibility constant for Ligand 1(Chlorothalidon) in THF

Molarity (M)	R.I.	Rm (cm3 mole-1)	□□x 10-23 cm3
0.01	1.418	0.1069	0.004241
0.005	1.414	0.0539	0.002138
0.0025	1.413	0.0270	0.001071
0.00125	1.412	0.0136	0.000539
0.000625	1.411	0.00682	0.000270

Table No:3

Molar refraction and polarizibility constant for Ligand 1(Chlorothalidon) in DMSO

Molarity (M)	R.I.	Rm (cm3 mole-1)	□□x 10-23 cm3
0.01	1.415	0.06800	0.002698
0.005	1.413	0.03427	0.001359
0.0025	1.4135	0.01718	0.000681
0.00125	1.412	0.00861	0.000341
0.000625	1.411	0.00431	0.000171

Table No:4

Molar refraction and polarizibility constant for Ligand2(.. Doxycycline) in DMF

Molarity (M)	R.I.	Rm (cm3 mole-1)	□□x 10-23 cm3
0.01	1.415	0.06261	0.002484
0.005	1.414	0.03140	0.001245
0.0025	1.4135	0.01571	0.000623
0.00125	1.413	0.00826	0.000327
0.000625	1.412	0.00415	0.000164

Table No:5

Molar refraction and polarizibility constant for Ligand 2(Doxycycline) in THF

Molarity (M)	R.I.	Rm (cm^3 $mole^{-1}$)	□□**x10^{-2} cm^3**
0.01	**1.468**	**0.08094**	**0.003118**
0.005	**1.467**	**0.04058**	**0.001563**
0.0025	**1.467**	**0.02003**	**0.0007827**
0.00125	**1.466**	**0.01018**	**0.0003940**
0.000625	**1.464**	**0.005201**	**0.00006570**

Table No:6

Molar refraction and polarizibility constant for Ligand 2(.. Doxycycline) in DMSO

Molarity (M)	R.I.	Rm (cm3 mole-1)	□□x 10-23 cm3
0.01	1.416	0.08372	0.003321
0.005	1.413	0.04224	0.001675
0.0025	1.412	0.02123	0.0008423
0.00125	1.411	0.01065	0.0004225
0.000625	1.399	0.00545	0.000216

Result and discussion: it could be seen from above tables (1 to 4) thatmolar refractivity and polarizibility constants decrease with decreasing the concentration of solution. It is also observed that the values of Rm and α are found to be grater in polar solvents, .THF and DMF. Polar solvents involve H-bonding, may from complex with solute and non polar solvent does not involve H-bonding and does not associate with solute. This may also be attribute to the fact that the dipole in the compound lies perpendicular to the longer axis of the molecules considerable dipole association (inter molecular attraction) takes place which would be accompanied by increase in polarizibility constants (α) as well as molar refractions (Rm) with increasing the concentration because of mutual compensation of the dipoles.

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The Impact of Modern Chemistry on Environmental Sustainability: Current Challenges and Future Perspectives

Prashant R. Mahalle
Assistant Professor and Head, Department of Chemistry,
Late B. S. Arts, Prof. N. G. Science and A. G. Commerce College, Sakharkherda

Abstract:

Modern chemistry has revolutionized various industries, contributing to technological advancements and improved quality of life. However, its influence on environmental sustainability is a double-edged sword. While chemistry has facilitated the development of sustainable technologies and green chemistry practices, it has also contributed to environmental degradation through pollution, resource depletion, and the production of hazardous chemicals. This article examines the dual impact of modern chemistry on environmental sustainability, analyzing current challenges and exploring future directions for achieving a balance between chemical innovation and ecological preservation.

Key Words: environmental sustainability, green chemistry, renewable energy etc.

Introduction:

Modern chemistry plays a pivotal role in shaping today's world, driving innovation across industries from pharmaceuticals to agriculture. Modern chemistry has transformed society, enabling technological advances and the creation of materials that have become indispensable. However, this progress has come at a cost to the environment. The chemical industry's role in pollution, resource depletion, and climate change has prompted a reevaluation of its practices. However, the rapid advancements in chemical technologies have raised significant concerns about their environmental impact. The balance between benefiting from chemical innovations and mitigating their environmental risks is a critical issue in the current scenario. This article explores the contributions of modern chemistry to environmental sustainability, emphasizing both its positive and negative aspects.

Positive Contributions of Modern Chemistry:

1. **Development of Green Chemistry**: Green chemistry[1], a concept introduced in the 1990s. Green chemistry is a subset of modern chemistry that focuses on designing products and processes that minimize environmental impact. It encourages the use of safer chemicals, reduces waste, and promotes energy efficiency. Innovations in green chemistry have led to the development of biodegradable materials, non-toxic solvents, and energy-efficient catalytic processes.

2. **Renewable Energy and Sustainable Materials[2]:** Advances in chemistry have driven the development of renewable energy technologies, such as solar cells, batteries, and biofuels. These innovations are crucial for reducing dependence on fossil fuels and decreasing greenhouse gas

emissions. Additionally, chemistry has enabled the creation of sustainable materials, including bioplastics and advanced composites, which reduce environmental impact and promote circular economy practices.

3. **Pollution Control and Environmental Remediation:** Chemistry has also contributed to the development of technologies[3] for pollution control and environmental remediation. Innovations such as catalytic converters, advanced water treatment methods, and air pollution control devices have significantly reduced the release of harmful pollutants into the environment.

Negative Impacts of Modern Chemistry

1. **Chemical Pollution and Toxicity:** Despite the benefits, modern chemistry has contributed to widespread environmental pollution. The production and disposal of hazardous chemicals, including pesticides, industrial solvents, and plastics, have led to the contamination of air, water, and soil, posing risks to human health and biodiversity.
2. **Resource Depletion:** The extraction and processing of raw materials for chemical production often lead to resource depletion and environmental degradation. Mining activities for metals, minerals, and fossil fuels[4], driven by the chemical industry, have resulted in habitat destruction, soil erosion, and loss of biodiversity.
3. **Waste Generation and Management Challenges:** Modern chemical processes[5] often generate significant amounts of waste, including hazardous and non-biodegradable materials. The management of chemical waste poses a major challenge, as improper disposal can lead to long-term environmental and health issues.

Current Challenges and Future Directions:

To reconcile the benefits of modern chemistry with environmental sustainability, several challenges must be addressed some of them are discussed as follows.

1. **Enhancing Green Chemistry Adoption:** Wider adoption of green chemistry[6] principles across industries is essential. This includes promoting the use of renewable resources, designing safer chemicals[7], and developing energy-efficient processes. Collaboration between academia, industry, and government is critical to drive innovation and implementation.
2. **Regulation and Policy:** Strong regulatory frameworks are needed to control the use and disposal of hazardous chemicals. Policies[8] should incentivize sustainable practices and penalize environmental violations. International cooperation is also necessary to address global chemical pollution.
3. **Public Awareness and Education:** Increasing public awareness[9] about the environmental impacts of chemical products and processes can drive consumer demand for sustainable alternatives. Education initiatives[10] should focus on the importance of sustainability in chemistry and encourage responsible consumption.
4. **Innovation in Waste Management:** Advances in waste management technologies, such as recycling, composting, and the development of biodegradable materials, are essential to reduce the environmental footprint[11] of the chemical industry. Research should focus on finding

innovative solutions to manage chemical waste effectively.

Conclusion:

Modern chemistry has a profound impact on environmental sustainability, offering both opportunities and challenges. While green chemistry and sustainable technologies[12] hold promise for a more environmentally friendly future, the risks associated with chemical pollution, resource depletion, and waste generation cannot be ignored. Achieving environmental sustainability in the context of modern chemistry requires a concerted effort to promote green practices, strengthen regulations, and foster innovation. The future of environmental sustainability will depend on the ability of the chemical industry to balance innovation with ecological preservation.

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A Glimpse into Ethno-medicinal Wisdoms of Traditional Healers of Satpura Mountain Inhabitants, Maharashtra, India

Rajesh Valvi
Department of Chemistry,
New Arts, Commerce and Science College, Shevgaon
Dist. Ahmednagar, Maharashtra- 414502, India.
And
Anil Athare
Department of Chemistry,
New Arts, Commerce and Science College, Ahmednagar,
Maharashtra-414001 India.
And
Sushma Takate
Department of Pharmacology,
MES's College of Pharmacy, Sonai Tal-Newasa, Dist-Ahmednagar
Maharashtra-414105 India.
And
Ramdas Pandhare
Department of Pharmacology,
MES's College of Pharmacy, Sonai Tal-Newasa, Dist-Ahmednagar
Maharashtra-414105 India.

ABSTRACT

In the present study, the authors highlight the healing practices used by the aboriginal community living in and around the Satpura Mountain, Maharashtra, India. The residents of this region rely on locally growing medicinal plants for their first aid needs. This article includes a list of 27 different plant-based remedies, derived from an interview with a traditional healers known as Vaidya or Bhagat. According to traditional healers, they utilize these remedies either the entire plant or specific parts of the plant to treat 49 different diseases in both humans and pet animals. Furthermore, this article also includes information on pharmacological activities that have been tested by various research groups so far. But due to modernization and lifestyle improvements, the community has moved away from traditional healing practices. Therefore, it is essential to preserve the knowledge of traditional plant remedies in written form for future generations. Additionally, exploring undiscovered traditional plant remedies or previously unknown pharmacological properties can significantly contribute to the research and development of new therapeutic drugs.

Keywords: Aboriginal community, Ethno-medicinal wisdoms, Satpura Mountain, *Vaidya* or *Bhagat*

Abbreviation and notation:
TM: traditional medicine, **WHO**: world health organisation, **AYUSH**: ayurveda, yoga and naturopathy, unani, siddha, homeopathy. **km^2**: square kilometre, **%:** percentage.

1. Introduction

Human life is impossible without the use of plants and their products. Since ancient times, humans have relied on plants to meet all their prime needs including health[1]. Historically, aboriginal communities from across the globe have depended on plants for their health needs and are recognized as the primary users of TMpractices [2–6]. Despite the absence of scientific validation, TM holds a significant role in these society as a method for managing, preventing, diagnosing, and treating human diseases. As per the WHO definition TM is the collective knowledge, skills and cultural practices derived from the theories, beliefs and traditions of different societies[7]. A prime example such kind of society is the aboriginal communities of the *Satpura*Mountain of India, who depend entirely on the surrounding natural resources for their livelihood and traditional plant remedies to treat various health problems[8]. They seek care from their community healers known as *Vaidya* and *Bhagat*. These healers possess extensive knowledge of the plant remedies native to their region, a precious heritage passed down through generations. This ancestral wisdom is invaluable and continues to be preserved and applied in their healing practices. Healers have remedy for primary treatments of infectious deficiencies, genetic diseases both genetic and non-genetic and physical ailments in humans and domestic animals. TM remedy consists of two primary aspects physical healing and psychological healing. Both aspects involve superstitions like *mantras*, rituals or ceremonies although these are not evident in the healers practice described here[9]. Even lacking knowledge of the chemical composition and its effects, these healers prescribe the quantity, dosage form and treatment timeline of TM remedy. Nevertheless, aboriginal communities place blind faith on healers and prefer their advice over consulting doctors or hospitals for various health-related problems. Over the years, the use of TM in health care systems is increasing globally. In response, the Government of India has established the Ministry ofAYUSH to prioritize TM. The Ministry focuses on the education and research of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy. Notably, Ayurveda and Unani are primarily plant-based health care systems[10–13]. Therefore, this article address the descriptive survey on TM among the aboriginal community around the hilly area of *Satpura*Mountain. The practices of TM remediesin aboriginal communities play a crucial role in the development and introduction of new drugs in both national and international markets. The researchers hope that this collection will assist young researchers in discovering and studying these medicinal plants, potentially leading to the development of new drugs for the market.

2. Study Area

Nandurbar district is locatedin the north-western corner of Maharashtra, India (**Figure 1**). This district is spread over an area of 5955 km^2 with population of 1,648,295 and shares its borders with Dhule district to the south and southeast, Gujarat to the west and Madhya Pradesh to the

northeast.Approximately 80-82% of the population in this district belong to the aboriginal community communicating among themselves in dialects such as *Bhil*, *Konkani*, *Pawara*and *Mavchi*.This district has the lowest literacy rate among the states but gender distribution rate is balanced [14](**Figure 2ab).** The residents of the district predominantly prefer to live in rural areas abundant with natural resources balancing traditional values with a progressive outlook.

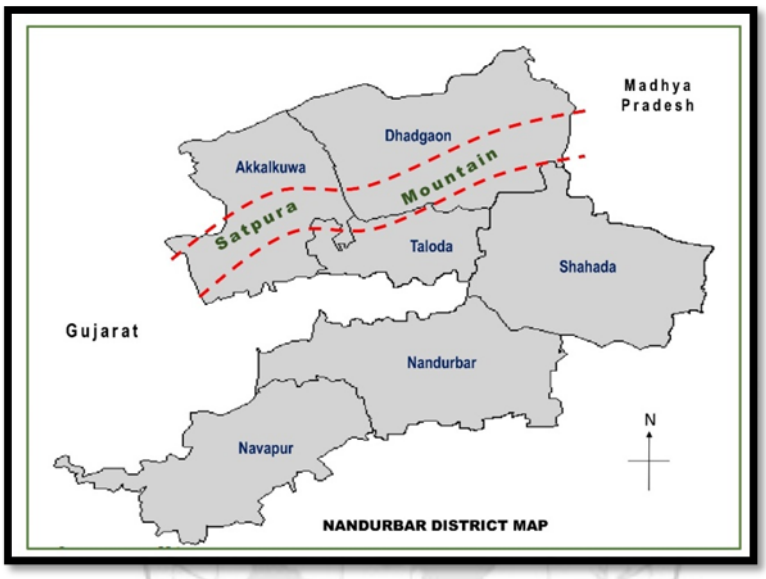
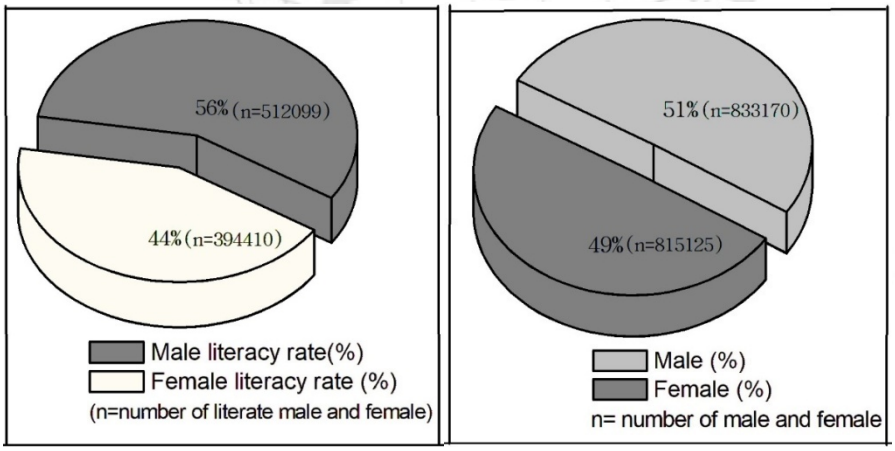


Figure 1 Map of study area



a) **b)**

Figure 2: Study area**a)** Gender literacy rate (%) **b)** Gender distribution rate (%)

3. Methodology

During the survey, the authors frequently visited the villages in the study area, fostering strong relationships with the local residents. With the local's assistance, the authors interviewed the majority of traditional healersin the region.The interviews revealed that each healersinherited their knowledge of TM remedies from their forefathers, and they are committed to preserving this heritage for future generations. To gain a deeper understanding of the TM system detailed in this descriptive survey, the authors closely observed the medicinal practices of the healers.The TM plant remedies discussed in this article have been identified with the assistance of expert botanists

and available flora of Dhule and Nandurbar districts, Maharashtra (India).

Result

Table 1 presents a summary of the medicinal plants and their parts used by traditional healers to treat ailments within the aboriginal community of Nandurbar district.The results show that the 27 different medicinal plants used in traditional medicine within these communities include trees, shrubs, herbs and climbers from 18 different families. These plants are used to treat 49 different diseases. Additionally, it was found that more TM plants are used for skin diseases (12), followed by menstrual problems (8).Similarly, other diseases like body or limb pain have 5 TM plants, diarrhoea, stomach ache, jaundice, cough have 3 TM plants each and partial paralysis, vision problem, fever, alcoholism, dog bite or scorpion bite or snakebite and childhood diseases have 2 TM plants each. The various parts of TM plants used include the bark with the highest frequency of use being 12 along with other parts such as the whole plant, oil or latex, roots, flowers, leaves, seeds, fruits, thorns and gum (**Figure 3)**.We noticed that traditional healers used numerous TM plants either individually or in combination for treating various ailments.This highlights the immense importance of these plant species to rural people who rely on them exclusively for their primary health care.Additionally, ***Table 2*** outlines the various pharmacological activities of TM plants that have been investigated by different researchers.This survey shows that the majority of TM plants have been scientifically tested using various present day modern technologies.Among the traditional medicinal plants discussed in this article*Boswellia serrateRoxb.*, *Butea monosperma Taub., Cordia dichotoma G. Forst., Morinda tinctoria Roxb., Terminalia belericaRoxb. and Vitex negundo Linn.* exhibited the highest levels of pharmacological activity testing. Conversely, *Convolvulus microphyllus Linn., Delonixelata Gamble, Ischaemumpilosum (Kl. ex Willd.) Wight, Melia azedarach Linn., Moringa concanensis Nimmo, Salmaliamalabarica Schott & Endl. and Vigna trilobata (L.) Verdc*. showed minimal pharmacological activity testing (**Figure 4)**.These results suggest that exploring traditional medicinal plants that have either not been tested or have been minimally tested could potentially uncover new therapeutic drugs.

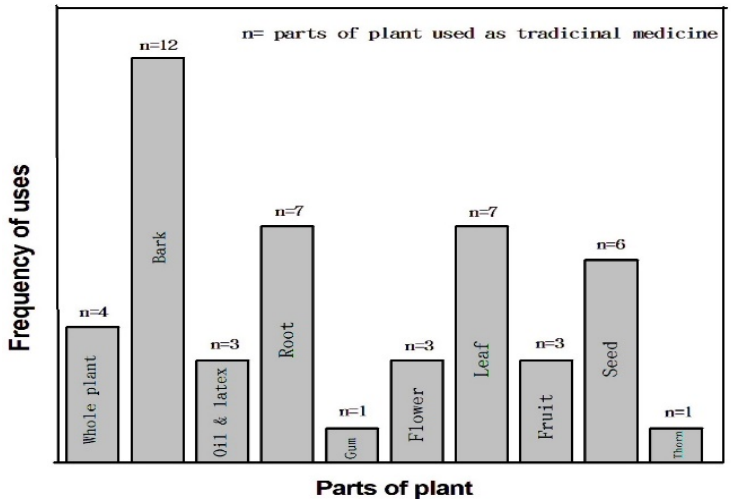


Figure 3 Parts of plant used as in TM remedy

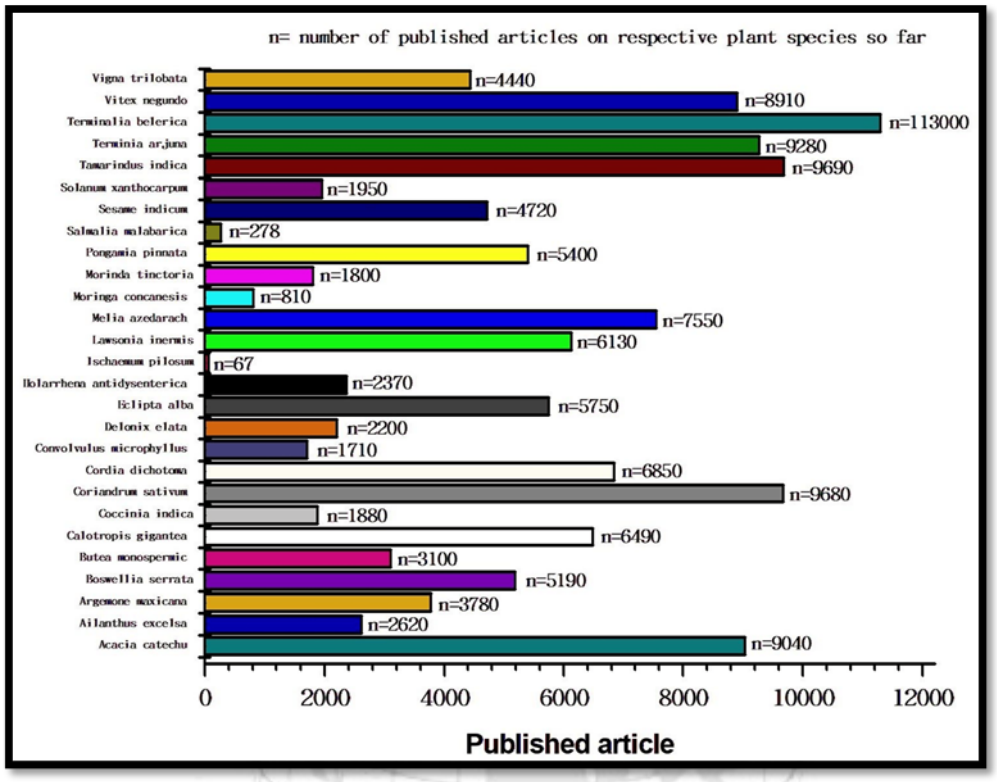


Figure 4TM plants species with their published data so far

4. Discussion

TM have been a major source of therapeutic agents and attracted considerable attention because of their good activity and comparatively lesser or no side effects as compared to synthetic formulations. The present study highlights TM practices of traditional healers and found that thesepeople skilfully utilize the available TM resources for the treatment of health-related issues.However, it raises some important questions about the validity of its uses[15]. But these kind of TM practitioners could serve as an additional source of health manpower in India and across the world. This is particularly true in developing countries striving to achieve comprehensive healthcare coverage for their populations. Moreover, present days the acceptance of TM practices is steadily increasing worldwide (**Figure 5**) due to various factors including the inaccessibility and high cost of conventional medicine as well as the side effects associated with it[16]. But the main factor is that it is deeply rooted in the culture of the people. Hence, despite the spread of modernization people in rural areas continue to prefer living in remote hamlets (*Padas*) where they enjoy a simple lifestyle and abundant natural resources. But in the pursuit of meeting basic needs and improving living standards they have been destroying the forest and its resources.More than 80% of the rural population in *Satpura* Mountain relies on TM remedies contributing to increased exploitation of herbal plants alongside a high rate of deforestation leading to forest depletion and destruction. As a result, the exploitation of medicinal plantsspecies not only decreases their population but also hinders their growth and development.Additionally, some of the TM plants mentioned in this article have been evaluated using modern technology confirming

their efficacy. However, there are still other plants that have not yet been tested leaving the validity of their use uncertain. Therefore, exploring these untested plants could potentially lead to the discovery of new therapeutic drugs.Consequently, we firmly advocate for further research in the field of TM.Again in recent times, aboriginal communities especially the younger generation have been drifting away from traditional practices due to urbanization and modernization. As a result, the authors fear that the knowledge of TM plant and their practices may be lost over time. To prevent this it is crucial to preserve this traditional information in written form.

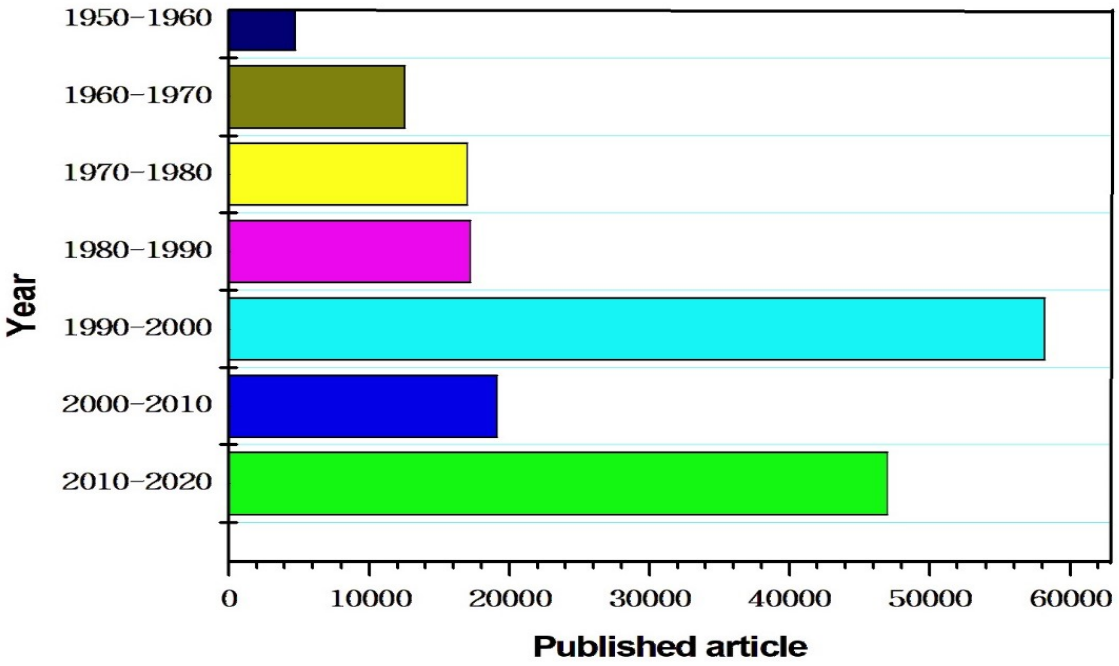


Figure Years-wise publication of articles on TM so far

Conclusion

The current study highlights that numerous TM remedies in *Satpura*hills are at risk of complete extinction due to ongoing destructive practices by end users who have yet to prioritize sustainable use and conservation of these crucial flora species.The decline of indigenous knowledge regarding their medicinal potential is rapidly accelerating. Findings from this study indicate that this trend may persist unless younger generations are properly educated about the significance of TM in our society and its role in human health restoration.Hence, it is essential to develop reliable strategies for conserving our diverse flora and to continuously document indigenous ethnobotanical knowledge. Numerous studies have demonstrated that native species form a significant portion of TM in India and across the globe.

Table 1: Detailed of TM plant ta{ }xonomy with its traditional therapy and global distribution[17].

Botanical name	Family	Vernacular name	Habit	Habitat	Traditional therapy	Distribution of plant species across globe as per available flora
Acacia catechu (L.f.) Wild	Leguminosae	Khair	Tree	Tropical dry deciduous forests	A bark decoction treats amenorrhea and painful menstruation, while its powder aids wound healing.	Bangladesh, Bhutan, China, India, Myanmar, Nepal, Pakistan, Thailand
Ailanthus excelsa Roxb.	Simaroubaceae	Maharukh	Tree	Tropical dry deciduous forests	Finely powdered bark mixed with sugar and water cures jaundice.	Andaman, Bangladesh, India, Sri Lanka, West Himalaya, Botswana, and Sudan
Argemone mexicana L.	Papaveraceae	PivlaDhotra	Herb	Common in waste places and in agriculture fields as a weed.	A coconut oil and latex mixture treats scabies, while root water extract helps with prolonged menstrual periods.	Now naturalized in the tropics
Boswellia serrata Roxb. ex Coleb.	Burseraceae	Salai	Tree	Deciduous forests and on the Ridges	The fumes of gum are given to cure fever and loss of consciousness	India, West Himalaya
Bombax ceiba L.	Malvaceae	Havri	Tree	Deciduous forests	Flower consumption treats irregular menstruation; root decoction alleviates mucus in stools and dysuria; thorn powder and milk mixture treats pimples.	India, Bangladesh, Bismarck Archipelago, Borneo, Brazil North, Cambodia, China, Bhutan, Guyana, Hainan, Jawa, Laos, Lesser Sunda Islands, Malaya, Maluku, Myanmar, New Guinea, Nicaragua, Northern Territory, Pakistan, Philippines, Solomon Islands, Sri Lanka, Sulawesi, Sumatera, Taiwan, Thailand, Vietnam
Butea monosperma (Lam.)	Leguminosae	Palas	Tree	Deciduous forests	A flower extract in bath water cures fever and severe itching, while crushed bark aids in	India, Indo-China, Tropical Himalayas, Nepal, Sri Lanka, Southeast Asia, Malaysia, Myanmar, Thailand

Taubert						healing fractures.	
Calotropis gigantea (L.) W.T.Aiton	Apocynaceae	Ruvandi	Shrub	colonizer by roads		Leaf latex treats scabies; leaf extract alleviates hand and foot pain, and leaf water eases earaches.	Bangladesh, Bhutan, Cambodia, China, Hainan, India, Jawa, Lakshadweep Islands, Laos, Malaya, Maldives, Myanmar, Nepal, Sri Lanka, Sulawesi, Thailand, Vietnam
Coccinia indica Wight &Arn.	Cucurbitaceae	Tondli	Climber	Tropical dry deciduous forests,		A root paste treats abscesses, while fruit water extract helps ease dizziness in cattle.	Tropical & sub-tropics of the World
Coriandrum sativum L.	Apiaceae	Dhane	Herb	Cultivated for condiments and used in cooking		The whole plant's juice is useful for treating weak vision.	Cultivated in most parts of the world
Cordia dichotoma Frost.	Boraginaceae	Bhokar	Tree	Tropical dry deciduous forests		Bark water extracts treat gonorrhoea, while inner bark water extracts address excessive menstruation.	India, Sri Lanka, Pakistan, North Africa
Convolvulus microphyllus Sieber ex Spreng.	Convolvulaceae	Sankhavali	Climber	Tropical dry deciduous forests		Plant juice treats excessive menstruation, while plant paste cures abscesses.	Afghanistan, Algeria, Burkina, Cape Verde, Chad, Djibouti, Egypt, Gulf States, India, Iran, Iraq, Libya, Mauritania, Morocco, Nepal, Niger, Oman, Pakistan, Saudi Arabia, Senegal, Sinai, Somalia, Sudan, West Himalaya, Yemen
Delonixelata (L.) Gamble	Leguminosae	Vayni	Tree	Planted along roads and avenues		Leaf water extract with goat dung treats infant pneumonia; leaf and bark water extracts cure jaundice.	Tropical Africa, Egypt, Arabia to India
Eclipta alba (L.) Hassk.	Compositae	Maako	Herb	Common in clayey moist ground, like bunds of paddy fields, by water		Leaf juice treats abscesses, liver swelling, sudden haziness, and sogginess between toes. Whole plant juice cures gonorrhoea and,	Pantropics

				courses and drainages	when mixed with coconut oil, promotes hair growth as a scalp tonic.	
Holarrhenaantidysenterica (Roth) Wall. ex A.DC.	Apocynaceae	Pandra Kuda	Tree	Deciduous and scrub forests	Seed powder treats abdominal pain, fever, and intestinal worms; bark decoction is used for diarrhoea.	India, Cambodia, Malaysia, Myanmar, Indo-China, Tropical Himalayas, Nepal, Taiwan, Province of China, Thailand, Vietnam, East Africa, South Africa, Laos, Pakistan
Ischaemumpilosum (Kl.ex Willd.) Wight	Poaceae	Kunda	Herb	Common in black cotton soils	Root decoction removes kidney stones and serves as an antipyretic and remedy for burning micturition.	India
Lawsonia inermis L.	Lythraceae	Mehdi	Shrub	Grown as hedge plant	Fresh leaf juice treats burning feet; seed water extract addresses bloody diarrhoea.	Central Asia, India; cultivated throughout warm tropics
Melia azedarach L.	Meliaceae	Bakananimb	Tree	Moist and dry deciduous forests	Leaf paste treats a baby's bronchitis, swelling, and chest pain; leaf juice relieves severe cough from tuberculosis. Bark decoction treats low fever.	Himalayas, India, Myanmar, China, Pakistan, Iran, Turkey, Africa, Australia
Moringa concanensis Nimmo	Moringaceae	JangliHegvo	Tree	Tropical dry deciduous forests	Bark strips treat partial paralysis, stiff neck, and intestinal worms; leaf juice cures night blindness.	West Asia
Morinda tinctoria Roxb.	Rubiaceae	Bartondi	Tree	Occasional in plains	Ripe fruits purify blood; bark water extract cures jaundice.	India, Sri Lanka, Malay Islands
Pongamia pinnata (L.) Pierre	Leguminosae	Karanj	Tree	Deciduous forests	Root decoction treats dog bites; seed water extract cures cough and skin diseases.	Indo-Himalayas, Sri lanka, Myanmar, Malaysia, Northern Australia, Polynesia, Mascarene Islands, Micronesia

Sesamum indicum L.	Pedaliaceae	Til	Herb	Cultivated	Seed oil treats piles and cures abscesses.	Tropical Africa, Asia
Solanum virginianum L.	Solanaceae	Bhuiringni	Climber	Tropical dry deciduous forests	Whole plant juice cures cough; seeds treat toothache.	Tropical Africa, Asia
Tamarindus indica L.	Leguminosae	Chinch	Tree	Planted	Seed paste treats scorpion stings; bark decoction combats excess menstruation.	Tropics of the World
Terminalia arjuna (Roxb. ex DC.) Wight &Arn.	Combretaceae	Arjun Sadada	Tree	Species along river banks	Bark water extract treats abdominal pain, diarrhoea, vomiting, and excessive menstruation.	India, Sri Lanka
Terminalia bellirica (Gaertn.) Roxb.	Combretaceae	Behda	Tree	Tropical semi-evergreen forests, Tropical moist deciduous forests, also in the plains	A bark decoction treats abdominal pain, while a fruit decoction heals mouth sores. The seed kernel treats alcoholism, and kernel oil serves as hair dye.	India, Sri Lanka, Nepal, Myanmar, Thailand, Indo-China, Malesia
Vitex negundo L.	Lamiaceae	Nirgudi	Shrub	Common in all areas along streams	Fresh leaf juice treats joint pain and partial paralysis.	India, Sri Lanka, Afghanistan, Himalayas, Myanmar, Malesia, Indo-China
Vigna trilobata (L.) Verdc.	Leguminosae	Mirchi Kand	Herb	Rocky areas in dry and Tropical moist deciduous forests	Water extracts of tuberous roots treat snake bites; root paste cures abscesses.	Indo-Malesia

Table 2: Detailed of pharmacological activity of TM plant tested by various researchers so far

Botanical name	Reported pharmacological activity	Ref.
Acacia catechu (L.f.) Willd	Antihyperglycemic, Antiulcer, Immunomodulatory, Immunostimulatory, Antihyperglycaemic, Antinociceptive, Antiproliferation, Antioxidant, Antidiabetic activity	[18]
Ailanthus excelsa Roxb.	Antileukemic, Antifungal, Antibacterial, Antifertility, Antimalarial, Anti-inflammatory, Antiamoebic, Anticancer, Antioxidant, Cytotoxic, Cyclooxygenase (COX) inhibitor screening assay, antischistosomal, Hypoglycaemic, Insect-feedent deterrent, Antipyretic, Leishmanicidal, Antitumor and cytotoxicity, Hepatoprotective activity	[19–22]
Argemone mexicana L.	Anticancer, Antimicrobial, Antitrypanosomal, Anti-inflammatory, Anthelmintic, Antidiabetic, Antioxidant, Larvicidal, Hepatoprotective, Anticancer, Neuropharmacological, Wound Healing activity.	[23–30]
Boswellia serrata Roxb. ex Coleb.	Anticancer, Anti-asthma, Anti- inflammatory, Anti-fungal, Analgesic and Psychopharmacological Effects, Anti-arthritic Effect, Effects on Leucocytes Migration, Anti-anaphylactic and Mast Cell Stabilizing, Anti-Depressant, Hypolipidemic, Hepatoprotective, Hypoglycemic, Anti-Cancer, Anti-Diarrhoeal, Anti-Arthritic, Ulcerative Colitis, Crohn's Disease, Collagenous Colitis, Osteoarthrosis, Cerebral Edema, Chronic Toxicity Studies, Skin disorders related activity	[31,32]
Bombax ceiba L.	Hypoglycemic, Antioxidant, Antihyperlipidemic, Effects, anti - acne activity	[33]
Butea monosperma (Lam.) Taubert	Anti-diabetic, Anti-Diarrheal, Anthelmintic, Hepatoprotective, Anti-stress, Anti-implantation, Anticonvulsant, Wound Healing, Giardiasis, Anti-dopaminergic, Anti-microbial, Sunscreen, Anti-filarial, Nephroprotective, Protease Inhibitor, Osteogenic, Hemagglutinating, Anti-ulcer and Anti-oxidant, Anti-asthmatic, Anti-inflammatory, Anti-fertility, Anti-cancer, Anti-nociceptive activity	[34]
Calotropis gigantea (L.) W.T.Aiton	Antidiarrheal, Antipyretic, Procoagulant, Pregnancy Interceptive, Insect Anti-feedant, Cytotoxic, CNS, Analgesic, Fungicide, Hepatoprotective, anti-inflammatory, hepatoprotective activity	[35]
Coccinia indica Wight &Arn.	Antidiabetic, Antibacterial, Antifungal, Hepatoprotective, Anthelmintic, Anti-ulcer, Antioxidant, Antimalarial, Anti-inflammatory, Analgesic, Mutagenic Effect, Anticancer activity	[36]
Coriandrum sativum L.	Effects on nervous system, liver and gastrointestinal tract, cardiovascular system, Hyperglycaemia, Dyslipidaemia, Nephropathy, Retinopathy, Alloxan-induced diabetes activity	[37]
Cordia dichotoma Frost.	Analgesic, Anti-inflammatory, Anti-ulcerative, Antioxidant, Hepatoprotective, Cytotoxic, Antibacterial, Anthelmintic, Hypoglycemic, Antipyretic, Antifungal, Wound healing, Antiaging, Antifertility, Antidepressant, Hypolipidemic, Anti-	[38]

	atherosclerotic, Inhibitory activity of angiotensin-converting enzyme, Diuretic, Anti-anemic, Thrombolytic, Anti-Alzheimer, Larvicidal activity	
Convolvulus microphyllus Sieber ex Spreng.	Epididymis Function, Antioxidant, Antihypoxic, CNS Depressant and Anti-anxiety, Aging-Related diseases and memory deficits activity	[39,40]
Delonixelata (L.) Gamble	Larvicidal, Ovicidal, Antimicrobial, Analgesic activity	[41,42]
Eclipta alba (L.) Hassk.	Hepatoprotective, Anti-hyperlipidemic, Neuropharmacological, Immunomodulatory, Analgesic, Anti-hyperglycemic, Hair growth, Prevention of skin disease, Antivenom, Antimicrobial, Antiulcer, Anthelmintic, Antimalarial, Anti-Inflammatory, Anti-epileptic, Anticancer, Antioxidant activity	[43]
Holarrhenaantidysenterica (Roth) Wall. ex A.DC.	Anti-amnesic, Neuroprotective, Acetylcholinesterase, Antidiabetic, Anti-urolithic, Antibacterials, Anti-inflammatory, Analgesic, Anti-malarial, Anti-diarrhoeal activity	[44]
Ischaemumpilosum (Kl.ex Willd.) Wight	-	
Lawsonia inermis L.	Antimicrobial, Antioxidant, Effect on hair, Anti-inflammatory, Analgesic, Antiparasitic, Hepatoprotective, Gastroprotective, Antitumor, Wound and burn healing, Hypoglycaemic activity	[45]
Melia azedarach L.	Different cattle diseases activity	[46]
Moringa concanensis Nimmo	Antimicrobial, Antioxidant, diuretic, Anticancer, Antiarthritic activity	[47–50]
Morinda tinctoria Roxb.	Antimicrobial, Antiplasmodial, antimalarial, Purgative, Anti-diarrhoeal, Cognition enhancement, Antiplasmodial, Anti-fatigue, Anti-aging, Anti-rheumatoid arthritis, Effect on muscle contractility, Anti-inflammatory , Antiosteoporotic, Antidepressant, Immunity enhancing, Anticancer, Wound healing, Gastric ulcer healing , Antidiabetic activity	[51]
Pongamia pinnata (L.) Pierre	Anti-plasmodial, Anti-Inflammatory, Anti-diarrhoeal, Antioxidant, Anti-hyperammonemic, Anti-ulcer, Anti-hyperglycaemic and Anti-lipidperoxidative activity	[52]
Sesamum indicum L.	Antioxidant, Cholesterol-lowering, Lipid-regulating, Protects liver and kidney, Anti-inflammatory, Hypoglycemic, Protects cardiovascular system, Inhibition of osteoclast differentiation, Hearing protection activity,	[53–55]

Solanum virginianum L.	Anti-fertility, Antihyperlipidemic, Hypoglycemic, Antifilarial, Anti-asthmatic, Anti-inflammation, Snail killing, Anti-allergy activity	[56]
Tamarindus indica L.	Analgesic, Anthelmintic, Antiasthmatic, Anti-nociceptive, Antiatherosclerosis, Antioxidant, Antiulcer, Antidiabetic, Fungicidal, Anti-emetic, Hepatoprotective, Anti-inflammatory, Hypolipidemic, Immunomodulatory, Antimicrobial activity	[57]
Terminalia arjuna (Roxb. ex DC.) Wight &Arn.	Antioxidant, Antiinflammatory, Immunomodulatory, Antimutagenic, Anticarcinogenic, Antimicrobial, Gastro-productive, DNA damage protecting activity	[58]
Terminalia bellirica (Gaertn.) Roxb.	Analgesic, Anti-diarrhoeal, Antihypertensive, Anti salmonella, Anti-Spasmodic, Bronchodilatory, Anti-microbial, Antioxidant, Antibiofilm, Wound healing, Anticancer, Immunological, β-lactamase inhibitor, Acute and Sub-acute, Antiulcer, Immune response, Antithrombotic, Thrombolytic, Hepatoprotective, Antipyretic, Antimutagenic activity	[59]
Vitex negundo L.	Anti-bacterial, Anti- feedant, Anti-filarial, Anti-fungal, Insecticidal, Larvicidal, Mosquito repellent, Anti-inflammatory, Analgesic, Anti-oxidant, Enzyme-inhibitory, Effect on reproductive potential, Anti-cancer, Drug potentiating ability, Anticonvulsant, Hepatoprotective, laxative effect, Anti-histaminic, Hypoglycaemic, CNS depressant, Anatomization of the lethal activity	[60]
Vigna trilobata (L.) Verdc.	Hypoglycaemic, rheumatism, narcotic property, Antioxidant, Anti-cancer activity	[61]

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Study of Classification and Benefits of some medicinal valued plants with active chemical compounds

Suresh Kumar
Department of Chemistry,
Dr. P.D.B.H. Govt. (P.G.) College Kotdwar (Pauri Garhwal) Uttarakhand
And
Babita Bantwan
Department of Zoology,
S.S.H.D. Govt. degree college Agrora (Dharmandal), Tehri Garhwal

Abstract

Present paper communicates potentially important medicinal plants with reference to their classification, description and medicinal properties. Natural products derived from plants for the treatment of diseases have proved that nature stands a golden mark to show the relationship between the interrelationship between man and his environment. The researches and utilization of herbal medicine in the treatment of diseases increases every day.

Key words: Classification, Medicinal plants, Botanical description, Medicinal Properties, Phytochemicals

Introduction

Medicinal plants represent the most ancient form of medication. Used for thousands of years in traditional medicine in many countries around the world. The empirical knowledge about their beneficial effects was transmitted over the centuries within human communities (Khan, 2014). Natural products play a pivotal role as a source of drug compounds and currently a number of modern drugs which are derived from traditional herbal medicine are used in modern pharmacotherapy (Patwardhan *et al.* 2008).

Since medicinal plants are nontoxic and easily affordable, they play a vital role not only for pharmacological research and drug development, but also when plant constituents are used directly as therapeutic agents and as starting materials for the synthesis of drugs (Masood, 1997).

Classification and Benefits of some medicinal Plants

1. Amla (*Phyllanthus emblica*)

Classification

Kingdom: Plantae
Division: Flowering plant
Class: Magnoliopsida
Order: Malpighiales
Family: Phyllanthaceae
Genus: *Phyllanthus*
Species: *P. emblica*

Botanical Description:

Amla tree is a small to medium sized deciduous tree with an average height of 8-18 m, with thin light grey bark exfoliating in small thin irregular flakes, exposing the fresh surface of a different color underneath the older bark. The average girth of the main stem is 70 cm. In most cases, the main trunk is divided into 2 to 7 scaffolds very near to the base (El-Desouky *etal.*2008). Leaves are 10 -13 mm long, 3 mm wide, closely set in pinnatefaishon3 which makes the branches feathery in general appearance. After setting of the fruits leaves develop.Fruits are fleshy, almost depressed to globose shape, 2.1-2.4 cm in diameter, 5.3-5.7 g in weight, 4.5-5.0 mL involume (Rehman *et al*. 2007).

Medicinal Properties:

Due to its cooling nature, amla is a common ingredient in treatments for a burning sensation anywhere in the body and for many types of inflammation and fever; these are manifestations of pitta (fire) agitation. Amla or Amlaki has been considered the best of the Ayurvedic rejuvenative herbs. It has a natural balance of tastes (sweet, sour, pungent, bitter and astringent) all in one fruit, so, stimulates the brain to rebalance the three main components of all physiological functions, the water, fire, and air elements within the body (Bajracharya,1979). In traditional folk medicine, the fruits exert several beneficial effects include cooling, ophthalmic, carminative, digestive, stomachic, laxative, dyspepsia, rejuvenative, diuretic, antipyretic and tonic. They are also useful in diabetes, cough, asthma, bronchitis, dyspepsia, flatulence, peptic ulcer, skin diseases, leprosy, inflammations, diarrhoea, haemorrhages, cardiac disorders, hair tonic and some other disease conditions.

Amla has been found to be a rich source of different types of bioactive compounds. Polyphenols comprise the main group of secondary metabolites wherein several compounds belonging to phenolic acids, flavonoids, tannins, other phenolic acids, flavonoids, tannins other phenolic and derivatives compounds have been reported in different studies (Liu et al. 2008).The amla fruit also includes numerous bioactive components including isostrictinin, ellagic acid, apigenin, chebulinic acid, quercetin, gallic acid, chebulagic acid.

2. Neem (*Azadirachta indica*)

Classification

Kingdom: Plantae
Division: Magnoliophyta
Class: Magnoliopsida
Order: Sapindales
Family: Meliaceae
Genus: *Azadirachta*
Species: *A. indica*

Botanical Description:

It is a tree 40-50 feet or higher, with a straight trunk and long spreading branches forming a broad round crown; it has rough dark brown bark with wide longitudinal fissures separated by flat ridges. The leaves are compound, imparipinnate each comprising 5-15 leaflets. The compound leaves are themselves alternating with one one another. Fruits are green, turning yellow on ripening, aromatic with garlic like odour.

Medicinal Properties:

Almost every part of the tree has long been used in folklore and traditional systems of medicine for the treatment of a variety of human ailments, particularly against diseases of bacterial and fungal origin **(**Manjunath 1948**).**Nimbidin is anti-arthritic and anti-inflammatory **(**Rojanapo *et al.* 1985**)**in its action and possesses significant antiulcer potential **(**Pillai, and Santhakumari 1984**)** whereas various other fraction have antipyretic and anti-inflammatory **(**Okpanyi SN. and Ezeukwu, 1981**)**and antitumor **(**Kurokawa *et al.*1988)properties.

The most important active constituent is azadirachtin and the others are nimbolinin, nimbin, nimbidin, nimbidol, sodium nimbinate, gedunin,salannin and Quercetin.

3. Castor oil plant (*Ricinus communis)*

Classification

Kingdom: Plantae
Division: Magnoliophyta
Class: Magnoliopsida
Order: Malpighiales
Family: Euphorbiaceae
Genus: *Ricinus*
Species: *R. communis*

Botanical Description:

Castor oil plant is a tall, branching perennial shrub that grows to 3 m high and occasionally higher. It has stout, hollow branches that are a dull pale green or red. Older branches and trunks turn greyish. Large leaves (10-60 cm across) are widely spaced on the branches and grow on long, stout, hollow stalks attached off-centre to the bottom of the leaf. Each leaf is divided into 7-9 pointed triangular segments.

Medicinal Properties:

India has a history of using different plants in its indigenous systems of medicine (Ayurveda, Unani and Siddha) that dates back to 5000 years. Ayurveda records over 8000 herbal remedies. About 6000 plants were used in traditional, folk and herbal medicines in India (Huxley, 1984). Different parts of the plant or oil from castor can be used as a base material in most of the medicinal treatments. E.g., the leaf can be used in the treatments related to antiviral, biliousness, burns, ear/head ache, malaria and night blindness while stem is used for treatment of cancer and

hypoglycemia. The flowers can be utilized against glandular and vaginal pain. Fruits are used for curing tumors, treating piles, liver and spleen diseases. Root bark is used as purgative, in abortion, ascites, asthma, bronchitis, carination (expulsion of gas from stomachand intestines), hypoglycemia, leprosy, pains, rectum and rheumatism diseases (Borthakar, 1981).

R. communis contain various bioactive phytochemicals such as kaempferol-3-*O* and kaempferol-3-*O*- β -D-glucopyranoside, ingenoltriterpenoids (lupeol, β - and α -amyrin), quercetin and gallic acid, athujone, camphor and beta thujone, ricin, epicatechin, gentisic acid, catechin, linoleic acid and ricinoleic acid, kaempferol-3-*O*- β -D-glucopyranoside and quercetin-3-*O*- β -monoterpenoids (Jeyam et al. 2014).

4. Timur (*Zanthoxylum alatum*)

Classification

Kingdom: Plantae
Phylum: Tracheophyta
Class: Magnoliopsida
Order: Sapindales
Family: Rutaceae
Genus: *Zanthoxylum*
Species: *Z. armatum*

Botanical Description:

Zanthoxylum armatum is an evergreen, thorny shrub or small tree; attaining a height up to 6 m. Leaves are 4–20 cm long, imparipinnate, pungent, and aromatic with glabrous, narrowly winged petiole having two stipular prickles at the base. Leaflets are glabrous on the underside, and occur in two to six pairs. The plant can be recognized by its shrubby habit, dense foliage, with pungent aromatic taste, prickled trunk and branches, and small red, subglobose fruits.

Medicinal Properties:

Tumburu is rich in medicinal properties. The understanding of these properties will help us to better utilize this herb. Below is given medicinal properties along with the meaning. Tumburu is a medicinal tree. Its leaves, roots, and seeds are used for medicinal purpose. In Ayurveda, the seeds are used in treatment of digestive impairment, piles, heart diseases, hiccups, cough, throat disorders, asthma, and dental diseases. Stem bark is used in cough, asthma, difficult breathing, and rheumatism.

lant Zanthoxylum armatum contains alkaloids such as g-fagarine,b-fagarine, magnoflorine,nitidine, chelerythrine, tambatarine. It also contains linalool, beta-sitosterol,tamblin, tambulatin, aramatamide,lignans,asarinin and fragesin.Barkof plant containsyellow crystelline compounds named as berberine(Siddhanadham et al 2017).Many chemical studies are donewhich introduced the isolation of further two new phenolic compounds 3-3′,4′-dimethoxyflavone-5-β-dxylopyranoside along with the five known compounds, 1-methoxy- 1,6,3-anthraquinone, 1-

hydroxy- 6,13-anthra quinone, 2-hydroxybenzoic acid, 2-hydroxy-4-methoxy benzoicacid and stigmasta-5-en-3β-deglucopyranoside, on the basis of spectral data and chemical analyses(Akhtar et al 2008).

5. Jamun *(Syzygium Cumini)*

Classification

Kingdom: Plantae
Division: Magnoliophyta
Class: Magnoliopsida
Order: Myrtales
Family: Myrtaceae
Genus: *Syzygium*
Species: *S. Cumini*

Botanical Description:

It may grow up to a height of 30 m (100 ft) and survive for more than 100 years. It is planted not only for decorative purposes, for its thick leaves, which offer shade. The bark is hard and dark gray at the base of the tree, becoming lighter gray and smoother higher up. The fruits are oblong or ovoid. Unripe fruit appears green. Its hue varies from pink to brilliant crimson red, then to black as it grows. The fruit has a flavour that is sweet, moderately acidic and astringent.

Medicinal Properties:

The jamun has received far more recognition in folk medicine andin the pharmaceutical trade than in any other field. Medicinally, thefruit is stated to be astringent, stomachic, carminative, antiscorbuticand diuretic (Srivastava *et al.* 1983). Additionally, a fruit extractshowed antimicrobial and cytotoxic activities and may potentiallybe used on typical antimicrobial products. In comparison to othernon-traditional fruits jamun showed considerable high antioxidantactivity, which can constituent such as anthocyanins, tannins and flavonols. Fruits contain many different kinds of anti-oxidant compounds, including flavonoids,phenolics, carotenoids and vitamins, which are all considered bene-ficial to human health, fordecreasing the risk of degen-erative diseases by reduction of oxidative stress, and for the inhibitionof macromolecular oxidation (Kubola *et al.*2011).

Jamun is a potential source of phytochemicals in its various parts: leaves, fruit, seed, and bark. The different investigations have showed the presence of phenols,flavonoids, alkaloids, glycosides, steroids, cardiac glycosides, saponins, terpenoid, and tannins in the Jamun leaves extract as demonstrated by Shyamala et al., (2010) and Reddy et al., (2013). The plentiful abundant constituents of the oils in the Jamun leaves are: α-pinene (32.32%),β-pinene (12.44%), trans-caryophyllene (11.19%), 1, 3, 6-octatriene (8.41%), delta-3-carene (5.55%), α-caryophyllene (4.36%) and α-limonene (3.42%) as reported by Mohamed et al., (2013).

Conclusion

Medicinal plants can be a good alternative for many diseases and conditions. They are low cost and tend to have fewer side effects. Moreover, they can be bought in health food shops, pharmacies and on -line without the need for a prescription. However, herbal medicine can still have unwanted health effects, especially when used in combination with other drugs.

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Molecular Oxygen-Mediated Catalytic Oxidation of Alcohols to Aldehydes: Evaluating the Efficacy of Different Catalysts

Kiran P. Sabale
Arts & Commerce College Warwat Bakal
And
Gopalrao K. Kakade
Arts, Commerce & Science College Kille Dharur

Abstract

We report an efficient process for the oxidation of benzyl alcohols using molecular oxygen as the oxidant catalysed by mixed metal oxides. The catalytic control oxidation of alcohols to aldehydes is a significant transformation in organic chemistry, often requiring environmentally benign oxidants and efficient heterogeneous catalysts. This study we explore the catalytic performance of Co_3O_4, $MoCuCo_3O_4$, $MoCo_3O_4$, and $CuCo_3O_4$ as catalysts for the selective oxidation of alcohols by using molecular oxygen as the oxidant. Catalysts were prepared via the impregnation method, and their structural properties were characterized using X-ray diffraction (XRD). The catalytic reactions were performed in a three-neck glass reactor, with oxygen bubbling and the detail optimization reaction conditions, such as a catalysts, temperature, time, and solvent variations with reaction product where analysed and quantified by GC. The results demonstrated that the$MoCuCo_3O_4$ oxide catalysts shown excellent catalytic activity for alcohol oxidation under milder condition.

Key word: Oxidation, Heterogeneous catalyst, Oxygen Oxidant, Aldehyde

Introduction

The selective control oxidation of benzylalcohols to benzaldehyde aldehydes is a most important transformation in both industry and academia. Different types of aldehyde and its derivatives are key intermediates and ingredients in the food, pharmaceutical, perfume industries [1], [2]. Sort out this global problemby develop efficient catalytic systems for production of high-grade aldehyde are particularly sought for industrial applications. Most of the common industrial commercial route for benzaldehyde production is the hydrolysis of benzyl chloride derived from toluene chlorination. However, contamination of the final product by chlorine and benzoic acid are major limiting factors in its industrial production [4], [5]. Another method has developed benzaldehyde synthesis from toluene, but when use toluene as a tarting material that reaction require very harsh reaction condition [6].

Aromatic aldehyde production through the oxidation process of corresponding aromatic alcohol is potentially important because this process is economically faceable and one step process.Non green stoichiometric oxidant such as a permagnate, chromate, organic permagnate and others halogenated such traditionally transformation were effected environment and cost of

process[7,8].However, the limitation of these process is economically and environmentallycreating disposal challenges.Recently, some research groups havebeen reported efficient catalytic process for the control oxidation of alcohol to aldehyde under milder condition, and generating water as a by-product. However, the main task in this reaction condition is selectivity of aldehyde because the formation of biproducts like over oxidation acid, ether, benzoate, acetal etc [9]. Still date various kind of homogeneous and heterogeneous catalysts reported for the oxidation of alcohol to aldehyde in which using different transition metals Fe, Zn, Zr, Ce, Mn, Co, Ag, Au etc. In which development and utilization of heterogenous catalysts for oxidation process is a better than the homogeneous catalysis, because separation process of homogeneous catalysts is very difficult. So different types of heterogeneous catalysts reported for oxidation of alcohol to aldehyde synthesis such as MnO_2, Cu/CeO_2, Fe/Co_3O_4, Cu/ZrO_2, TiO_2, etc. [10,11].

In this study we are reporting the synthesis of mixed metal oxide $Mo/Cu/Co_3O_4$ oxide catalyst, by using simple impregnation method for catalyst preparation and their use for control oxidation of benzyl alcohol to selectively benzaldehyde synthesis by using oxygen as a oxidant with using catalytic amount H_2O_2 as a reaction initiator. Detail optimization of reaction condition such as a temperature, solvent, catalysts, and time variations.

Experiment

Materials and Reagents

Benzyl Alcohol(LR), $Co(NO_3)_2.6(H_2O)$, $Mo(NO_3)2.6(H2O)$, $CuCl_2$, 1,2-Dichloroethane, Acetonitrile, Tetrahydrofuran (THF), and Dimethyl Sulfoxide (DMSO) were used as received, NaOH, Oxygen, 35% H_2O_2.

Catalyst Preparation

Mixed metal oxide $MoCuCo_3O_4$ catalyst prepared by using very simple incipient wetness impregnation method, here we used our own parameter**[xx]**. Briefly, initially 5 g of Co_3O_4 oxide powder taken in 100 mL beaker then add 20 mL Di. water stir for 15 min at room temperature, up to complete disperse in water. In other beaker make a 2 g of $Mo(NO_3)_2.6H2O$ and 2g of $CuCl_2$ precursors solution in 20 ml water solution. The first beaker cobalt oxide stirred at room temperature and start the dropwise addition of second beaker molybdenum and copper nitrate solution, after complete addition of these metals then add 7 ml (25%) acquis ammonia solution. Stir this solution for one hour at room temperature then start temperature up 80 °C for complete water evaporate. Then obtained solid material dry in oven on 120 °C for overnight then washed by water and again dry in oven and finally calcined on 500 °C for 5 hours in open air muffle furnace. Obtained $Mo/Cu/Co_3O_4$ oxide catalysts characterised by HR-TEM and powder XRD analysis and confirmed the active phases of prepared catalyst (See in SI fig.)

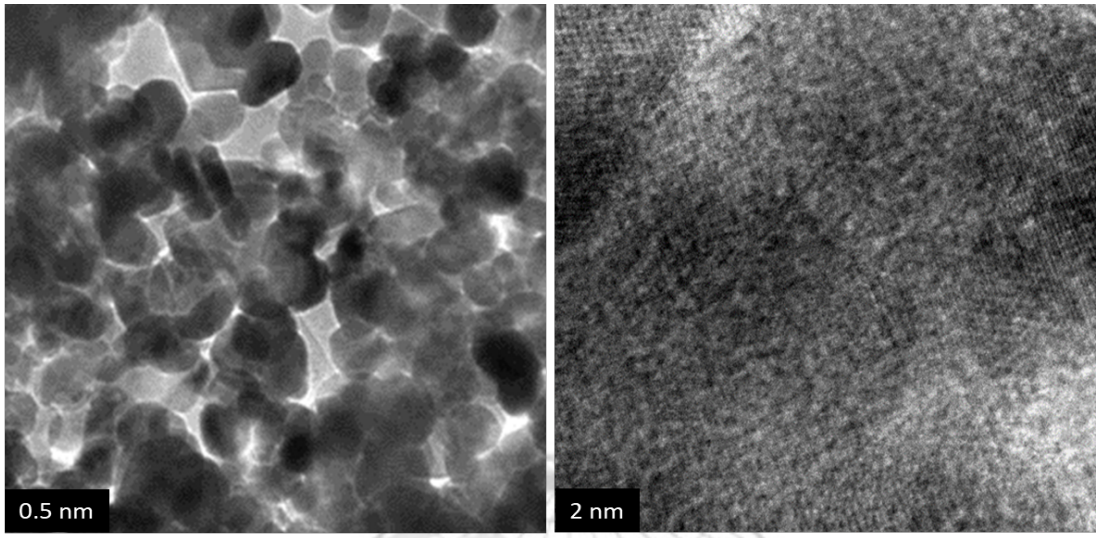

Fig. Hr-TEM

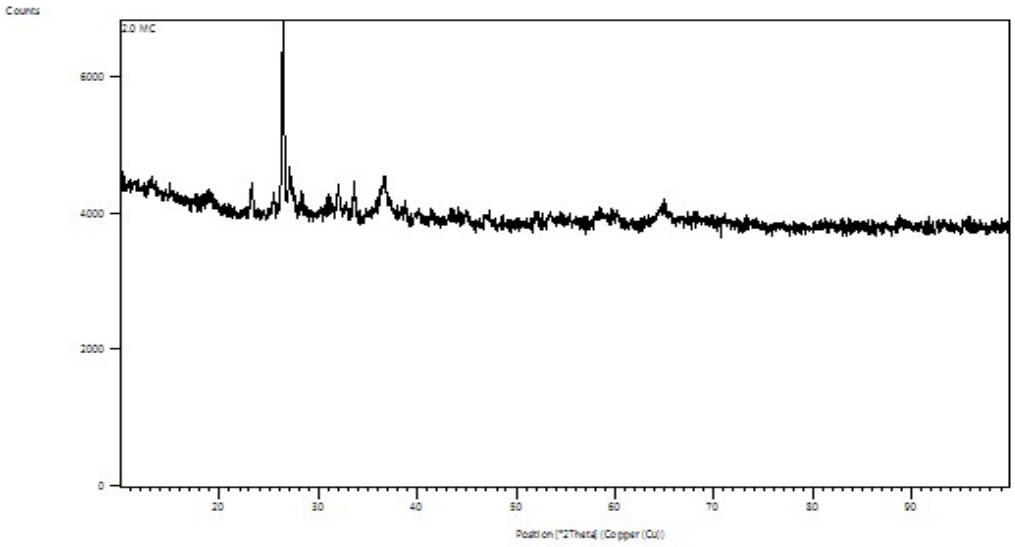

Fig. XRD analysis

Result and Discussion

Catalytic reaction where carried out in 100 mL three neck round bottom flask, set the experiment on magnetic stirrer. Here we choose benzyl alcohol as a model substrate for reaction optimization, so round bottom flask charged by 1 mmol benzyl alcohol, 10 mL dichloromethane, 20 mg freshly prepared MoCu/Co3O4 oxide catalysts, catalytic amount H2O2 add as initiator, 10 mg NaOH as an additive reaction promotor. Then set the RB in oil bath magnetic stirrer, connect with condenser and one side oxygen bubbler connect and other side outlet of bubble oxygen. Performed the reaction on 80 C temperature for 12 hours. After complete the reaction product analyzed by gas chromatography. Describe the reaction detail optimization result and discussion following way.

The catalytic performance of Co_3O_4, supported different loading percent mixed metal oxide

catalysts use for benzyl alcohol oxidation to selectively aldehyde synthesis. Initially check out the simple blank reaction without catalysts and supporting material Co_3O_4 oxide does not showing any conversion of alcohol at reaction condition 1 mol of benzyl alcohol substrate, 20 mg catalysts, 80 C temperature, for 12 hours by using catalytic amount H_2O_2 and oxygen bubbling with 10 mg NaOH same reaction condition use for further. Then check out the bimetallic CuCo3O4 catalysts prepared by same method and check out catalytic activity for oxidation but this catalyst showing 5 % conversion and 100 % selectivity. Further bimetallic $MoCo_3O_4$ oxide catalysts showing 11 % conversion with 90% selectivity of benzaldehyde, both bimetallic Mo and Cu loaded Co_3O_4 oxide catalysts catalytically actie for oxidation but not effectively conversion then we develop the combination of Mo and Cu containing Co_3O_4 supported trimetallic $Mo/Cu/Co_3O_4$ oxide catalysts showing excellent 65% conversion but decrease the selectivity 75% of benzaldehyde and remaining product was observed benzoic acid and benzyl benzoate. The combination of Mo and Cu metal showing synergetic effect that's why increase the conversion oxidation process.

Further extent the optimization study of oxidation of benzyl alcohol, check out the various polar and non-polar solvent for oxidation, here we observed non-polar solvent toluene does not showing any conversion of alcohol. Other side polar protic solvent ethanol showing 17% conversion and 88% selectivity of aldehyde, then check out polar aprotic acetonitrile, DMSO, and THF showing 21, 9 and 15% conversion. Then we check out polar aprotic dichloromethane showing excellent conversion 66% and 75% selectivity of aldehyde. Further optimization temperature variation at lower temperature at 60 °C does not showing any conversion so 80 °C temperature is suitable temperature for this catalytic reaction condition for oxidation process. The kinetic study of this reaction check out, the rate of reaction was at initial tie up to 10 hour continuously increase the conversion but after 12 hour does not effectively increase the conversion of benzyl alcohol so that why we choose the 12 hour reaction time for all reaction optimization (See in SI table). This trimetallic $Mo/Cu/Co_3O_4$ oxide catalysts recycle up to three cycles without loss any activity and selectivity in final product.

Sr.No	Time (hr)	O_2 Pressure (psi)	% Con.	% Sel.
1	8	900	35	80
2	10	900	53	78
3	12	900	65	75
4	14	900	67	73
5	16	900	68	68

Conclusion

The trimetallic Mo/Cu/Co3O4 oxide catalyst efficiently catalysed the aerobic oxidation of benzyl alcohol with 66% conversion of the alcohol 75% selectivity for the benzaldehyde, at 80 °C and 12 h reaction time. The excellent performance of trimetallic mixed metal catalysts for

oxidation under milder condition. Although the Mo and Cu catalyst supported on the Co3O4 exhibited good conversion of the benzyl alcohol, its selectivity for the aldehyde was lacking, but introduction of Cu in the system greatly enhanced the conversion and selectivity because showing syngartic effect with Mo. The detail optimization of this oxidation such catalysts, temperature, solvent and time variation. The overall conclusion of this study, this process is sustainable process for the oxidation benzylic alcohol through molecular oxygen.

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A Short review on Gallium Arsenide (GaAs) Light Emitting Diode (LED)

Sachin V. Mukhamale
Department Of Physics,
Shri Pundlik Maharaj Mahavidyalaya, Nandura (Rly), Maharashtra, India
And
Sakshi Jaware
Department Of Physics,
Shri Pundlik Maharaj Mahavidyalaya, Nandura (Rly), Maharashtra, India
And
Smita Tarale
Department Of Chemistry,
Shri Pundlik Maharaj Mahavidyalaya, Nandura (Rly), Maharashtra, India

Abstract:

Gallium Arsenide (GaAs) Light Emitting Diodes (LEDs) are key components in optoelectronics, offering high efficiency and performance due to GaAs's direct bandgap of 1.42 eV. This abstract discusses the synthesis, properties, and applications of GaAs LEDs, highlighting their advantages in emitting infrared light, which is critical for applications in telecommunications, remote controls, and high-speed data transmission. The material's superior electron mobility and ability to operate at high frequencies make GaAs LEDs particularly effective in advanced communication systems and other specialized applications.

Keywords: LED, GaAs, Gallium Semiconductor, electroluminescence, incandescent and fluorescent lighting.

Introduction:

Gallium Arsenide (GaAs) is a compound semiconductor material that has become a cornerstone in the field of electronics and optoelectronics. Composed of gallium (Ga) and arsenic (As)[1], GaAs is known for its direct bandgap, high electron mobility, and superior performance at high frequencies, making it an essential material in applications where silicon, the most widely used semiconductor, falls short. Key Characteristics of GaAs Direct Bandgap: GaAs has a direct bandgap of 1.42 eV, which allows it to efficiently emit light when electrons and holes recombine. This property is particularly advantageous for optoelectronic devices like LEDs and laser diodes. High Electron Mobility: The material's high electron mobility enables faster signal processing and lower power consumption in high-frequency and microwave applications, making GaAs the material of choice for RF amplifiers and satellite communication systems.Thermal Stability: GaAs exhibits better thermal stability than silicon, allowing it to operate effectively at higher temperatures, which is crucial in power electronics and harsh environments [2]. Applications: GaAs is widely used in a variety of advanced technologies. In optoelectronics, it

serves as the basis for high-efficiency light-emitting diodes (LEDs), laser diodes, and photodetectors. In telecommunications, GaAs is used to manufacture microwave frequency integrated circuits (MMICs) and high-speed transistors that are critical for mobile phones, radar systems, and satellite communications. Additionally, GaAs-based solar cells are among the most efficient available, particularly in space applications where high power-to-weight ratios are essential [3]. Advantages Over Silicon: While silicon dominates the semiconductor industry, GaAs offers several advantages in specific applications. Its ability to operate at higher frequencies with less noise makes it ideal for high-speed electronics. Moreover, the direct bandgap of GaAs enables it to convert electrical energy into light efficiently, a feature that silicon lacks, and thereby limiting silicon's effectiveness in optoelectronic devices [4].Challenges: Despite its advantages, GaAs is more expensive to produce than silicon, and the material is more brittle, which complicates manufacturing processes. These factors have limited its widespread adoption to niche areas where its unique properties are essential [5].

Methodology:

The methodology for producing Gallium Arsenide (GaAs) semiconductors involves several complex steps, from material synthesis to device fabrication. This process is critical to ensuring the high quality and performance of GaAs-based electronic and optoelectronic devices. Here's an overview of the key steps involved in the GaAs semiconductor methodology:

Synthesis Characterization:

1. Crystal Growth

Substrate Preparation: The process begins with the preparation of a substrate, typically made from a high-purity GaAs wafer. The substrate must be free of defects and contaminants to ensure the quality of the subsequent layers [6].

Molecular Beam Epitaxy (MBE):One of the most common methods for growing GaAs crystals is Molecular Beam Epitaxy (MBE). In MBE, gallium and arsenic are evaporated in a high vacuum chamber, where they condense on the substrate to form a single crystal layer of GaAs. This method allows for precise control of layer thickness and composition, essential for creating complex semiconductor structures.

Metal – Organic Chemical Vapor Deposition (MOCVD): Another technique is Metal-Organic Chemical Vapor Deposition (MOCVD), where metal-organic precursors such as trimethylgallium (TMGa) and arsine (As) are introduced into a reactor. The precursors decompose at high temperatures, allowing gallium and arsenic atoms to bond and form GaAs on the substrate. MOCVD is widely used for its scalability and efficiency in producing high-quality GaAs films.

2. Doping

N – Type Doping: Doping is a process used to introduce impurities into the GaAs crystal to modify its electrical properties. For n-type GaAs, donor atoms such as silicon (Si) are introduced, adding free electrons to the material and enhancing its conductivity.

P – Type Doping: For p-type GaAs, acceptor atoms like zinc (Zn) or magnesium (Mg) are used,

which create holes (positive charge carriers) in the crystal structure. The combination of n-type and p-type regions in the GaAs creates a p-n junction, which is essential for diode and transistor operation [7].

3. Wafer Processing

Photolithography: Photolithography is employed to pattern the GaAs wafer. A photoresist is applied to the wafer surface, and then ultraviolet (UV) light is used to transfer a pattern from a mask onto the wafer. The exposed regions of the photoresist are then developed, revealing the underlying GaAs.

Etching: After patterning, etching is performed to remove unwanted GaAs material. Wet or dry etching techniques can be used, depending on the specific requirements. This step shapes the GaAs layer into the desired structures, such as channels for transistors or wells for LEDs.

Layer Deposition: Additional layers, such as insulating oxides or metal contacts, are deposited onto the wafer. Techniques like sputtering or chemical vapor deposition (CVD) are used to apply these layers with precision.

4. Device Fabrication

Formation of Contacts: Metal contacts are deposited on the n-type and p-type regions to allow for electrical connection to the device. These contacts are typically made of gold, aluminium, or other conductive metals.

Annealing: The wafer undergoes thermal annealing, a process that heats the material to activate the dopants and improve the crystalline quality of the GaAs. Annealing also helps in forming ohmic contacts, which are necessary for efficient current flow in the device.

Passivation: To protect the GaAs surface and reduce surface recombination of charge carriers, a passivation layer (e.g., silicon nitride or silicon dioxide) is applied. This layer also enhances the device's stability and performance [8].

Results and discussion: Characterization of Gallium Arsenide (GaAs) is crucial to assess its quality, properties, and suitability for various applications in electronics and optoelectronics. Characterization involves a range of techniques to analyze the material's structural, electrical, optical, and thermal properties [9]. Below are the key methods and aspects involved in the characterization of GaAs:

1. Structural Characterization

X – Ray Diffraction (XRD): XRD is used to determine the crystal structure, phase composition, and crystallographic orientation of GaAs. It provides information on the lattice parameters and identifies any defects or imperfections in the crystal structure.

Scanning Electron Microscopy (SEM): SEM provides high-resolution images of the GaAs surface, allowing for the examination of surface morphology, grain size, and texture. It can also be used to assess the quality of epitaxial layers and the uniformity of thin films.

Transmission Electron Microscopy (TEM): TEM offers detailed insights into the internal

microstructure of GaAs at the atomic level. It can reveal dislocations, stacking faults, and other crystal defects that may affect the material's performance.

Atomic Force Microscopy (AFM): AFM is employed to measure surface roughness and to analyze the topography of GaAs wafers at the nanoscale. It provides a 3D surface profile, which is critical for assessing the smoothness of layers in device fabrication [10].

2. Electrical Characterization

Hall Effect Measurement: Hall effect measurements are used to determine the carrier concentration, mobility, and type (n-type or p-type) of charge carriers in GaAs. These parameters are essential for understanding the material's conductivity and suitability for electronic devices [11].

Current – Voltage (I – V) Characteristics: I-V measurements provide information on the electrical behavior of GaAs devices, such as diodes or transistors. This includes assessing the forward and reverse bias characteristics, breakdown voltage, and leakage currents [12].

Capacitance – Voltage (C – V) Profiling: C-V profiling is used to evaluate the doping profile and the interface quality of GaAs junctions. It helps in determining the depletion region width and the charge distribution within the material [13].

Four – Point Probe Method: The four-point probe method is employed to measure the resistivity [14].

5. Testing and Characterization

Electrical Testing: The fabricated GaAs devices are subjected to various electrical tests to measure their performance. Key parameters such as carrier mobility, current-voltage characteristics, and breakdown voltage are evaluated.

Optical Characterization: For optoelectronic devices like LEDs and laser diodes, optical properties such as emission wavelength, intensity, and efficiency are measured to ensure they meet the desired specifications [15].

Failure Analysis: If any defects or failures are detected during testing, failure analysis techniques such as electron microscopy or spectroscopy may be used to diagnose and correct the issues[16].

6. Packaging

Die Preparation: The GaAs wafer is diced into individual chips, each containing one or more devices. These chips are then mounted onto a package or substrate that provides mechanical support and electrical connections.

Encapsulation: The GaAs devices are encapsulated in a protective material, such as epoxy or ceramic, to shield them from environmental factors like moisture and mechanical stress.

Final Testing: The packaged devices undergo final testing to ensure their performance under real-world conditions. This includes thermal cycling, stress testing, and long-term reliability assessments [17].

7. Application Integration

System Integration: The finished GaAs semiconductor devices are integrated into larger electronic systems, such as mobile phones, satellite communications equipment, or optoelectronic modules [17].

Quality Control: Throughout the entire process, rigorous quality control measures are applied to ensure that the GaAs semiconductors meet industry standards and customer specifications.

This methodology outlines the complex and precise processes required to produce high-performance GaAs semiconductors, which are critical components in advanced electronic and optoelectronic devices.

Conclusions:

Gallium Arsenide (GaAs) stands out as a highly valuable semiconductor material due to its exceptional properties, which make it indispensable in various high-performance applications. Here are the key conclusions regarding GaAs:

GaAs offers several advantages over traditional semiconductors like silicon, particularly its direct bandgap, high electron mobility, and excellent thermal stability. These properties enable GaAs to perform efficiently in optoelectronic devices, such as LEDs and laser diodes, as well as in high-frequency and high-speed electronic applications like RF amplifiers and microwave circuits.

The direct bandgap of GaAs makes it highly effective in converting electrical energy into light and vice versa. This property is crucial for the development of optoelectronic devices, including high-efficiency LEDs, laser diodes, and photodetectors, which are used in communications, medical devices, and consumer electronics

GaAs remains a vital material in the semiconductor industry, particularly in applications that require high performance, efficiency, and reliability. While challenges related to cost and fabrication persist, ongoing innovations in GaAs technology continue to unlock new possibilities, ensuring its relevance in both current and future technological advancements.

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Equitable Access to Mathematics Education in Rural Areas: Strategies for Promoting Student Interest

C. S. Khodre
Department of Mathematics,
Late B. S. Arts, Prof. N. G. Science and A. G. Commerece College, Sakharkherda.

Abstract:

In this paper we study the promotion of interest in mathematics among students in rural areas is an essential step towards achieving equity in education. Mathematics is an essential subject that plays a significant role in daily life, yet students in rural areas often lack the resources and support to develop an interest in this subject. To promote interest in mathematics among students in rural areas, policymakers must implement effective strategies. One such strategy is to use real-life examples and applications of mathematics, making the subject more engaging and relevant to students. Incorporating technology and interactive teaching methods, such as gamification and peer collaboration, can also make mathematics more accessible and enjoyable for students. Community partnerships can provide additional resources, including tutoring and mentoring programs, to support students' academic progress and interest in mathematics. Extracurricular activities like mathematics competitions and workshops can also stimulate students' curiosity and inspire them to pursue careers in mathematics-related fields. By prioritizing and investing in mathematics education, we can provide equitable opportunities for students in rural areas to develop the skills and knowledge necessary for academic and professional success.

Introduction:

Mathematics is a fundamental subject that plays a crucial role in our everyday lives. It provides a foundation for many other subjects and is essential for various careers. However, promoting interest in mathematics among students in rural areas can be challenging due to various factors, such as limited access to resources, cultural beliefs, and lack of exposure to opportunities.To overcome these challenges, we must use effective strategies to make mathematics more accessible, interesting, and relevant to students in rural areas. Providing hands-on and experiential learning opportunities, incorporating technology, creating a positive learning environment, making connections to real-world situations, and addressing negative attitudes are some of the strategies that can be used to promote interest in mathematics among students in rural areas.It is crucial to understand that promoting interest in mathematics among students in rural areas requires a multifaceted approach that considers instructional strategies and cultural factors. By using these strategies, we can engage students and foster their interest in mathematics, which will not only benefit the students but also the wider community by providing a foundation for the growth and development of the rural areas.

Promoting interest in mathematics among students in rural areas can be a challenging task

due to various socio-economic and cultural factors. However, there are several strategies that have been identified in the literature to promote interest in mathematics among students in rural areas.One approach is to provide hands-on and experiential learning opportunities. These types of activities help to make mathematics more tangible and relevant to students' lives, and can help to spark their interest in the subject. For example, teachers can use manipulatives, such as blocks and counters; to help students visualize mathematical concepts.Another strategy is to incorporate technology into mathematics instruction. This can be particularly effective in rural areas, where students may have limited access to resources and opportunities. Teachers can use online math games and simulations, as well as educational software, to engage students and make math more interesting and accessible.

In addition, it is important to create a positive and supportive learning environment. Teachers can do this by encouraging students to ask questions and providing opportunities for them to work collaboratively. This can help to build students' confidence in their mathematical abilities and foster a sense of community in the classroom.Furthermore, it is important to make connections between mathematics and real-world situations that are relevant to students' lives. Teachers can do this by using examples and problems that relate to rural contexts, such as agriculture and farming.Finally, it is important to address any negative attitudes or beliefs that students may have about mathematics. This can be done by highlighting the usefulness and practical applications of mathematics, and by celebrating students' successes in the subject.

Overall, promoting interest in mathematics among students in rural areas requires a multifaceted approach that addresses both instructional strategies and cultural factors. By providing hands-on and experiential learning opportunities, incorporating technology, creating a positive learning environment, making connections to real-world situations, and addressing negative attitudes, teachers can help to engage students and foster their interest in mathematics.

Objectives:

The following are some objectives that can be set to promote interest in mathematics among High School Levelstudents in rural areas:

1. To provide hands-on and experiential learning opportunities to make mathematics more tangible and relevant to students' lives.
2. To incorporate technology into mathematics instruction to make the subject more accessible and interesting for students in rural areas, who may have limited access to resources and opportunities.
3. To create a positive and supportive learning environment that encourages students to ask questions, work collaboratively, and build their confidence in their mathematical abilities.
4. To make connections between mathematics and real-world situations those are relevant to students' lives, such as agriculture and farming, to help them see the practical applications of mathematics.
5. To address negative attitudes or beliefs that students may have about mathematics by

highlighting the usefulness and practical applications of mathematics and celebrating students' successes in the subject.

6. To increase student engagement in mathematics by providing opportunities for students to participate in math-related extracurricular activities and competitions.
7. To improve access to mathematics resources and opportunities, such as tutoring and mentorship programs, for students in rural areas.

By setting these objectives, we can have a clear focus on the strategies they need to implement to promote interest in mathematics among students in rural areas. These objectives can help ensure that the efforts made by we are targeted towards specific outcomes, making it easier to measure their success and adjust their approach accordingly.

Methodology:

Promoting interest in mathematics among High School Level students in rural areas requires a well-designed methodology that is tailored to the unique challenges and opportunities of these regions. Here are some steps that can be taken to promote interest in mathematics among students in rural areas:

1. **Understand the cultural context:**
   It is important to understand the cultural context of the rural area in order to design an effective methodology. Some rural areas may have different attitudes towards mathematics than urban areas, and may require different approaches to engaging students. Therefore, it is important to conduct an assessment of the local context and identify the needs and interests of students.
2. **Collaborate with local schools and teachers:**
   Collaboration with local schools and teachers is essential in promoting interest in mathematics among students in rural areas. Teachers are key stakeholders in the education of students, and they have a deep understanding of the local context and the needs of their students. Therefore, involving them in the design and implementation of the methodology can help to ensure that it is effective and culturally appropriate.
3. **Provide hands-on learning experiences:**
   Students in rural areas may have limited access to technology and other resources, and may benefit from hands-on learning experiences. Providing activities such as science and math fairs, competitions, and field trips can help to promote interest in mathematics and expose students to new and exciting ideas.
4. **Use real-world examples:**
   Mathematics can be made more relevant and interesting to students by using real-world examples that are relevant to their lives. For example, teaching mathematics through agriculture, health, and other topics that are important to rural communities can help to make the subject more engaging.
5. **Provide access to technology:**
   Technology can be a powerful tool in promoting interest in mathematics among students in

rural areas. Providing access to computers, tablets, and other technology can help to make learning more interactive and engaging. Additionally, online resources and tools can help to supplement classroom instruction and provide students with additional opportunities to practice and learn.

6. **Provide mentorship and tutoring:**
   Students in rural areas may not have access to the same level of academic support as their urban counterparts. Providing mentorship and tutoring programs can help to fill this gap and provide students with the support they need to succeed in mathematics.
7. **Celebrate success:**
   Celebrating the success of students in mathematics can help to reinforce the importance of the subject and motivate students to continue learning. Recognition programs, awards, and other forms of public recognition can help to promote interest in mathematics and encourage students to pursue careers in related fields.

Conclusion:

In conclusion, promoting interest in mathematics among students in rural areas is essential to ensure equitable access to quality education. By using real-life examples and applications of mathematics, incorporating technology and interactive teaching methods, and establishing community partnerships, policymakers can make mathematics more accessible, engaging, and relevant to students. Extracurricular activities such as mathematics competitions and workshops can also inspire students to pursue careers in mathematics-related fields.

Furthermore, investing in mathematics education can create opportunities for students in rural areas to develop essential skills such as problem-solving, critical thinking, and decision-making, which are essential for academic and professional success. Therefore, it is vital to prioritize and invest in mathematics education and ensure that every student, regardless of their background, has access to quality mathematics education. With collaborative efforts from policymakers, and community members, we can promote interest in mathematics among students in rural areas and provide them with the tools they need to succeed.

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The Impact of Artificial Intelligence on Society

G. R. Kankale
B. Sc. III year, Department of Computer Science, Shri. D. M. Burungale Science & Arts College, Shegaon, (M.S.), India
And
V. V. Agarkar
Assistant Professor, Department of Computer Science, Shri. D. M. Burungale Science & Arts College, Shegaon, (M.S.), India

Abstract:

Artificial Intelligence (AI) refers to the development of machines that replicate human intelligence and are designed to think and act like humans. AI can learn from experience, make decisions, and carry out tasks that usually demand human intelligence. Artificial Intelligence (AI) is increasingly becoming a central force in shaping the future of society. Its influence spans across multiple domains, including healthcare, education, industry, governance, and everyday life. AI's ability to process vast amounts of data and make decisions at unprecedented speeds has led to innovations that are revolutionizing these sectors. This paper deals with the impact of AI on society. AI is reshaping society in profound ways, offering numerous benefits while also posing significant challenges. Its impact is wide-ranging, affecting the economy, job market, healthcare, education, and even our social and ethical norms. As AI continues to advance, it will be crucial to navigate these changes thoughtfully to maximize the benefits while minimizing the risks. As AI continues to evolve, it is essential that AI technologies are developed and deployed in a manner that benefits all members of society and promoting its role as a tool for positive societal transformation while minimizing potential harms.

Keywords – Artificial Intelligence (AI), AI Integration, Algorithmic Bias.

1. Introduction

Artificial Intelligence (AI) refers to the simulation of human intelligence processes by machines, particularly computer systems. This includes learning, reasoning, and self-correction. AI's rapid development has led to significant changes in various sectors, raising questions about its overall impact on society. This paper aims to explore these impacts in depth. As AI technology advances rapidly, it brings both exciting opportunities and significant challenges. On the one hand, AI can make our lives easier and more efficient, helping with tasks in healthcare, education, and finance. On the other hand, it raises concerns about job displacement, privacy, and ethical issues [1]. This paper explores how AI is impacting different areas of society, looking at both the benefits it brings and the problems it poses. Understanding these effects is crucial as we continue to integrate AI into our daily lives and shape a future where technology plays a central role.

2. Historical Context and Evolution

AI has evolved from early symbolic AI to modern deep learning systems. Key milestones include the development of expert systems in the 1970s, the advent of machine learning algorithms in the 1990s, and the recent advances in neural networks and natural language processing [2].

3. Economic Impact

- **Job Market Transformation**: AI has led to both job displacement and creation [3]. Automation of routine tasks has reduced the need for certain roles, while new opportunities in AI development and data science have emerged.
- **Productivity and Innovation**: AI-driven tools enhance productivity by automating repetitive tasks and optimizing operations. Businesses leverage AI for data analysis, predictive maintenance, and customer service [4].

4. Social Impact

- **Privacy and Security**: AI technologies, particularly those involving data collection and surveillance, raise concerns about privacy and data security.
- **Ethical Considerations**: The deployment of AI systems can lead to ethical dilemmas, such as algorithmic bias and discrimination. Ensuring fairness and transparency in AI decision-making processes is crucial [5].

5. Challenges of AI

- **Job Displacement**: Automation and AI can lead to job losses as machines and software take over tasks previously done by humans. This can affect many industries, from manufacturing to customer service.
- **Privacy Concerns**: AI systems often require large amounts of data, which raises concerns about data privacy and security. There is a risk that personal information could be misused or exposed.
- **Bias and Fairness**: AI algorithms can inherit biases from their creators or the data they are trained on, leading to unfair or discriminatory outcomes. For example, biased AI could impact hiring practices or law enforcement.
- **Ethical Issues**: Decisions made by AI systems can raise ethical questions, such as how to ensure AI makes fair choices and how to handle situations where AI may cause harm [6].
- **Dependence on Technology**: Increased reliance on AI might lead to over-dependence, where individuals and organizations may struggle to function effectively without AI tools.

6. Future Possibilities

- **Advanced AI Integration**: Future AI systems could be more integrated into various aspects of life, from enhancing daily convenience to solving complex global problems.
- **AI in Education**: AI could revolutionize education by providing personalized learning experiences and helping educators tailor instruction to individual student needs.

- **Ethical AI Development**: As AI technology evolves, there will be a greater focus on developing ethical guidelines and standards to ensure AI benefits society while minimizing risks.
- **Collaboration between Humans and AI**: The future may see more collaboration between humans and AI, where AI handles complex data analysis and humans provide creativity and critical thinking.
- **Global Impact**: AI has the potential to address global challenges, such as climate change and health crises, by providing innovative solutions and improving resource management [7].

7. Healthcare Impact

- **Diagnostic and Treatment Advances**: AI has improved diagnostic accuracy and personalized treatment plans. For instance, AI algorithms analyze medical images to detect diseases at earlier stages.
- **Healthcare Management**: AI tools assist in managing patient records, predicting patient outcomes, and optimizing hospital operations [8].

8. Education Impact

- **Personalized Learning**: AI-powered educational tools provide personalized learning experiences by adapting to students' needs and learning styles.
- **Administrative Efficiency**: AI systems help automate administrative tasks such as grading and scheduling, allowing educators to focus more on teaching [9].

9. Governance and Policy

- **Regulation and Policy Frameworks**: Governments and organizations are developing policies to regulate AI technology and address ethical concerns.
- **Global Collaboration**: International cooperation is essential for creating consistent regulations and standards for AI technology [10].

10. Conclusion

Artificial Intelligence is having a profound impact on society, bringing numerous benefits and posing significant challenges. As AI continues to evolve, it will be crucial to address its ethical, social, and economic implications to ensure that its advantages are maximized while minimizing potential drawbacks. By understanding and managing these impacts, society can better harness the power of AI for a positive future.

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Blockchain Technology: Applications, Works, Challenges and Uses

G. S. Raundale
B. Sc. III year, Department of Computer Science,
Shri. D. M. Burungale Science & Arts College, Shegaon, (M.S.), India,
And
S. K. Dabre
B. Sc. III year, Department of Computer Science,
Shri. D. M. Burungale Science & Arts College, Shegaon, (M.S.), India
And
S. M. Pakhare
B. Sc. III year, Department of Computer Science,
Shri. D. M. Burungale Science & Arts College, Shegaon, (M.S.), India
And
V. V. Agarkar
Department of Computer Science,
Shri. D. M. Burungale Science & Arts College, Shegaon, (M.S.),

ABSTRACT

Blockchain technology is a distributed ledger system designed to securely and immutably record transactions across a network of computers. Blockchain technology is a system designed to securely record information, making it nearly impossible to alter, hack, or manipulate. It operates by generating a series of blocks, each containing a list of transactions. These blocks are chronologically linked, forming an unbroken chain.Blockchain technology provides a secure, transparent, and unchangeable record of transactions, enabling decentralized operations and automating processes with smart contracts. Some of the features of Blockchain technology are transparency, security, chain, nodes, etc. Blockchains are used in various areas such as cryptocurrencies, smart contracts, supply chain management, and voting systems. Blockchain technology involves in transaction initiation, verification, block creation, block verification, block addition, and consensus achievement. Blockchain technology faces some challenges like scalability and Energy Consumption. Also it addresses challenges in traditional systems, such as security issues, lack of transparency, and inefficiencies caused by intermediaries. As the technology evolves, Blockchain technology's potential applications and impact across various sectors continue to grow. This paper emphasis the applications, uses, challenges and work of the Blockchain technology.

Keywords – Blockchain, Cryptocurrency, smart contracts, Cryptography.

1. Introduction

A blockchain is a distributed ledger technology that maintains a secure and immutable record of transactions across a network of computers. Each record, or "block", contains a list of

transactions and is linked to the previous block, forming a "chain" of blocks [1]. This structure ensures that once data is recorded, it is very difficult to alter. Artificial intelligence (AI), which enables machines to learn from data and make decisions based on their learning, is a highly visible and rapidly advancing field [2]. Blockchain is a new way to handle digital transactions safely and clearly [1]. It records transactions in a chain of blocks, with each block checked and added to the chain [3]. Key benefits include making transactions transparent, secure, and managed by a network of computers [4]. It's used in health care and education [1]. However, it faces issues like slowing down with more transactions and high energy use [5]. Despite these, blockchain has great potential for many industries [4].

The paper is structured as follows, section 1 introduce the Blockchain Technology, section 2 reviews related works of Blockchain Technology, section 3 gives features of Blockchain Technology, section 4 discusses the application Blockchain Technology, section 5 briefs Challenges of Blockchain Technology, section 6 gives uses of Blockchain Technology and section 7 gives cconclusions.

2. Related Work

A blockchain transaction begins when a request is made and broadcasted to the network [1]. Nodes, or participants in the network, then verify the transaction against a set of predefined rules to ensure its validity [3]. In Nakamoto S. [1] once the transaction is validated, it is grouped with other transactions into a block. This block, containing the validated transactions, is subsequently verified by the network's nodes to ensure its integrity [6]. In Tapscott et al. [3] after verification, the block is added to the blockchain, permanently recording the transactions. Finally, the network reaches consensus, ensuring that all nodes agree on the validity of the new block, and updating all copies of the blockchain to reflect the latest changes [1].

3. Features of Blockchain Technology

Some following features of the Blockchain Technology:

In a blockchain network transparency is a key feature, as all participants can see the transactions recorded on the blockchain, ensuring that everyone has access to the same information [4]. Security is another crucial aspect, achieved through cryptographic techniques that protect data from tampering and unauthorized alterations [1]. The blockchain itself consists of a chain of blocks, where each new block is linked to the one before it, creating a continuous and unchangeable sequence [3]. Yli-Huumo et al. [6] stated that nodes, which are the computers involved in the network, play an essential role by maintaining a copy of the blockchain and validating new transactions to ensure their accuracy and integrity.

4. Applications of Blockchain Technology

Here are some important Applications:

Cryptocurrencies such as Bitcoin and Ethereum leverage blockchain technology to facilitate secure and decentralized transactions [1][7]. This means that these digital currencies operate without a central authority, relying instead on a distributed ledger to verify and record transactions. Beyond cryptocurrencies, blockchain also enables the use of smart contracts [1] self-

executing agreements where the contract terms are encoded directly into the blockchain. These smart contracts automatically execute when predefined conditions are met, streamlining and automating various processes. In supply chain management, blockchain helps track goods from production to delivery, enhancing transparency and reducing opportunities for fraud by providing a clear, immutable record of each step in the supply chain [8]. Additionally, blockchain technology is being applied to Tapscott et al. [3] voting systems, offering a secure and transparent method for casting and counting votes. This application aims to prevent tampering and fraud, ensuring that election results are accurate and trustworthy.

5. Challenges with Blockchain Technology

Scalability is a significant challenge for blockchain networks as they expand. As the number of transactions on the network increases, it can lead to delays and higher transaction fees. This is because the blockchain must process a greater volume of transactions, which can overwhelm the network's capacity and slow down its overall performance. The increased demand on the network's resources can lead to congestion, making transactions take longer to confirm and increasing costs for users [5]. Energy consumption is another major issue, particularly for blockchain networks that use Proof of Work (PoW) consensus mechanisms. These networks require extensive computational power to validate transactions and secure the network. This heavy reliance on computing resources results in high energy usage, which has significant environmental impacts due to increased carbon emissions. Additionally, the substantial energy requirements contribute to higher operational costs, which can affect the overall sustainability and affordability of using such blockchain systems [9].

6. Uses of Blockchain Technology

Blockchain technology holds transformative potential across various sectors, including healthcare and education. In healthcare, blockchain can enhance the security and privacy of patient records, ensuring that sensitive information is protected while making it easier to share data across different health organizations. This can streamline processes and improve coordination between providers. Additionally, blockchain can ensure that medical research data is accurate and trustworthy by providing an immutable record of research findings and data provenance [10]. In education [11], blockchain can revolutionize how academic records and achievements are stored and verified. By securely recording educational credentials on a blockchain, schools and employers can easily and reliably check qualifications and verify achievements. This not only streamlines the verification process but also helps prevent diploma fraud and ensures the integrity of educational records.

7. Conclusion

Blockchain technology is a powerful tool that helps securely and transparently record transactions in a way that's hard to alter. It's widely used in areas like cryptocurrencies, smart contracts, supply chain management, and voting systems because it offers clear benefits such as improved security and reduced reliance on intermediaries.

However, blockchain faces some challenges, including slower transaction speeds and high

energy use, especially with certain types of blockchain systems. As the technology advances, solutions to these problems are likely to improve its efficiency and reduce its environmental impact.

Beyond its current uses, blockchain has promising applications in other fields like healthcare and education. It can help keep sensitive information safe, make verifying identities easier, and securely manage educational records.

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Blockchain Technology: Architecture, Security and Applications

M. P. Chaudhari
B. Sc. III year, Department of Computer Science,
Shri. D. M. Burungale Science & Arts College, Shegaon, (M.S.), India
And
S. V. Rajvaidya
B. Sc. III year, Department of Computer Science,
Shri. D. M. Burungale Science & Arts College, Shegaon, (M.S.), India,
And
V. V. Agarkar
Department of Computer Science,
Shri. D. M. Burungale Science & Arts College, Shegaon, (M.S.), India,

ABSTRACT

Blockchain technology, which originated with Bitcoin, has evolved into a versatile and powerful tool with applications across various sectors. This paper examines the architecture of blockchain, emphasizing its decentralized, transparent, and immutable nature. The decentralized structure ensures that no single entity has control, while transparency allows all participants to view transactions, and immutability prevents any alteration of recorded data. Security features of blockchain, such as cryptographic hashing, consensus mechanisms, and smart contracts. Cryptographic hashing ensures data integrity by converting input data into a fixed-size string of characters, which is unique to each input. Furthermore, explore the applications of blockchain technology in various fields, including finance, healthcare, and supply chain management. Blockchain technology enhances security and transparency in financial transactions and supply chain management by reducing fraud and improving efficiency through traceability.

Keywords – Blockchain, Bitcoin, Cryptocurreny.

I. Introduction

Blockchain technology is a revolutionary concept that has garnered significant attention across various domains. At its core, Blockchain is a decentralized, distributed ledger technology that enables secure and transparent recording of transactions in a tamper-resistant and immutable manner [1]. The record of all these transactions must be stored somewhere in some databases. Why it is not considered that databases are reliable? The first reason is that it does not have access to the database and second the administrator of the database can go and change the database at any time. So it is not reliable. So, it came up with a system which is decentralized meaning that one person should not have his authority but it should be shared with everyone. Secondly, it becomes almost impossible to change or modify, such a system can be trusted more. Such a system and such a

database are called Blockchain.

The Blockchain came into existence in 1990 when research started and it was actually implemented in 2009. An anonymous developer named Satoshi Nakamoto created Bitcoin with the help of Blockchain [2]. Bitcoin has been a cryptocurrency ever since with the help of Blockchain.

Blockchain in simple language, then it is like there are many records at a shop, which goods came and which goods went, it is said from whom it came, so the entire book of this record is called ledger or account. So Blockchain is that account and its single record is that single block. Blockchain is a chain of blocks, meaning a chain of these records. Now, these single blocks, the some information or data is saved inside the block.

The first thing that is stored is relevant information such as for bitcoins. Transaction information, who received the bitcoins and who is receiving them. Similarly different data is stored for different cases. The second thing that is stored is the hash and the hash as a unique fingerprint. As soon as a unique code is generated for the Blockchain, then hash is generated. The third thing that is stored is the hash of previous block.

Two significant attributes of this technology are its scalability and decentralized nature. These characteristics offer major advantages for Blockchain's use. However, they can also introduce challenges to the technology's security [3].

Over the past decade, Blockchain technology has gained significant popularity and is increasingly being applied in various fields such as healthcare, IOT and cryptocurrency. This review study focuses on the different types of Blockchain technology usage, the techniques employed, and the various applications. It also examines the security and privacy-related issues associated with these applications [4].

II. Overview of Blockchain

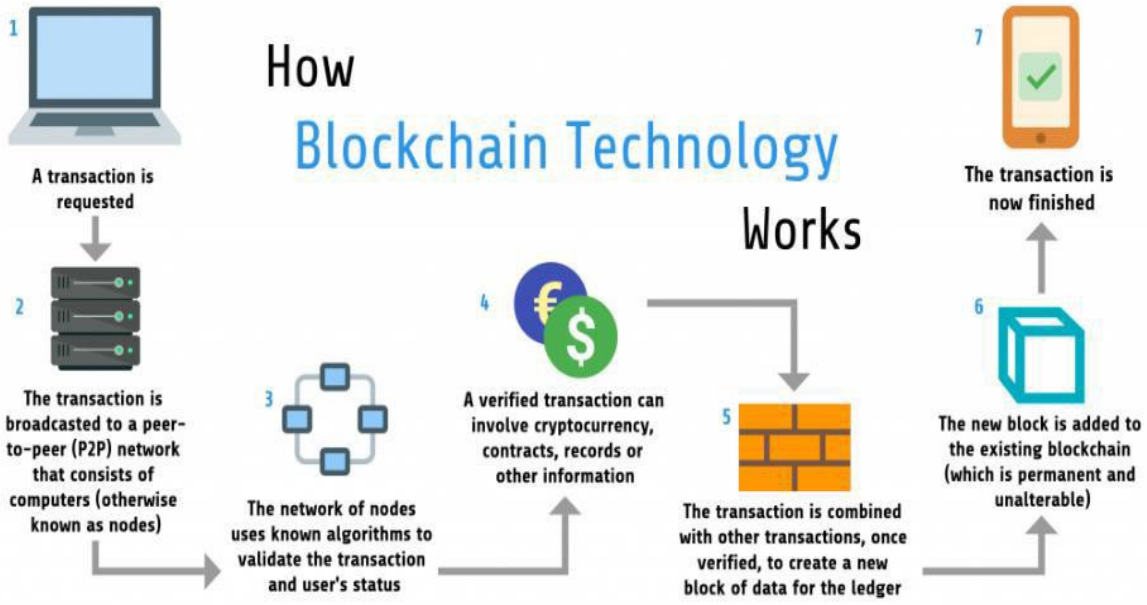
- Distributed Ledger

  A distributed ledger is a record of transactions that can only be appended to and is shared across multiple machines. The 'append-only' feature is essential: new transactions can be added, but existing ones cannot be deleted or modified. Even if a new transaction reverses a previous one, both transactions remain in the ledger, ensuring audit ability and preserving long-term integrity.

- Blockchain

  A Blockchain is a distributed ledger organized into a linked list of blocks, each containing an ordered set of transactions. Cryptographic hashes are typically used to secure the link between a block and its predecessor. These hashes ensure that previous blocks cannot be altered; if a block were changed, its new hash would not match the original, breaking the link between the blocks [5].

III. Architecture of Blockchain Technology



[Fig. Blockchain Technology [6]]

Blockchain architecture relies on a distributed database called Distributed Ledger Technology. This system stores data across multiple nodes, ensuring transparency, immutability, and enhanced security. Data is stored in interconnected blocks, each containing a hash of the previous block, transaction data, and a timestamp, forming a continuous chain of blocks [7].

a. Block

A block has two main parts:

i. Block Header
ii. List of Transactions

The Block Header consists of three elements:

i. Previous Block Hash: This links the current block to the previous one.
ii. Mining Data: Information used to create the block.
iii. Merkle Tree Root: The hash of the current block, which helps verify all transactions in the block.

The second part of a block contains a list of valid transactions

The number of transactions per block varies based on the block and transaction sizes. Transactions are authorized and authenticated using asymmetric cryptography. Once added to the chain, transactions cannot be removed or altered. Each block is linked to the previous one through a hash, forming a continuous chain of blocks, known as a Blockchain [8].

b. Digital Signature

Each one of user has a pair of private and public keys. The private key, which must remain confidential, is used to sign transactions. These digitally signed transactions are broadcast across

the network. The digital signature process involves two phases: signing and verification. For example, if wants to send a message to anyone:

i. Signing phase: It encrypts data with private key and sends the encrypted result along with the original data.
ii. Verification phase: It uses public key to validate the data. This allows checking if the data has been tampered with [7].

IV. Block Chain Security

To reduce cyber-security risks Blockchain technology has unique capabilities: (I) Removing single points of failure Blockchain technology enhances network resiliency. (II) The consensus mechanism ensures the transparency and integrity of the ledger. (III) It is highly challenging for hackers to inject or deploy malicious software or malware [9].

IoT networks are beginning to use Blockchain for security, and in healthcare, Blockchain helps keep personal health data private and secure [10].The basic idea of Blockchain is closely linked to transactional data and can be applied to various security uses [11].

V. Applications of Blockchain

- BT in Internet of Things

Blockchain technology has emerged as a significant player in the realm of the Internet of Things. Insecure IoT devices have already led to major cyber incidents, such as the October 2016 attack on Dyn, an Internet routing company, which disrupted over 80 popular websites and affected Internet traffic across the US. According to Findlay, the solution lies in integrating IoT with Blockchain and cyber security systems [12].

- **BT in Cryptocurrency**

Blockchain technology is extensively used in the financial sector, particularly in the form of cryptocurrencies, which are introduced and managed through application software. Cryptocurrency employs a highly secure method known as encryption technology to facilitate direct transactions between buyers and sellers without the need for third-party intervention [13].

- **BT in smart contracts**

Smart contracts automatically carry out agreements between buyers and sellers. These agreements are written in code and stored on a decentralized Blockchain network [14].Smart contracts act like a person, automatically executing codes and temporarily holding assets [15].A smart contract doesn't need to involve multiple parties or be legally binding [16].

- **BT in Publishing E-Books & Protect Digital First Sale Right**

Currently, using e-Books involves third-party interference, forcing libraries or users to pay for entire packages, regardless of usage. Additionally, authors lack full control over their creations. Blockchain technology can address these issues. Authors can establish smart contracts to specify their own terms and conditions for their books. These smart contracts operate on the Ethereum network, allowing anyone to purchase books using book tokens [6].

VI. Conclusion

The Blockchain technology is a secure and decentralized digital ledger that stored information in linked blocks, making it highly trustworthy. Its architecture ensures that once data is added, it cannot be changed. The security of Blockchain comes from being managed by multiple computers (nodes) rather than a single entity, making it nearly impossible to hack. Beyond cryptocurrencies like Bitcoin, Blockchain has diverse applications, including secure financial transactions, IoT, Smart Contracts, Cryptocurrency, and Publishing E-Books & Protect Digital First Sale Right. Overall, Blockchain offers a reliable way to store and verify information across various industries.

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The Role of Internet of Things (IoT) in Smart Education

S. A. Avchar
B. Sc. III year, Department of Computer Science,
Shri. D. M. Burungale Science & Arts College, Shegaon, (M.S.), India
And
S. S. Wankhade
B. Sc. III year, Department of Computer Science,
Shri. D. M. Burungale Science & Arts College, Shegaon, (M.S.), India
And
V. V. Agarkar
Department of Computer Science,
Shri. D. M. Burungale Science & Arts College, Shegaon, (M.S.), India,

ABSTRACT

The Internet of Things (IoT) refers to a network of interconnected physical devices, vehicles, home appliances, and other objects equipped with sensors, software, and connectivity, enabling them to collect, exchange, and respond to data. Meanwhile, smart education is an innovative learning approach that utilizes advanced technologies, data analytics, and digital tools to foster a personalized, adaptive, and inclusive learning environment. This paper examines the concept of IoT and its impact on smart education, exploring how IoT-enabled solutions can improve learning outcomes, boost student engagement, and enhance teacher productivity. The key benefits, challenges, and limitations of IoT implementation in education are identified through a systematic review of current literature and case studies. The findings of this study contribute to advancing the understanding of IoT's role in education, offering valuable insights for educators, policymakers, and technologists aiming to leverage IoT to create a more efficient and intelligent educational system.

Keywords – Internet of Things (IoT), Smart Education, IoT in Education.

1. Introduction

The Internet of Things (IoT) has revolutionized various aspects of modern life, and education is no exception. The integration of IoT in education has given rise to the concept of "Smart Education", which harnesses the power of connected devices, sensors, and data analytics to create personalized, efficient, and immersive learning experiences. IoT-enabled smart education systems can track student engagement, automate administrative tasks, and provide real-time feedback, making the learning process more effective and enjoyable. With the ability to connect physical and virtual learning environments, IoT has the potential to bridge the gap between theory and practice, preparing students for success in an increasingly interconnected world. This paper examines an overview of IoT in smart education institutions, especially in universities and takes a look at

several emerging trends that are evolving smart education, and explore the potential impact of IoT and the future of the IoT in smart education.

The paper is structured as follows, Section-1 Introduce IoT, Section-2 Architecture of IoT, Section-3 IoT in Education, Section-4 Impact of IoT on smart education, Section-5 future of IoT in smart education, and Section-6 concludes the research.

2. IOT Architecture

The architecture of IoT varies based on its functionality and application across different sectors. It is composed of four layers: the Sensing Layer, Network Layer, Data Processing Layer, and Application Layer.

- **Sensing Layer –** This layer includes sensors, actuators, and devices. The sensors and actuators collect physical or environmental data, process it, and transmit the information over the network.
- **Network Layer–** This layer consists of Internet/network gateways and the Data Acquisition System (DAS). The DAS is responsible for collecting, aggregating, and converting sensor data, such as turning analog signals into digital form. Advanced gateways facilitate the connection between sensor networks and the Internet while providing essential functions like malware protection, filtering, decision-making based on the input data, and data management services.
- **Data Processing Layer–** This is the processing hub of the IoT ecosystem, where data is analyzed and pre-processed before being sent to data centers. From there, the data is accessed by business applications, which monitor and manage it. Edge IT or edge analytics plays a significant role at this stage, enabling faster decision-making.
- **Application Layer –** The final layer of IoT architecture, where data centers or cloud platforms manage the collected data. This data is utilized by end-user applications in various sectors, such as agriculture, healthcare, education, aerospace, farming, and defense [1].

3. Io T in Education

Information and communication technologies have revolutionized learning, shifting it from traditional methods to digital-based learning [2][3][4]. IoT is one such paradigm contributing to this transformation. This section reviews studies on the general application of IoT in education. Pei et al. [5] analyzed the benefits of IoT in education, focusing on the advantages and disadvantages of mobile education. They proposed a mobile education architecture that leverages cloud technology for flexibility and scalability. Additionally, an IoT-based mobile learning tool was developed for primary schools in northern Thailand [6], aiming to enhance teaching effectiveness by utilizing a large number of tablet computers. Furthermore, Saritas [7] conducted a detailed study exploring the relationship between IoT, cloud computing, and the emerging learning theory of connectivism. He concluded that educational institutions must develop a comprehensive strategy that includes curriculum updates, professional development for teachers, educational philosophy, data security, legal and political considerations, and resource and infrastructure transformation to address the unique challenges ahead.

To address the challenge of incorporating numerous IoT-related courses into STEM curricula, He et al. [8] proposed transforming core STEM courses by integrating an IoT-based learning framework into their lab projects. The study outlines the design of the framework and suggests effective learning strategies to overcome the identified challenges. Maenpaa et al. [9] conducted a study focused on addressing practical, problem-based project courses. The study introduces a framework for evaluating students' learning outcomes, regardless of their diverse educational backgrounds. Additionally, Kamal et al. [10] developed a learning kit to teach the fundamental concepts of IoT technology, incorporating Blockchain to distribute digital information. The combination of IoT and blockchain in the kit effectively introduced learners to both technologies in an engaging and accessible manner.

Majeed and Ali [11] proposed a model to transform a university campus into a smart environment through the adoption of IoT technology. The study aimed to integrate IoT into education by connecting physical objects, sensors, and controllers via the Internet. The model focuses on creating smart classrooms, smart parking areas, and delivering smart education to university students. Additionally, Kassab et al. [12] conducted a study introducing a 3-D scheme for IoT in education. The study first outlined the ethical, technical, economic, and physical challenges of implementing IoT in education. It then presented a 3-D scheme consisting of three dimensions: delivery mode, perception, and learning principles. The study demonstrated how IoT adoption can benefit instructors, students, and staff by enhancing the academic environment. Interestingly, while schools and universities are being made smarter, it is expected that individuals, in turn, should be made smarter by these institutions.

4. Impact of Internet of Things on Smart Education

The IoT is set to impact every aspect of society in the near future. Smart education institutions, particularly universities, have the potential to lead advancements in IoT technologies, business models, ethics, and the development of future IoT-driven economies across various disciplines. The IoT is not merely a technological advancement within the industry but has the potential to drive widespread change across society, including higher education institutions. IoT is poised to lead transformation in smart education, bringing reforms to educational technology, teaching methods, learning processes, management, campus environments, and teaching resources, as noted by [13].

This evolution will offer greater convenience for students and make teaching more efficient for instructors. With an increasing number of connected devices and technologies, instructors will be able to focus more on meaningful learning experiences for students rather than being burdened by routine tasks. IoT enhances the learning experience by providing real-time, actionable insights into student performance. As students, especially at the university level, increasingly shift from textbooks to technologies like tablets and laptops, advanced e-learning applications enable them to learn at their own pace and have a consistent experience both in the classroom and at home [14].

5. Future of IoT in Smart Education

Universities have long recognized the potential of technology to transform teaching, learning, and assessment. Moreover, technological disruption is essential for a modern university to differentiate its student offerings, boost admissions, improve retention, and achieve desired outcomes. However, preparing students to confidently enter the workforce is a complex task. It demands strong academic leadership, access to high-quality curricula and content, and opportunities for students to engage with new technologies effectively. With the rise of the Internet of Things (IoT), many smart education institutions have begun to focus on IoT-related technologies and their application [15].

Although education may not be an immediately obvious application of the IoT, it is indeed part of the list [16], with numerous applications in universities that have far-reaching implications. IoT has the potential to greatly enhance operational efficiency across all learning environments. It can support classroom instruction by improving learning settings, enriching learning resources, advancing teaching methods, increasing management efficiency, and reducing management costs.

6. Conclusion

The integration of IoT into smart education has dramatically reshaped the structure of learning environments, revolutionizing how teaching and learning are conducted. This shift has greatly improved student engagement, personalization, and accessibility, resulting in better educational outcomes. As IoT continues to advance, its potential in smart education is vast, with emerging trends like AI-driven adaptive learning, immersive technologies, and smart campuses set to further enhance the learning experience. To fully realize this potential, ongoing innovation and investment in IoT infrastructure, pedagogical research, and teacher training are crucial. This will lead to a more inclusive, efficient, and connected smart education system that equips students for success in an increasingly interconnected world.

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Feature Extraction of Images Using Hu's Invariants

V. V. Agarkar
Assistant Professor,
Department of Computer Science,
Shri. D. M. Burungale Science & Arts College, Shegaon (M.S.), India

Abstract

The rapid growth in the use of digital images over the past few decades has made automatic shape recognition and feature extraction increasingly important in today's digital world. Image processing, which utilizes computer algorithms to extract valuable information from digital images, plays a crucial role in this context. It encompasses tasks such as visualization, pattern recognition, feature extraction, and classification. One approach in image processing involves using moment invariants as features, which can uniquely represent an object's shape. These features are invariant to changes in translation, scale, and rotation. This paper aims to explore the effectiveness of moment invariants in feature extraction from digital images. Two experiments were conducted to evaluate the moment invariants' robustness against rotation and scale changes. The results showed that most of the seven features exhibited only minor fluctuations when the image was rotated or scaled.

Keywords – Moment Invariant, Image processing, Pattern Recognition

1. INTRODUCTION

Digital computers have seen remarkable advancements over the past few decades, leading to the availability of data from nearly every field in digital format. This data includes multimedia forms such as text, images, videos, and audio. Digital images, in particular, hold vast amounts of information that require analysis, for which digital image processing techniques are employed. Digital image processing is rapidly replacing optical image processing [1] due to its greater flexibility and the wider range of algorithms available for processing digitally stored data. Digital image processing relies on computer algorithms to perform various operations on images. Fundamental steps in this process include image acquisition, morphological processing, segmentation, recognition, feature extraction, and classification. The advent of affordable computers and specialized hardware in the 1970s made digital image processing more accessible [2]. Moment invariants have been extensively used in image pattern recognition due to their invariance under image translation, scaling, and rotation. While moments are strictly invariant for continuous functions, images in practical applications are discrete, meaning that geometric transformations may affect these moment invariants [3].

The paper is structured as follows, Section 1 introduces digital image processing, Section 2 reviews related work on moment invariants, Section 3 outlines measures of moment invariants, Section 4 discusses their application in digital images and experimental background, Section 5 presents results and discussion, and Section 6 concludes the research.

2. RELATED WORK

The literature review started science the introduction of moment invariants, focusing on their application in various areas of image processing. The concept of moment invariants dates back to the 19th century, rooted in algebraic invariants theory [4]. In 1962, Hu [5] applied this theory to pattern recognition by constructing seven rotation invariants for 2-D objects. Since then, many studies have refined and expanded Hu's work, with applications in fields such as satellite image, and character recognition [6].

Invariant moments have diverse applications in image processing, such as pattern recognition, image normalization, registration, focus measurement, and watermarking [7]. Human facial expression recognition has become a growing field, with feature extraction being a key step. Geometric moment invariants were used for facial expression recognition [8], while Hu's moment invariants were applied to extract shape and texture features [9].

Moment invariants have been applied by various researchers in different areas of image processing, with significant growth in medical image processing in recent decades. S. Sharma et al. [10] used Zernike moments and a support vector machine (SVM) to detect abnormalities in digital mammograms, achieving better results with Zernike moments of order 20. S. Urooj et al. [11] developed a framework for geometric invariant feature extraction using Hu's moment invariants, testing the method for scale and rotation invariance. Y. M. Vaidya et al. [12] presented an algorithm for extracting features from retinal blood vessels using geometric and Zernike moment invariants. Hu's moment invariants were also applied to feature extraction in radiographic images of dental caries [13] and object comparison on radar satellite imagery [14].

3. MOMENT INVARIANTS

Feature extraction using moment invariants involves identifying and quantifying characteristics of an object's shape within an image that remain consistent despite transformations like translation, scaling, and rotation. Moment invariants are mathematical descriptors derived from the moments of an image, which are statistical measures related to the pixel intensity distribution. These invariants are particularly valuable because they provide a set of features that uniquely describe the shape of an object, regardless of its orientation or size within the image. Hu [5] provided the mathematical basis for two-dimensional moment invariants and exhibited their applications for shape recognition. Hu's moment invariant values are invariant to translation, scale and rotation of the shape.

Hu [5] defines seven of these shape descriptor values computed from central moments through order up to three that are independent to object translation, scale and orientation. Translation invariance moments are derived by calculating central moments, size invariance moments are achieved from algebraic invariants and a set of seven invariant moments can be calculated from the second and third order values of the normalized central moments which are independent of rotation.

Moment invariants are usually calculated based on the information provided by both the

shape boundary and its interior region [5]. Given a function *f(x,y)*, these regular moments are defined by:

$$M_{pq} = \iint x^p y^q f(x,y) dx dy \quad (1)$$

Where, M_{pq} is the two-dimensional moment of the function *f(x, y)* for *p*, *q* = 0, 1, 2, …. The order of the moment is *(p+q)* where *p* and *q* are both natural numbers. For implementation in digital form this becomes:

$$M_{pq} = \sum_X \sum_Y x^p y^q f(x,y) \quad (2)$$

Image centroids are used to define the central moment and to normalise the image for translation. The equation (2) further used to calculate the co-ordinates of the centre of gravity of the image and is shown by:

$$\mu_{pq} = \sum_X \sum_Y (x - \bar{x})^p (y - \bar{y})^q \quad (3)$$

Where, $\bar{x} = \frac{M_{10}}{M_{00}}$ and $\bar{y} = \frac{M_{01}}{M_{00}}$

The central moments do not change; therefore, the central moments are invariants under translation. From (3), it is easy to express the central moments of order up to 3 are as follows in expression (4).

$$\eta_{pq} = \mu_{pq} / \mu_{00}^{\gamma} \quad (4)$$

Where the normalization factor: $\gamma = (p+q/2) + 1$. A set of seven values can be determined from normalized central moments and they are described by:

$$\phi_1 = \eta_{20} + \eta_{02}$$

$$\phi_2 = (\eta_{20} - \eta_{02})^2 + 4\eta_{11}^2$$

$$\phi_3 = (\eta_{30} - 3\eta_{12})^2 + (3\eta_{21} - \eta_{03})^2$$

$$\phi_4 = (\eta_{30} + \eta_{12})^2 + (\eta_{21} + \eta_{03})^2$$

$$\phi_5 = (\eta_{30} - 3\eta_{12})(\eta_{30} + \eta_{12})[(\eta_{30} + \eta_{12})^2 - 3(\eta_{21} + \eta_{03})^2] + (3\eta_{21} - \eta_{03})(\eta_{21} + \eta_{03})[3(\eta_{30} + \eta_{12})^2 - (\eta_{21} + \eta_{03})^2]$$

$$\phi_6 = (\eta_{20} - \eta_{02})[(\eta_{30} + \eta_{12})^2 - (\eta_{21} + \eta_{03})^2] + 4\eta_{11}(\eta_{30} + \eta_{12})(\eta_{21} + \eta_{03})$$

$$\phi_7 = (3\eta_{21} - \eta_{03})(\eta_{30} + \eta_{12})[(\eta_{30} + \eta_{12})^2 - 3(\eta_{21} + \eta_{03})^2] - (\eta_{30} - 3\eta_{12})(\eta_{21} + \eta_{03})[3(\eta_{30} + \eta_{12})^2 - (\eta_{21} + \eta_{03})^2]$$

(5)

All the seven Hu's [5] invariant moments, ϕ_I, $1 \leq I \leq 7$, computed on the shape boundary and its interior region and also shown to independent to scale and rotation.

4. MOMENT INVARIANTS APPLIED TO DIGITAL IMAGE

Image processing systems typically involve image acquisition, preprocessing, feature extraction, and classification. Pattern recognition is a key aspect of such systems, with moment invariants often used for shape recognition, addressing a common problem in pattern recognition. The digital image in Fig.1 was used for the experiment, with necessary preprocessing steps [15]

applied. All algorithms were tested using MATLAB version 7.

[Fig. 1: A Digital Image (Source: Internet)]

5. RESULTS

This section presents the results of applying moment invariants to the chosen image for shape recognition. The test image (Fig. 1) was processed in MATLAB 7. In the first experiment, the image was rotated counterclockwise direction from 0° to 60° in 10° increments, and seven invariant moments were calculated. Results, shown in Table-I, indicate that ϕ_3, ϕ_5, and ϕ_7 exhibit near-rotational invariance. In the second experiment, the image was scaled by factors from 0.1 to 0.5 in 0.1 increments. Table-II summarizes the results, showing that except ϕ_4, other $\phi 1$ to ϕ_7 display almost scale-invariant properties, though ϕ_4 fluctuate the most.

[Table-I: Features of Moment Invariant under different rotation angles]

Rotation by 10 degrees							
	ϕ_1	ϕ_2	ϕ_3	ϕ_4	ϕ_5	ϕ_6	ϕ_7
Original	5.2199	10.6070	25.6442	23.7814	50.3284	30.3170	50.2041
10º	4.9415	10.0104	25.6423	23.7227	50.3287	30.4784	50.2026
20º	4.7731	9.6622	25.6498	23.7766	50.3223	31.5298	50.2016
30º	4.6435	9.4013	25.6416	23.9619	50.3270	31.1070	50.2057
40º	4.5930	9.3105	25.6497	24.2551	50.3418	30.1531	50.2151
50º	4.5928	9.3278	25.6486	24.5544	50.3266	29.7590	50.2028
60º	4.6427	9.4535	25.6372	24.7030	50.3167	29.6319	50.1998

[Table-II: Features of Moment Invariant under different Scaling factors]

Scaling by 0.1 factor							
	ϕ_1	ϕ_2	ϕ_3	ϕ_4	ϕ_5	ϕ_6	ϕ_7
Original	5.2199	10.6070	25.6442	23.7814	50.3284	30.3170	50.2041
0.1	5.2437	10.6512	25.5185	24.0676	50.5094	30.6842	50.7195
0.2	5.2219	10.6118	25.6885	23.7678	50.3039	30.3118	50.2077
0.3	5.2255	10.6161	25.6407	23.7908	50.3522	30.3255	50.2127
0.4	5.2222	10.6119	25.6419	23.7922	50.3436	30.3483	50.2294
0.5	5.2264	10.6211	25.6534	23.7899	50.3630	30.3337	50.2180

6. CONCLUSION

This study explores feature extraction using moment invariants. Seven moment invariant features were used to extract invariant characteristics from the test image. Two experiments were conducted to evaluate rotation and scale invariance. The results showed that most of the seven features exhibited only minor fluctuations when the image was rotated or scaled.

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Evaluation of biodegradation capacity of bacterial isolate

Nilesh Ananda Sonune
Department of Microbiology
Adarsha Science, J. B. Arts and Birla Commerce Mahavidyalaya Dhamangaon Rly.

Abstract:

Bacterial strain NS 12 was isolated from sewage water and it was tested for bioremediation ability of sewage water in term of reduction in chemical oxidation demand, ammonical nitrogen and phosphate. This isolate was identified as Serratia liquefaciens based on morphological, cultural and biochemical tests.The study showed that reduction in COD, ammonical nitrogen and phosphateby S. liquefaciens was found to be 58.62%, 40%and 24.98 after 72 h, respectively.

Keywords: Ammonical nitrogen, bioremediation, COD, sewage water

Introduction:

In recent year, sewage effluent disposed into water bodies due to uncontrolled urbanization results into water pollution (Wignyanto *et al*., 2009). Sewage water contains components of residential, institutional, commercial and industrial establishments. The composition of sewage is differ widely but may contain more than 95% water with pathogens. Chemical contaminants include organic particles; inorganics particles (Sonune and Garode, 2015). Because of high organic material, sewage water has high concentration of COD, ammonical nitrogen and phosphate. The quality of waste water is determined by analyzing these parameters and they provide crucial information of the quality of the waste water (Loos *et al*., 2013).

The use of bacteria to reduce the pollutants from the polluted site which results into the restoration of the site without further disruption to the local environment is term as bioremediation. Bioremediation is an economical, eco-friendly and requires less expensive techniques for water pollution. However, the correct microbe should be utilized in the appropriate place with the precise environmental factors (Vezzulli *et al*., 2004).

Hence, the aim of the present study was to determine the ability of bacterial isolate for bioremediation of sewage water.

Materials and method:

Sample collection and isolation of bacteria

Sewage water was collected according to standard procedures from American Public Health Association (APHA, 2005). Sewage water sample was serially diluted and inoculated on the Nutrient agar medium separately. Morphologically different colonies were isolated and maintained at 4^0C on nutrient agar slants and were identified by morphological and biochemical characteristics based on Bergey's Manual of Determinative Bacteriology (Holt, 1994).

Analysis of parameters

Sewage sample was analyzedbefore and after the treatment. The parameters were analyzed by using Standard Methods for the Examination of Water and Wastewater (APHA, 2005).

Bioremediation study of bacteria

Each bacterial cultures were inoculated individually in pre-sterilized 50 ml waste water broth i.e. only waste water. The flask was kept in a shaker at 120 rpm for 48 h at 37^0C. The O.D. of cell suspension was adjusted to 0.5 by using sterile saline solution (0.85%) at 600 nm. Inoculum of each isolates (10%) was taken in 250 ml flask containing 90 ml non-sterile waste water separately. Along with this, one control flask was used containing only non-sterilized waste water. These flasks were kept in shaker at 120 rpm for 72 hr. After treatment, all samples were centrifuged at 10,000 rpm for 20 minutes at 10^0C and supernatants were used for further analysis (Sonune and Garode, 2018).

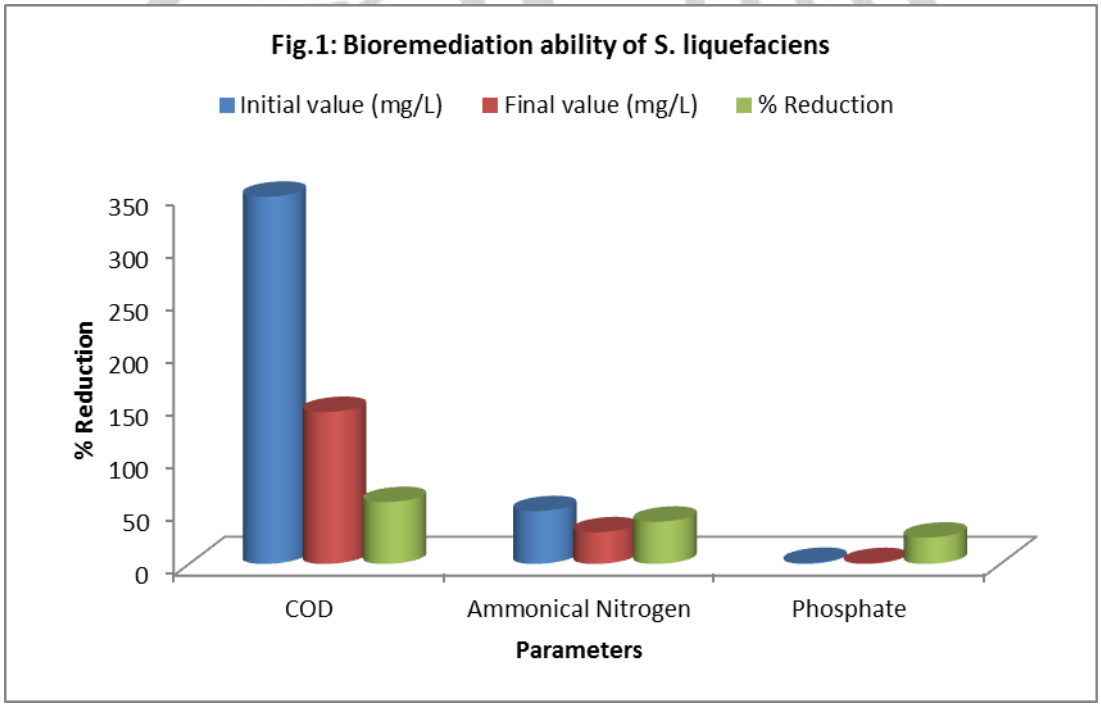
Result and discussion:

Isolation and characterization of bacteria

Bacterial strain NS 12 was isolated from sewage water and was identified as *S. liquefaciens* based on morphological and biochemical characteristics.

Bioremediation study of bacteria

S. liquefaciens was examined for reduction of COD, ammonical nitrogen and phosphate of sewage water by batch experimentsby using Standard Methods for the Examination of Water and Waste water (APHA, 2005). The results of biodegradation of wastewater by *Serratia liquefaciens* NS12 was shown in fig.1.



The initial COD of sewage water was found to be 348 mg/L.It was reduced to 144 mg/L (58%) by *S. liquefaciens* after 72 h of treatment. The reduction in COD values could be related with utilization of organic material by bacteria present in the water.The previous study reported that *Serratia marcescens* has potential to reduce physicochemical characteristics of sugar mill effluent (Saranraj and Stella, 2012). Similarly, Mazzucotelli *et al.,* (2014) reported the use of *Serratia* sp. for treatment of dairy waste water.

Discharge of sewage water in large amounts significantly increases the nitrogen content in aquatic ecosystems that leads to severe ecological stress and biodiversity loss. The initial ammonical nitrogen of sewage water was found to be 50 mg/L.*Serratia liquefaciens* NS12 showed 40% reduction in ammonical nitrogen and reduce it up to 30 mg/L. Zhang *et al*., 2022 reported isolation of ammonical nitrogen reducing *B. idriensis, B. australimaris* and *P. oleovorans.*

In present study, the initial phosphate of sewage water was found to be 1.04 mg/L which was below permissible limit.The phosphate was reduced to 0.78 mg/L from sewage water by *Serratia liquefaciens* NS12 (24.98%).The previous study reported bacteria that reduced phosphate (Seviour *et al*., 2003).

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Antimicrobial Activity of *Azadirachta indica* (Neem) Old and Juvenile Leaves against Microorganisms

S. N. Mendhe
Department of Microbiology,
Shri Shivaji Science and Arts College, Chikhli, Dist. Buldhana
And
J. K. Ingle
Department of Microbiology,
Shri Shivaji Science and Arts College, Chikhli, Dist. Buldhana

Abstract:

From the ancient time Azadirachta indica (Neem) used as a herbal remedies and also used in Ayurvedic, and Unani medicines worldwide especially in Indian Subcontinent in the treatment and prevention of various diseases. Azadirachta indica (Neem) has one of the* richest *sources of antioxidant.* It *is a member of the Meliaceae family and belongs to genus Azadirachta. The present study was carried out to evaluate antimicrobial activity of Azadirachta Indica (Neem) old leaf & juvenile leaf against microorganism such as Escherichia coli, Salmonella typhi, Vibrio cholera, Staphylococcus aureus and Pseudomonas aeruginosa. Azadirachta indica leaves both old and young were collected from the chikhli nearest towns and botanical garden in Shri Shivaji Science and Arts College, Chikhli. The required pure cultures of the test microorganisms used for antimicrobial study were obtained from the P.G. Department of Microbiology, Shri Shivaji Science and Arts College, Chikhli. All the test microorganisms were screened for their antibacterial activity against old and young leaf extract of Azadirachta indica by agar well diffusion method. Both old and young leaf extract of Azadirachta indica showed more inhibition zone against Vibrio cholerae and Pseudomonas aeruginosa, while Salmonella typhi, Staphylococcus aureus and Escherichia coli are less inhibition zone to neem extract of old and young leaf.

Keywords: *Azadirachta indica*, *Escherichia coli, Salmonella typhi, Vibrio cholera, Staphylococcus aureus and Pseudomonas aeruginosa.*

Introduction:

Azadirachta indica (Neem) plants parts shows antimicrobial role through inhibitory effect on microbial growth/potentiality of cell wall breakdown. Azadirachtin, a complex Azadirachtin limonoid present in seeds, is the key constituent responsible for both antifeedant and toxic effects in insects (Mordue (Luntz) *et al.,* 2000). *Azadirachta indica* L. (Neem) shows therapeutics role in health management due to rich source of various types of ingredients. The most important active constituent is Azadirachtin and the others are nimbolinin, nimbin, nimbidin, nimbidol, sodium nimbinate, gedunin, salannin, and quercetin.

Leaves contain ingredients such as nimbin, nimbanene, 6-desacetylnimbinene, nimbandiol, nimbolide, ascorbic acid, n-hexacosanol and amino acid, 7-desacetyl-7-benzoylazadiradione, 7-desacetyl-7-benzoylgedunin, 17-hydroxyazadiradione, and nimbiol (Ali A, 1993, Hossain M. A., *et al.,* 2011 and Kokate C. *et al.,* 2010). Aqueous extract of neem leaf has a good therapeutic potential as antihyperglycemic agent in IDDM and NIDDM (Mossadek and Rashid, 2008; Patil *et al.*, 2013). Neem tree has adaptability to a wide range of climatic, topographic and edaphic factors. It thrives well in dry, stony shallow soils and even on soils having hard calcareous or clay pan, at a shallow depth. Neem tree requires little water and plenty of sunlight (Tewari D. N., 1992). The Neem seeds in traditional medicine to treat infections conditions especially those involving the eye and ear. Administration of alcoholic extract of Neem flower disrupts the estrous cycle in Sprague Dawley rats and causes a partial block in ovulation and has the potential of an ideal antifertility agent (Gbotolorun S. C. *et al.,* 2008). The great potential Neem aqueous extract as powerful chemotherapeutic and viral agent (Hassan Amer *et al.,* 2010). Medicinal properties of the plant *Azadirachta indica* were studied by several workers. They were anti-pyretic (Okpanyi and Ezeukwk, 1981**;** Khattak *et al.,* 1985), anti-malarial and anti-tumour effect (Fujiwara *et al.,* 1982), anti-ulcer effect (Pillai and Santhakumari, 1984), anti-diabetic effect (Patil *et al.,* 2013), anti-fertility effect (Sinha *et al.,* 1984), effect on central nervous system and antioxidant activity (Bandyopadhyay *et al*., 2002). *Azadirachta indica* in folklore medicine for the treatment of Diabetes and show the potential role of anti diabetic activity (Shravan kumar Dholi *et al.,* 2011). Aqueous extract of Neem leaf extract has a good therapeutic potential as anti hyperglycemic agent in IDDM and NIDDM (Sonia Bajaj, and Srinivasan B.P 1999).

Material and Methods:

Collection of plant old and young leaf and extract preparation: *Azadirachta indica* leaves were gathered from the nearest towns of Chikhli and the botanical garden at Shri Shivaji Science and Arts College, Chikhli. The leaves collected were healthy and without any deformities. They were brought to the laboratory for further processing. In the lab, the leaves were cut into small pieces and then ground into a powder using a blender. This powder was sieved to ensure uniform particle size and stored in an airtight container in a moisture-free environment. For extraction, careful selection of solvents was made to meet both extractability and regulatory standards. Approximately 25 grams of the powder were weighed and added to a conical flask containing 200 ml of distilled water. The mixture was shaken thoroughly to ensure the powder was fully dissolved. The flask was then kept at room temperature under aseptic conditions for 7 to 8 days, after which the mixture was extracted and filtered through muslin cloth and Whatman filter paper. The resulting liquid was centrifuged at 4,000 rpm for 5 minutes to separate the pure extract, which was then stored at 4°C for further use.

Isolation of Test Organisms: Pure cultures for the antimicrobial study were obtained from the P.G. Department of Microbiology at Shri Shivaji Science and Arts College, Chikhali. The test organisms were cultured on nutrient agar slants and maintained through regular sub-culturing.

Prior to use, the cultures were preserved at 4°C.

Antibacterial Activity: The antibacterial activity of the old and young leaf extracts of *Azadirachta indica* was evaluated against the test organisms using the agar well diffusion method. With the increasing range of antimicrobial agents available, it became essential to conduct antimicrobial susceptibility tests. In this procedure, the antimicrobial agent was allowed to diffuse into the medium and interact with the test organism, which had been freshly spread on the plate. The antibacterial activity was assessed using Mueller-Hinton agar.

Preparation of Stock Solution: To perform antimicrobial tests on the selected cultures, a stock solution of the extract was prepared. For this, 1 g of the extract, consisting of 0.5 g leaf extract, was accurately weighed and dissolved in 10 mL of DMSO, resulting in a stock solution with a concentration of 100 mg/mL. The solution was then centrifuged, and the supernatant was transferred to a separate test tube, sealed with paraffin wax, and stored at 4°C for future use.

Agar Well Diffusion Method: Muller-Hinton agar plates were prepared for assessing antibacterial activity. A 0.1 mL aliquot of a fresh 18-hour-old broth culture was evenly spread over the media. After spreading, wells 6 mm in diameter were created at the center of each plate using a sterile cork borer. The wells were opened using sterile forceps, and 100 µL of the stock solution was added to each well with a micropipette, resulting in a final concentration of 1 mg/mL. The plates were left at room temperature for 30 minutes to allow the extract to diffuse before being incubated at 37°C for 24 hours.

Results and Discussion:

Based on observations from the cultured nutrient agar plates, the antibacterial activity of *Azadirachta indica* young and old leaf extracts was assessed against both gram-positive and gram-negative bacteria. The extracts demonstrated a larger inhibition zone against *Vibrio cholerae* and *Pseudomonas aeruginosa*, whereas *Escherichia coli*, *Staphylococcus aureus* and *Salmonella typhi* showed lower susceptibility to the neem extracts.

Table No. 1. Antimicrobial activity of young and old leaf extract of *Azadirachta indica*.

Sr. No.	Name of test Microorganism	Zone of inhibition
1	*Vibrio cholerae*	18mm
2	*Pseudomonas aeruginosa*	16mm
3	*Escherichia coli*	13mm
4	*Staphylococcus aureus*	11mm
5	*Salmonella typhi*	12 mm

The results of this study are consistent with the findings reported by various researchers. *Azadirachta indica* leaves possessed good anti bacterial activity, confirming the great potential of bioactive compounds and is useful for rationalizing the use of this plant in primary health care (Saradha jyothi, Subbarao 2011). The extracts of Neem when used as medicinal plant, could be useful for the growth inhibition of the carcinogenic bacterium, S. sobrinus. (Md

Mohashine Bhuiyan *et al.,* 1997). Oil from the leaves, seeds and bark possesses a wide spectrum of antibacterial activity action against gram-negative and gram-positive microorganisms. Koona and Budida (2011) reported the antimicrobial activity of the seed oil against a variety of pathogens. Antimicrobial effects of neem extract have been demonstrated against Streptococcus spp. (Mehrotra *et al.,* 2010). The phytoconstituents alkaloids, glycosides, flavanoids and saponins are antibiotic principles of plants. These antibiotic principles are actually the defensive mechanism of the plants against different pathogens (Hafiza, 2000).

Conclusion:

This study aimed to evaluate the impact of *Azadirachta indica* leaf extracts on five bacterial strains, *Vibrio cholerae*, *Pseudomonas aeruginosa*, *Escherichia coli, Staphylococcus aureus* and *Salmonella typhi*. Among the extracts, ethanol proved to be the most effective for both fresh and dried neem leaves, with fresh leaves showing superior efficacy compared to dried ones. *Azadirachta indica* is beneficial for medicinal purposes. Increasing awareness and utilization of neem alongside other traditional herbs could be advantageous. *Azadirachta indica* leaf extract is a valuable source of compounds with a range of properties, including antimicrobial, antioxidant, antitumor, antimalarial, antifungal, anti-inflammatory, and antiviral effects. The results suggest that neem plant parts have a positive impact on managing microorganisms and could potentially be incorporated into therapeutic formulations in the future.

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Studies On Synergistic Activity of Plant Extract Combinations Against MDR and Biofilm Producing *E. coli*

A. P. Nagrale
Assistant professor, Department of Microbiology
Shri Dnyaneshwar Maskuji Burungale Science and Arts College Shegaon, Maharashtra, India
And
P. M. Deshmukh
Mohsinbhai Zaweri Arts, Commerce and Science College · Wirshi Ward, Bramhapuri Road, Desaiganj (Wadsa). District - Gadchiroli Pin Code- 441207
And
K. D. Hivase
Mohsinbhai Zaweri Arts, Commerce* and *Science College · Wirshi Ward, Bramhapuri Road, Desaiganj (Wadsa). District- Gadchiroli Pin Code- 441207

Abstract:

The synergistic activity of ethanolic plant extract of different plants was tested against MDR and Biofilm producing E. coli isolates. Six different combinations of ethanolic extracts of four plants was investigated and zone of inhibition was recorded.The zone of inhibition for the combinations was observed to be in the range of 2- 24 mm diameter. The synergistic activity of Ocimum sanctum/ Eucalyptus globulus showed strong and best inhibition against E. coli isolates with mean value of 20.3 ± 0.3 mm. nearly, 50 % of the isolates were found to be inhibited at the inhibition zone of 20 mm and above. The lowest antibacterial activity was recorded for the combination of Eucalyptus globulus/ Azadirachta indica with mean value of 4.9 ± 0.0 mm. The isolates for these combinations were inhibited at zones of inhibition greater than 15 mm by 52.5% and 62.5%, respectively. The best antibacterial activity was recorded for Ocimum sanctum/ Eucalyptus globulus against isolate EC- 43 with zone of inhibition of 23.7 ± 0.3 mm. The lowest antibacterial activity was recorded from the combination of Eucalyptus globulus/ Azadirachta indica of 2.1 ± 0.0 mm zone of inhibition against four E. coli isolates EC- 9, EC- 11, EC- 44, and EC- 45 respectively.

Keywords: Synergistic Activity, plantextracts, antibacterial, agar-well diffusion method.

Introduction:

Antibiotic resistance in microbes is one of the biggest problems facing global public health. The effectiveness of antimicrobial drugs has lost its potential due to the evolution of pathogen resistance. It is a fact that continuous exposure of bacteria to antibiotics resulted in the development of resistant microbial strains, which has created an interest in finding a substitute for antibiotics. In a quest to find an alternative to antibiotics, medical practitioners widely used medicinal plants to treat infectious diseases and were set into systematic scientific investigations. The emergence and spread of antibiotic-resistant microorganisms also triggered this plant

investigation.

Biofilm formation is well known for its physical and biological properties that confer antibiotic resistance, making it one of the significant challenges in modern antibiotic therapy (Gunn et al., 2016; Peterson et al., 2015). Clinical studies have focused on the bacteria *Escherichia coli* and *Staphylococcus epidermidis. E. coli* O157: H7 is a Gram-negative foodborne pathogen that develops Shiga toxins and causes life-threatening diseases such as hemorrhagic colitis, hemolytic uremic syndrome, and thrombotic thrombocytopenic purpura (Coombes et al., 2011; Xue & Zhu, 2018). If conditions are in place, *E. coli* O157: H7 can form biofilms on biotic and abiotic surfaces, including stainless steel sheets, polymers, glass, and plant tissues (Coombes et al., 2011).Plants can naturally produce a wide range of molecules, especially secondary metabolites, which have been shown to protect plants from pathogens due to their biological properties (Hancock et al., 2015). Bhardwaj et al., (2016) studied herbal drugs that have great potential as antimicrobial agents. In combination with each other or with other antimicrobial agents, they may be of immense value in decreasing the use of antibiotics. The synergistic effects between herbal drugs and antibiotics against resistant bacteria provide a new and alternative way of treatment of resistant microbes. The synergistic action is of more importance in cases where antibiotics are no longer effective as a therapeutic agent. Combinations of herbal drugs in form of essential oils provide an effective and economical way in combating antibiotic-resistant bacteria. The analysis of a combination of herbal drugs with other aroma-therapeutic essential oils has largely demonstrated against the pathogens tested.

Chhetri et al., (2017), reported the effect of effect four plants for six Synergistic combinations of leaf extract of four medicinal plants- *Azadirachta indica, Artemisia vulgaris, Castanopsis indica* and *Ocimum tenuiflorum* against five strains of MRSA were studied at five different concentrations. the synergistic effect was observed with equal volume combination of *Ocimum tenuiflorum* + *Castanopsis indica, Ocimum tenuiflorum* + *Artemisia vulgaris, Ocimum tenuiflorum* + *Azadirachta indica, Castanopsis indica* + *Artemisia vulgaris, Castanopsis indica* + *Azadirachta indica, Artemisia vulgaris* + *Azadirachta indica*. The combination of plant extracts with *Castanopsis indica* exhibited better inhibitory activity against all isolates of MRSA.

Materials and Methods:

Isolation and identification of clinical isolates:

The different clinical samples like urine, pus, sputum, blood, implant specimens, etc. were collected from hospitalized and outdoor patients from private clinics and nursing homes from Amravati and Akola city for isolation and identification of *E. coli.*These isolates were identified based on routine cultural, morphological, biochemical characteristics, other tests using Bergey's Manual of Systematic Bacteriology and confirmation of isolates by 16S rRNA molecular studies.

Determination of Drug resistance profile of isolated pathogen: Identified isolates were screened for their sensitivity and resistance profile against commercially available antibiotics disc by Agar disc diffusion method. The inhibitory zone size was interpreted according to CLSI, 2012

guidelines

All ingredients and media were purchased from Hi-Media Laboratories Pvt. Ltd. Mumbai, India and prepared in double distilled water.

Biofilm Production Assay: Biofilm production was assayed by the Tube method- A loopful of test organisms inoculated in 10 ml of trypticase soy broth with 1% glucose in test tubes. Incubate the tubes at 37ºC for 24 h. After incubation, tubes were decanted and washed with phosphate buffer saline (pH 7.3) and dried. Tubes were then stained with crystal violet (0.1%). Wash excess stain with distilled water. Tubes were dried in inverted position. The scoring for tube method was done according to the results of the control strains. Biofilm formation was considered positive when a visible thick film lined the wall and the bottom of the tube. (Christensen et al., 1985).

Collection of plant materials:

The medicinal plant *Azadirachta indica* (Neem) parts like leaves, flowers, seeds, fruits and roots etc. were collected from selected from different localities of Amravati region, East of Maharashtra state, India. The collected plant materials were transported soon to the Research Laboratory and washed with sterile water. Plants were identified and authenticated by a competent authority in the Department of Botany, Adarsha Mahavidyalaya, Dhamangaon (Rly). And all the plant parts were placed for shade dry and then made a fine powder with a mechanical grinder and collect in an airtight container then subsequently used for extraction using Soxhlet extractor using different solvents such as chloroform, acetone, ethanol, and methanol with increasing polarity. Crude extracts were obtained through filtration by using Whatman No.1 filter paper and bottled in containers and concentrated at 40ºC using drier and Extracts were stored in sterile capped bottles under refrigeration conditions (4ºC) prior to use for subsequent assays.

Determination of synergistic action of essential oils

The essential oils were coupled in a 1:1 ratio to test their synergistic activity. Sterile Muller Hinton agar plates were prepared as per the composition. The plates were then swabbed with 24 hour old cultures of the selected isolates and a sterile disc of 6 mm diameter (Hi-Media, Mumbai) was soaked with an essential oil combination to be tested. The discs were placed on the surface of seeded Petri plates, aseptically and essential oils were allowed to diffuse into the agar.The plates were then left undisturbed for 30 min. After incubation at 37 ºC for 24 hours, the plates were checked for the zone of inhibition. at 37 ºC for 24 hours. The test was performed in triplicates.

Result &Discussion

In our present study a total of 342 samples, 94 urine samples, 83 sputum samples, 77 blood samples, 46 pus samples and 42 catheter samples were sampled with relevance to Multiple Drug Resistance (MDR). Out of the 342 samples, the isolates were shortlisted and identified by the biochemical investigation. IMViC test provides the key to the identification based on the biochemical tests as illustrated in table 1.0. *E. coli* andisolation percentage was 41.30% shown in table 1.1

Table 1.0 Descriptive statistics of clinical microbial samples

Sr.no	Type of sample	Sampling number	Predominant isolates
			E. coli
1	Urine	94	61
2	Sputum	83	3
3	Blood	77	2
4	Pus	46	2
5	Catheter Tip	42	8

Table 1.1 Percentage of isolates

Sr.no	Microbe	Total	Percentage of isolates
1	*Escherichia coli*	76	41.30%

The antibiotic susceptibility of 76 *E. coli*, cultures isolated from the clinal samples were tested. The antibiogram of the cultures were found using amoxicillin (10 µg), ampicillin (10 µg), Ticarcillin (75 µg), Pristinamycin (15 µg), Nalidixic acid (30 µg), ciprofloxacin (5 µg), ofloxacin (5 µg), cefotaxime (30 µg), cefoxitin (30 µg), Kanamycin (30 µg), azithromycin (15 µg) and Clarithromycin (15 µg). Amoxicillin, ampicillin and Ticarcillin formed the penicillin group of antibiotics. Pristinamycin belonged to the streptogramin group, nalidixic acid and ofloxacin belonged to fluoroquinolones, cefotaxime, and cefoxitin belonged to the cephalosporin group, Kanamycin belonged to aminoglycoside group whereas azithromycin and clarithromycin belonged to macrolide group. The definition of Multiple Drug Resistance mentions the microbe to be resistant to at least one of the antibiotics from any three groups of antibiotics. The same was followed in this research. *E. coli* was resistant to Penicillin (Beta-lactam group) of antibiotics, with about 88.16 % showing resistance. The isolated *E. coli* showed to be susceptible to aminoglycosides as per this research

Table 1.2

Antibiotic group	*E. coli (76)*
Penicillin	67 (88.16%)
Streptogramin	51 (67.11%)
Fluoroquinolones	67 (88.16%)
Cephalosporin	62 (81.58%)
Aminoglycoside	22 (28.95%)
Macrolide	54 (71.05%)

Drug resistant profiling of *E. coli*

The isolated cultures of *E. coli* showed a strong resistant pattern to many antibiotics, as seen in (Table 1.3). About 54 isolates of *E. coli* (71.05%) was found to be MDR. As per result *E. coli* found a different range of resistance to different antibiotics but the highest (82.89 %) to ampicillin and susceptible to Kanamycin (61.84 %).. isolates probably showed a probable dose-

dependent sensitivity to antibiotics.

Table1.3.

Antibiotic	*Escherichia coli* isolate (%) (n=76)		
	Resistant	Intermediate sensitive	Sensitive
AMX (10µg)	54 (71.05%)	5 (6.58%)	17 (22.37%)
AMP (10µg)	63 (82.89%)	5 (6.58%)	8 (10.53%)
TIC (75µg)	26 (34.21%)	9 (11.84%)	40 (52.63%)
PIT (15µg)	51 (67.11%)	8 (10.53%)	16 (21.05%)
NA (30µg)	54 (71.05%)	10 (13.16%)	12 (15.79%)
CIP (5µg)	40 (52.63%)	6 (7.89%)	30 (39.47%)
OFX (5µg)	45 (59.21%)	11 (14.47%)	20 (26.32%)
CTX (30µg)	52 (68.42%)	5 (6.58%)	19 (25%)
FOX (30µg)	40 (52.63%)	8 (10.53%)	27 (35.53%)
KMN (30µg)	22 (28.95%)	6 (7.89%)	47 (61.84%)
AZM (15µg)	53 (69.74%)	8 (10.53%)	14 (18.42%)
CLR (15µg)	31 (40.79%)	4 (5.26%)	41 (53.95%)

Biofilm Production of *E. coli*

These MDR isolates with higher MAR indices were used to identify their biofilm production potential. Sixteen isolates were found to have strong biofilm production potential. 24 isolates of *E. coli* were moderate, whereas 14 were found to have weak biofilm production potential. (Table 1.4)

Isolate name	No. of MDR Isolates	Biofilm formation		
		Strong	Moderate	Weak/Non biofilm
E. coli	54	16	24	14

Synergistic activity of plant extracts combinations against MDR and biofilm producing *E. coli*

The synergistic activity of ethanolic plant extract of different plants was tested against MDR and Biofilm producing *E. coli* isolates. Six different combinations of ethanolic extracts of four plants were investigated and zone of inhibition was recorded.The zone of inhibition for the combinations was observed to be in the range of 2- 24 mm diameter. The synergistic activity of *Ocimum sanctum/ Eucalyptus globulus* showed strong and best inhibition against *E. coli* isolates with mean value of 20.3 ± 0.3 mm. nearly, 50 % of the isolates were found to be inhibited at the inhibition zone of 20 mm and above. The lowest antibacterial activity was recorded for the combination of *Eucalyptus globulus/ Azadirachta indica* with mean value of 4.9 ± 0.0 mm. The combinations of *Ocimum sanctum/Azadirachta indica*, and *Mentha piperita/ Azadirachta indica* recorded low zone of inhibitions with mean values 5.8 ± 0.0 mm, and 7.3 ± 0.0 mm respectively. *Ocimum sanctum/ Mentha piperita* and *Mentha piperita/ Eucalyptus globulus* showed intermediate inhibition in the range of 10- 20 mm with mean values of 15.4 ± 0.3 mm and 16.3 ± 0.3 mm respectively. The isolates for these combinations were inhibited at zones of inhibition greater than

15 mm by 52.5% and 62.5%, respectively. The best antibacterial activity was recorded for *Ocimum sanctum/ Eucalyptus globulus* against isolate EC- 43 with zone of inhibition of 23.7 ± 0.3 mm. The lowest antibacterial activity was recorded from the combination of *Eucalyptus globulus/ Azadirachta indica* of 2.1 ± 0.0 mm zone of inhibition against four *E. coli* isolates EC- 9, EC- 11, EC- 44, and EC- 45 respectively. Details of the performance of the ethanolic extract of six plant combinations against *E. coli* have been shown inTable 1.5. The synergistic activity of plant extract combinations against EC-18 is shown in photoplate 1.

Table 1.5 Synergistic activity of plant extract combinations against MDR and biofilm producing *E. coli*.

Isolate no.	*Ocimum sanctum/ Mentha piperita* (mm)	*Ocimum sanctum/ Azadirachta indica* (mm)	*Ocimum sanctum/ Eucalyptus globulus* (mm)	*Mentha piperita/ Azadirachta indica* (mm)	*Mentha piperita/ Eucalyptus globulus* (mm)	*Azadirachta indica/ Eucalyptus globulus* (mm)
EC-2	10.1 ± 0.0	7.9 ± 0.0	20.1 ± 0.3	6.3 ± 0.0	15.4 ± 0.3	2.8 ± 0.0
EC-3	11.3 ± 0.0	5.6 ± 0.0	21.4 ± 0.3	4.9 ± 0.0	17.8 ± 0.3	7.8 ± 0.0
EC-4	19.8± 0.3	4.3 ± 0.0	18.2 ± 0.3	10.1 ± 0.0	21.5 ± 0.3	2.8 ± 0.0
EC-6	17.4 ± 0.3	7.8 ± 0.0	23.5 ± 0.3	9.8 ± 0.0	10.9 ± 0.0	5.7 ± 0.0
EC-7	18.2± 0.3	4.4 ± 0.0	20.2 ± 0.3	6.6 ± 0.0	12.4 ± 0.0	3.6 ± 0.0
EC-9	12.5 ± 0.0	6.3 ± 0.0	19.5 ± 0.3	4.4 ± 0.0	13.3 ± 0.0	2.1 ± 0.0
EC-11	13.6 ± 0.0	7.8 ± 0.0	19.6 ± 0.3	11.2 ± 0.0	16.8 ± 0.3	2.1 ± 0.0
EC-12	14.1 ± 0.0	5.6 ± 0.0	22.3 ± 0.3	6.9 ± 0.0	17.9 ± 0.3	4.3 ± 0.0
EC-14	16.3± 0.3	2.4 ± 0.0	18.7 ± 0.3	7.8 ± 0.0	19.1 ± 0.3	6.4 ± 0.0
EC-15	17.7± 0.3	3.5 ± 0.0	19.6 ± 0.3	8.9 ± 0.0	18.5 ± 0.3	7.8 ± 0.0
EC-17	14.2 ± 0.0	4.8 ± 0.0	20.2 ± 0.3	10.5 ± 0.0	17.4 ± 0.3	2.8 ± 0.0
EC-18	18.6± 0.3	7.7 ± 0.0	19.8 ± 0.3	9.9 ± 0.0	16.6 ± 0.3	7.1 ± 0.0
EC-20	19.8± 0.3	6.1 ± 0.0	18.4 ± 0.3	8.7 ± 0.0	13.7 ± 0.0	3.6 ± 0.0
EC-21	11.1 ± 0.0	2.3 ± 0.0	18.8 ± 0.3	5.9 ± 0.0	12.2 ± 0.0	6.4 ± 0.0

Isolate no.	*Ocimum sanctum/ Mentha piperita* (mm)	*Ocimum sanctum/ Azadirachta indica* (mm)	*Ocimum sanctum/ Eucalyptus globulus* (mm)	*Mentha piperita/ Azadirachta indica* (mm)	*Mentha piperita/ Eucalyptus globulus* (mm)	*Azadirachta indica/ Eucalyptus globulus* (mm)
EC-22	15.5± 0.3	6.3 ± 0.0	19.6 ± 0.3	4.8 ± 0.0	18.2 ± 0.3	5 ± 0.0
EC-24	16.3± 0.3	2.9 ± 0.0	20.5 ± 0.3	3.6 ± 0.0	20.7 ± 0.3	5 ± 0.0
EC-25	17.4± 0.3	3.3 ± 0.0	21.3 ± 0.3	6.7 ± 0.0	21.6 ± 0.3	6.4 ± 0.0
EC-26	10.2 ± 0.0	8.9 ± 0.0	20.3 ± 0.3	8.8 ± 0.0	11.9 ± 0.0	6.4 ± 0.0
EC-27	11.3 ± 0.0	7.4 ± 0.0	22.4 ± 0.3	7.9 ± 0.0	17.2 ± 0.3	7.8 ± 0.0
EC-28	15.4± 0.3	6.5 ± 0.0	19.1 ± 0.3	10.9 ± 0.0	19.4 ± 0.3	3.6 ± 0.0
EC-30	16.6± 0.3	4.8 ± 0.0	22.6 ± 0.3	7.8 ± 0.0	20.1 ± 0.3	5.7 ± 0.0
EC-31	14.6 ± 0.0	5.2 ± 0.0	23.2 ± 0.3	4.1 ± 0.0	20.3 ± 0.3	5.7 ± 0.0
EC-33	17.1± 0.3	5.5 ± 0.0	17.2 ± 0.3	3.7 ± 0.0	18.9 ± 0.3	7.8 ± 0.0
EC-35	18.2± 0.3	2.8 ± 0.0	18.6 ± 0.3	8.2 ± 0.0	16.3 ± 0.3	4.3 ± 0.0
EC-39	19.6± 0.3	7.9 ± 0.0	20.5 ± 0.3	7.7 ± 0.0	14.1 ± 0.0	6.4 ± 0.0
EC-40	11.5 ± 0.0	8.4 ± 0.0	21.4 ± 0.3	9.1 ± 0.0	12.6 ± 0.0	2.8 ± 0.0
EC-43	15.2± 0.3	6.9 ± 0.0	23.7 ± 0.3	10.6 ± 0.0	10.9 ± 0.0	4.3 ± 0.0
EC-44	12.4 ± 0.0	4.1 ± 0.0	22.6 ± 0.3	11.9 ± 0.0	11.8 ± 0.0	2.1 ± 0.0
EC-45	13.7 ± 0.0	5.5 ± 0.0	21.4 ± 0.3	10.8 ± 0.0	14.7 ± 0.0	2.1 ± 0.0
EC-47	19.6± 0.3	6.7 ± 0.0	20.7 ± 0.3	3.1 ± 0.0	16.1 ± 0.3	6.4 ± 0.0
EC-48	17.8± 0.3	4.8 ± 0.0	19.1 ± 0.3	4.2 ± 0.0	14.4 ± 0.0	2.8 ± 0.0
EC-49	13.3 ± 0.0	2.2 ± 0.0	18.6 ± 0.3	9.7 ± 0.0	20.8 ± 0.3	5 ± 0.0
EC-50	10.6 ± 0.0	8.4 ± 0.0	21.4 ± 0.3	8.6 ± 0.0	19.6 ± 0.3	5 ± 0.0
EC-51	11.2 ± 0.0	8.8 ± 0.0	18.6 ± 0.3	5.3 ± 0.0	18.7 ± 0.3	6.4 ± 0.0
EC-54	13.5 ± 0.0	2.8 ± 0.0	20.3 ± 0.3	6.4 ± 0.0	10.3 ± 0.0	7.1 ± 0.0
EC-56	14.8 ± 0.0	3.7 ± 0.0	22.4 ± 0.3	3.9 ± 0.0	12.5 ± 0.0	4.3 ± 0.0
EC-57	17.9± 0.3	6.9 ± 0.0	23.3 ± 0.3	4.7 ± 0.0	14.9 ± 0.0	5 ± 0.0
EC-60	20.1± 0.3	8.1 ± 0.0	17.5 ± 0.3	6.6 ± 0.0	16.8 ± 0.3	6.4 ± 0.0
EC-62	19.6± 0.3	7.5 ± 0.0	18.9 ± 0.3	5.8 ± 0.0	18.4 ± 0.3	5.7 ± 0.0
EC-69	15.3± 0.3	9.9 ± 0.0	20.2 ± 0.3	7.5 ± 0.0	20.2 ± 0.3	5 ± 0.0

Any mean value followed by ± is the standard error of the mean.

Conclusion

A novel idea, synergism between two or three existing bioactive plant extracts may be advantageous (synergistic or additive interaction) or harmful (antagonistic or toxic outcome). In the present study, the plant extracts selected for the study were ethanolic plant extracts of all plants. It was observed that the ethanolic extracts pre-dominated the antibacterial activities and MIC activities compared to other extracts.Therefore, the extracts of these plants should be further analyzed to identify specific bioactive compounds.

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Groundwater quality of compact rock aquifers from Deccan trap basalt in Malegaon Tehsil of Washim District, Maharashtra was analysed using hydrogeochemistry and multifaceted statistical analysis.

Mr. N. A. Deshmukh
Shri Shivaji College of Arts, Commerce and Science Akola
And
Dr. G. V. Korpe
Shri Shivaji Science College Amravati
And
Dr. R. G. Korpe
Shri Shivaji Science College Amravati
And
Mr. A. L. Tarale
Shri Shivaji College of Arts, Commerce and Science Akola

Abstract

In the current experiment, groundwater quality from compact rock aquifers of the Deccan trap basalt in the Malegaon tehsil of Washim district of Maharashtra was evaluated using hydrogeochemistry and multifaceted statistical analysis. To prevent bias in sampling, groundwater samples (n=26) were systematically gathered from the research region in a grid pattern. All of these groundwater samples' water quality characteristics were assessed using sensors and titrimetry in accordance with established BIS and WHO protocols. All samples were examined for uranium using an LED fluorimeter.At every stage of the investigation, strict quality assurance and quality control measures were used to guarantee the accuracy of the data.The average measured uranium value was 2.99 µg/L, significantly below the 30 and 60 µg/L safe limits suggested by the AERB and WHO, respectively. The detected uranium values ranged from 1.14 to 6.42 µg/L.The research area's prominent hydrochemicalfacies, as shown by the piper trilinear diagram, are Mixed Ca^{2+}–Na^{+}–HCO_3^{-}, Na^{+}–Cl^{-}, and Ca^{+}–HCO_3^{-}.

Key words: LED fluorimeter, Hydrogeochemistry and Groundwater.

Introduction

Among all of the natural assets on Earth, water is the most valuable resource. Because there is an abundance of water on Earth, it is regarded as a "blue planet" superficially [1]. In India's rural and urban areas, groundwater is the primary source of drinking water. Because to the massive use of chemical fertilisers, industrial development, urbanisation, and other human activities, contaminating the groundwater. As stated the World Health Organisation estimates that 80% of

human illness arises from the declining standard of drinking water.An estimated 3.4 million people, primarily children, may away from illnesses linked to water each year [2].In many nations, groundwater is a significant source of water supply for all uses [3]. The effects of industrialisation, rapid urbanisation, unmanaged land-use methods, population growth, and intensive farming techniques that raise the risk of soil and ground water contamination have raised awareness about groundwater quality during the past several years [4].Understanding the appropriateness of groundwater for a given area's usage requires knowledge of its hydrogeochemistry. There is a strong relationship between water.

Numerous writers have reported on quality criteria [5].In the past, hydrogeochemistry assessments were solely conducted through laboratory research; however, these days, geospatial methodologies are employed to evaluate water quality. overseeing the resource that is accessible, and analysing the groundwater data accurately and with ease in an economical way [6,7].When creating a geographic decision support system with GIS-based software like ArcGIS, a ground water model is also useful[8].A geographical distribution map of uranium and other water quality indicators of the research region is prepared by using the inverse distance weighting (IDW) interpolation approach in spatial data analyst tools. Groundwater is a crucial natural resource that plays a pivotal role in meeting the water demands for various sectors, including domestic, agricultural, and industrial. In the Deccan Trap basalt region of Malegaon Tehsil, Washim District, Maharashtra, the quality of groundwater in compact rock aquifers is of particular concern due to the potential impact of geological and anthropogenic factors.This study aims to investigate the hydrogeochemical characteristics and employ a multifaceted statistical analysis to assess the suitability of groundwater for various purposes in the region.

Materials and methods

Study area's geography

Malegaon taluka of Washim district, the selected research area, is an administrative taluka in the state of Maharashtra's vidharbha region (Fig. 1a). Malegaon Jahangir is a town in the Washim district of Maharashtra, India. It's located in the Malegaon taluka of the Washim subdivision, and is situated on the main road between Washim and Mehkar.The research area is between 20º 45′00”. and latitudes 20º03′36” N, longitudes 77º 15′00” and 76º 48′00” E.and is covered by India's Toposheet Survey nos.The study area is bordered to the east by the taluka of Mangrulpir and the north by Akola district, to the west by the district Buldhana, and to the south by the Washim and Risodtaluka. Using the digital elevation model tool of ArcGIS 10.8 (ESRI 2019), a map of the study area was prepared (Fig. 1a) [9].

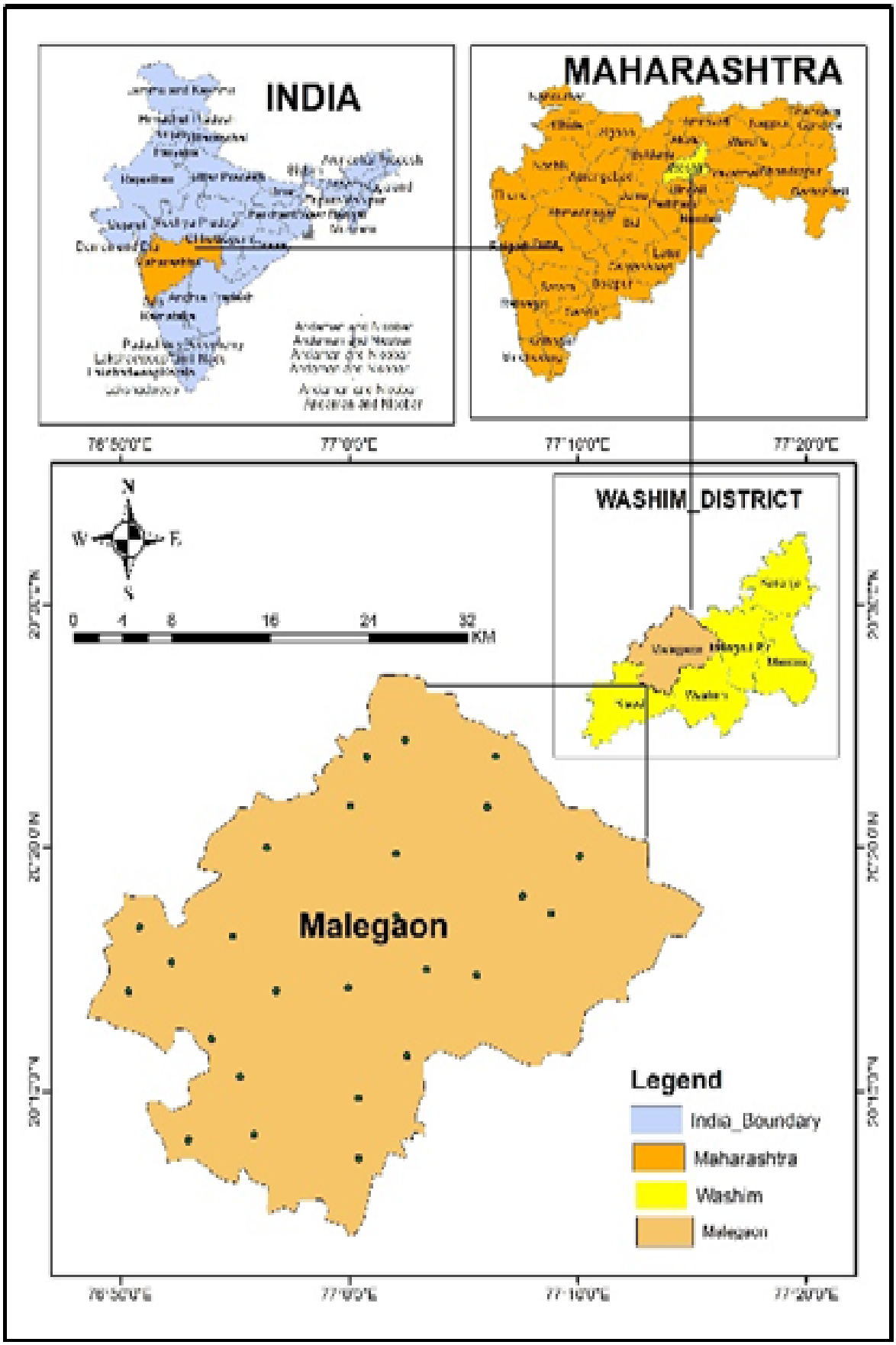


Fig.1 Study area map

Collection of samples

A water sample was taken in accordance with the Central Pollution Control Board and BIS standard protocols for the examination of geochemical parameters and uranium. Plastic bottles that had been cleaned and pre-acidified held 1 litres of water samples. Water sources utilised for drinking were the sources from which samples were taken. Sample information was also noted, including the name of the area, the kind of rock, and the depth of the water source.

Geochemical parameters analysis

Using a portable ion selective electrode based multi-parameter water analysis kit (HANNA Portable Multiparameter), geochemical parameters such as dissolved oxygen (DO), temperature, pH, total dissolved solids (TDSs), oxidation reduction potential (ORP), electrical conductivity, chloride, fluoride (ORP), salinity, and nitrate were analysed at the sampling location. Throughout the investigation, verified standard solutions were used to calibrate every equipment. The inventory of instruments utilised with a minimal degree of detection is shown in Table 1. The obtained samples underwent hardness and alkalinity utilising the BIS procedure in less than 24 hours.The H_2SO_4 titration method employed methyl orange and phenolphthalein as indicators to assess total alkalinity, whereas the ethylenediaminetetraacetic acid complexometric titration method measured total hardness. Analytical grade (AR) chemicals and reagents were used in the chemical process.

Uranium analysis

Using an array of seven LEDs as the excitation source, the fluorimetry technique was used to assess the uranium content in water samples that were collected [10]. uranium complexes in the solution to be excited. Within the normative addition technique, 5.4 mL of the water sample that was obtained was placed in a dry, clean quartz cuvette with 0.54 millilitres of 5% sodium pyrophosphate (with phosphoric acid to adjust to pH 7) and then 0.06 millilitres of normal uranium origin (1000 μgL^{-1}). This approach measures the water sample's initial fluorescence intensity. After adding uranium standard to the cuvette, the intensity of the fluorescence is measured once more. To calibrate the device, a recognised standard uranium solution was used.

Correlation analysis

The degree of linear relationship between two variables is measured statistically using correlation analysis. The variables are not selected based on their dependability or independence. Correlation analysis was employed in most study to look for a linear relationship between two variables. The IBM Statistical Package for Social Sciences (2015) was used to conduct the statistical analysis [11]. The correlation matrix was constructed by computing the coefficient of various parameter sets in order to compute correlation coefficients. Using p values, the correlation's significance was examined. The variance is significant if the p value is less than 0.05, 0.01 ($p < 0.05$ and $p < 0.01$). The variation is not significant if $p > 0.05$. When the analysis is two-tail, the significance is assessed at the levels of 0.01 and 0.05 [12].

Spatial distribution mapping

When interpreting spatial data properties across a geographic region, the spatial distribution approach might be helpful. Evaluations of spatial patterns, distribution trends, pattern flow, area relationship, proximity, distance, placement, and spatial relationship are also beneficial [13]. The GIS is an effective tool for evaluating and analysing monitored data because this specific tool monitored water quality data set, which has time and location properties [14]. The geographical data of water quality based on distance weighting is interpolated in the current study using the inverse distance weighting (IDW) interpolation method. Spatial distribution analysis of water quality parameters was performed using ArcGIS software, 10.8 version.

Results and Discussion

Descriptive statistical evaluation of the results

A statistical analysis was conducted on the water geochemical parameters in the collected samples, and the results are listed in Table 1. pH, Electrical conductivity, ORP, TDS, DO, chloride, fluoride, nitrate, hardness, and alkalinity were found to vary from 6.7-7.9, 788-2628 μScm^{-1}, 214.6-301 mV, 394-1314 ppm, 3.2-4.5 ppm, 32.8-164 ppm, 0.3-1, ppm 6.4-42.3 ppm, 146-851 ppm, and 91-334 ppm, respectively. Figure 2 shows a comparative graphical portrayal of the lowest, median, and highest concentration of various geochemical parameters from water, including TDS, alkalinity, nitrate hardness, and chloride etc. The values of Total dissolved solids (TDS) were found in the range from 394 to 1314 mg/L with an average value of 607.1 mg/L. Only11.5 percent sample has higher values than the allowable limit of 1000 mg/L, recommended for drinking purposes (WHO 2011)[15].

Table 1 Descriptive Statistical Data of Water Quality Parameters

Paraneters	Min	Max	Average	Median	SD
pH	6.7	7.9	7.3	7.4	0.3
TDS (ppm)	394	1314	607.1	529.5	226.9
EC (µS/cm)	788	2628	1214.2	1059	453.9
ORP (mV)	214.6	301	276.1	279.8	20
DO (ppm)	3.2	4.5	3.8	3.6	0.4
Floride (ppm)	0.3	1.0	0.6	0.6	0.1
Chloride(ppm)	32.8	164	81.8	82.4	35.5
Nitrate(mg/l)	6.4	42.3	12.5	10.1	8.6
Sulphate (mg/L)	24.3	143	57.4	49.9	28.4
Phosphate (mg/l)	2.1	12.3	5.9	5.2	2.5
Uranium (ppb)	1.1	12.1	3.6	2.1	3.2
Total hardness(mg/l)	146	851	268.7	196	170.3
Ca^{2+} (mg/l)	38	219.9	72.9	53.9	42.9
Mg^{2+} (mg/l)	5.8	73.3	21	15.5	16
K^{+}	0.2	5.7	1.8	1.7	1.1
Na^{+}	4.9	27.3	11	10.3	4.9

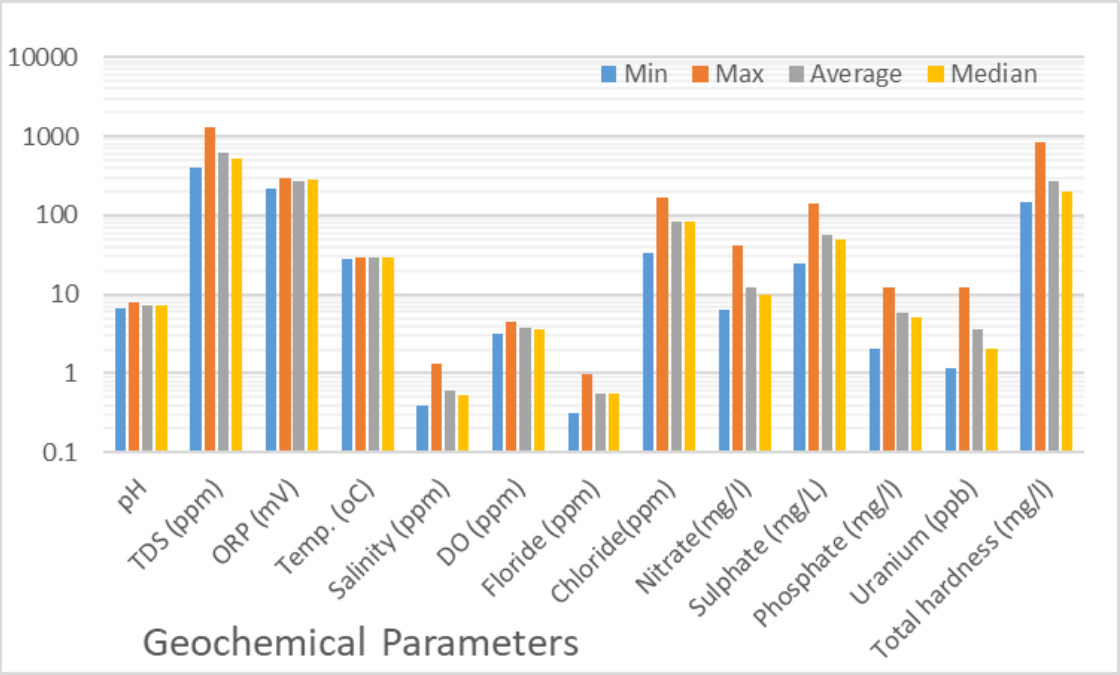


Fig. 2 comparative graphical geochemical parameters.

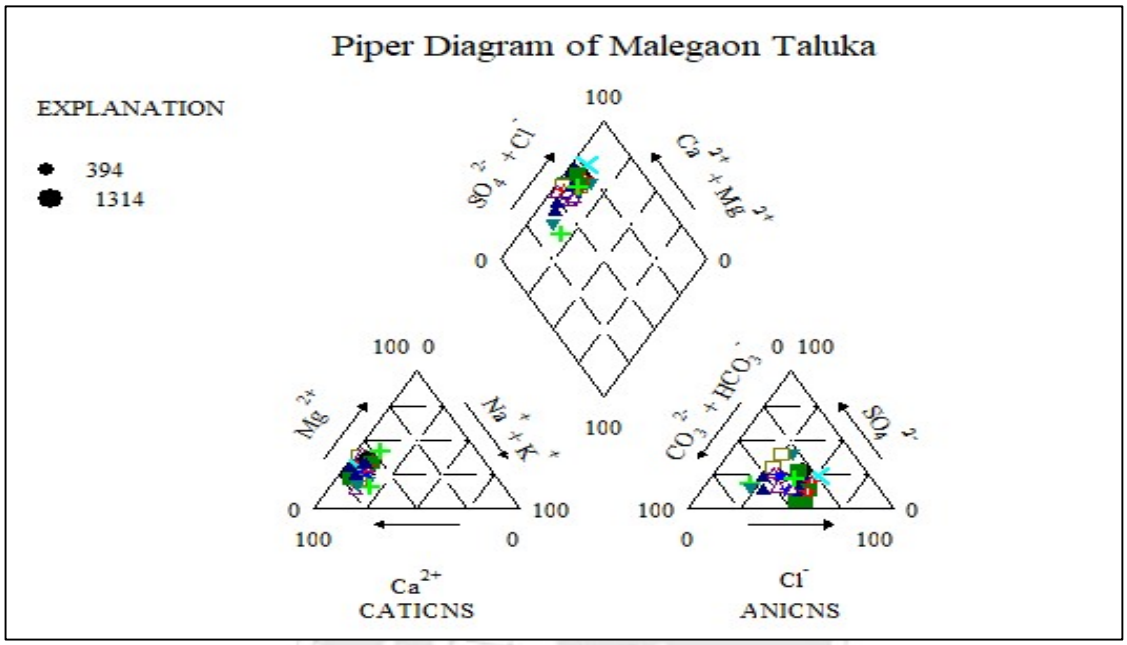
Examination of the amount of uranium in a sample of water

The estimated concentration of uranium in the collected water samples varied from 1.1to 12.1 μgL^{-1}, with an average of 3.6 μgL^{-1}. These results are displayed in Table 1, and Figure 2 shows the average uranium concentrations. Uranium was traced back to rainfall causing the uranium concentration in the ground to leach. However, because of sufficient interactions with the rock and sediment under a particular geochemical state that causes uranium to leach in rechargeable water during the rainy season, the majority of the accessible water samples have greater uranium concentrations.

Groundwater classification

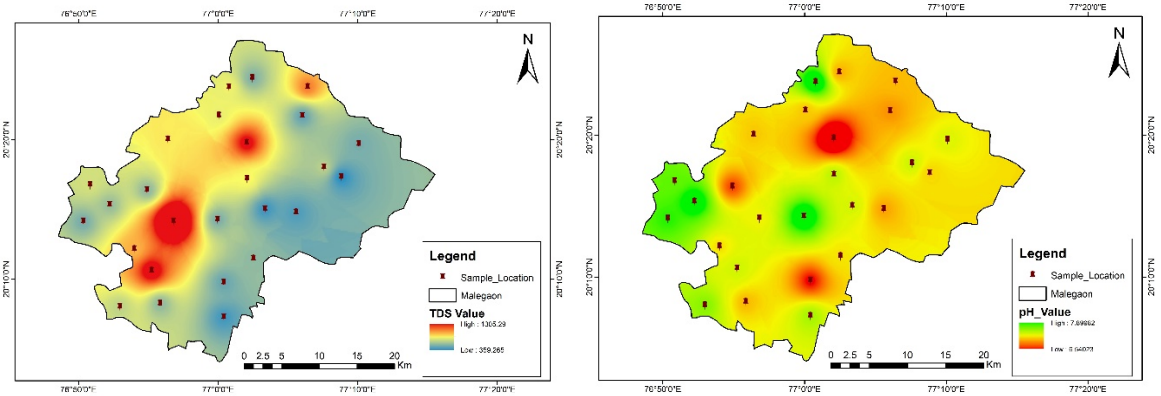
Piper (1944) introduced the modified trilinear diagram, which is frequently used to illustrate the composition of groundwater. Additionally, it's employed to track analytical values of Plotting groundwater on the Piper trilinear diagram and to comprehend how cationic and anionic concentrations differ across the research field. The trilinear diagram Piper of The sample of groundwater is displayed in Figure 3. Based on differences in ionic content, three primary forms of water have been identified: mixed Ca^{2+} –Na^{+}–HCO_3^{-}, Na^{+}–Cl^{-}, and Na^{+}-$HCO3^{-}$. Major percent of the water samples belong to the first group, which is Mixed $Ca2^{+}$ –Na^{+}–$HCO3^{-}$. This broad range of water types illustrates how groundwater compositions are greatly impacted by regional variations in geology and geochemistry.

Fig. 3 Piper trilinear diagram of Malegaon Taluka



Spatial distribution mapping

Arc GIS 10.8 was used to undertake a spatial distribution study of the uranium content and other water quality indicators. Distribution maps are created by the inverse distance weighted (IDW) interpolation technique. IDW is a method that uses the weighted average values of the sample points that surround it to interpolate the spatial data. The interpolation technique makes the assumption that values that are closer to one another are more similar than values that are farther apart. Fig. 4a-d shows the geographical distribution map for the following parameters: pH, TDS, nitrate and uranium. The distribution of water quality characteristics over a research region is practically visualised by these figures. The pH is not evenly distributed; that is, the west side of the research area has higher pH values 7.9. There is a scatter distribution in the research area's TDS and EC spatial distributions. The heights of the red-colored points on the distribution map indicate those that exceed the health agency's recommended acceptable level. According to Sharma et al. (2017), the dissolution of soluble salts in an unsaturated zone is the primary source of dissolved solids[16].



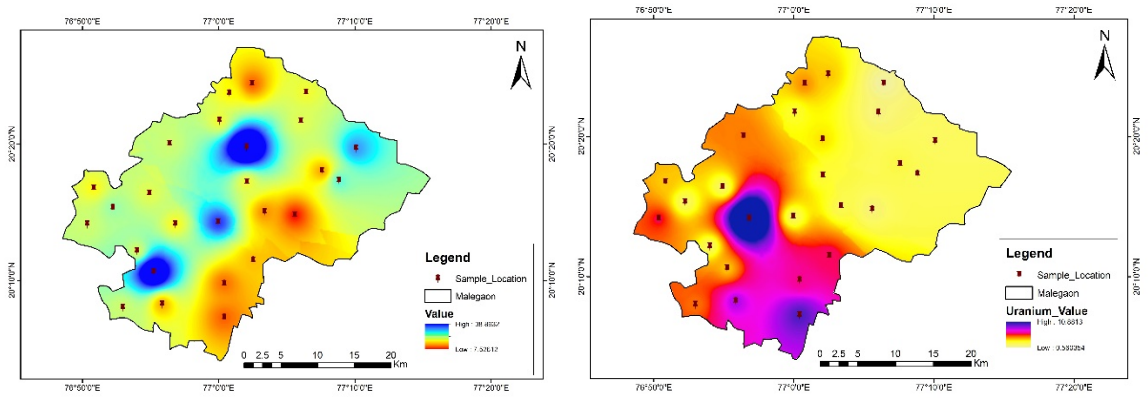


Fig. 4a-d Spatial Distribution Mapping.

Conclusion

Analysis was done on uranium content and geochemical parameters in 26 water samples from the research region. The estimated concentrations of uranium varied from 1.0 to 12.1 μgL^{-1}. It was found that the majority of the examined samples' median and mean values were comparable to those of previous studies conducted globally. In certain places, water has been found that geochemical parameters such TDS and hardness were greater than the BIS recommendation level. The research area's very varied uranium concentration distribution indicates the impact of local geochemistry and lithography. Water resource planning in the long run will benefit from this research study on uranium and other geochemical characteristics.

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Taxonomic study on potter and paper wasps (Hymenoptera: Vespidae: Eumeninae, Polistenae, Vespinae) of Buldhana district, Maharashtra.

Diksha D. Salve
Shri Shivaji Science and Arts College Chikhli, District Buldhana, Maharashtra
And
Vijayshree M. Hemke
Shri Shivaji Science and Arts College Chikhli, District Buldhana, Maharashtra.

ABSTRACT:

The present study aimed to document the diversity of vespid wasps (Hymenoptera: Vespidae) in the Khadakpurna Canal Chikhli and Rohda located in the Buldhana district region of Maharashtra, India. We used aeroic net for sampling and collected a total of 51 individuals belonging to 8 species, 6 genera, and 3 subfamilies of Vespidae between July to November 2021.

The study was carried out to explore the diversity 8 species of Vespid wasps (Eumeninae, Polistenae, Vespinae) Delta pyriforme, Delta esuriens, Delta conoideum, Eumenes fraternus, Ropalidia fasciata, Ropalidia marginata, Polisties metricus, Vespa tropica in Buldhana district, Maharashtra. It was found that the Khadakpurna canal with 34 individuals and the Rohda with 17 individuals of wasp species.

Keywords- Vespidae: Eumeninae, Polistenae, Vespinae, Nests.

1. INTRODUCTION:

Vespidae is the cosmopolitan family of predatory wasps. Vespid wasps are a very important group of insects in terms of the ecological as well as economic services they provide. They are pollinators, and predators and are excellent biocontrol agents (Das and Gupta 1989). The subfamily Eumeninae is the largest and most diverse subfamily of the family Vespidae. It contains 3,773 species under 205 genera. They are generally named potter wasps. It is a more abundant and varied group having many species as compared to other subfamilies of the Vespidae. They made their nest from mud. These wasps are also called mason wasps.

Subfamily Polistinae is commonly known as paper wasps. Numerous taxonomic works have been done on Polistinae documenting about 221 species under Polistes genera and about 180 species under the genus Ropalidia worldwide.

The vespinae are social wasps of the family Vespidae. The group consists of four genera: Vepsa, Provespa, and Dolichovespula, Vespula. The present study was undertaken to document Vespidae diversity in the Khadakpurna Canal Chikhli and Rohda in the Buldhana district of Maharashtra, India.

2. MATERIALS AND METHODS:

Study area

The study was conducted in the Buldhana district region of Maharashtra, India. Two sites,

(Fig-1) Khadakpurna Canal Chikhli and Rohda were selected as the study area. The Buldhana district is one of the most diversified regions in the Maharashtra State of India, concerning biodiversity. It is situated at the westernmost border of the Vidarbha region of Maharashtra and is 500 km from the state capital, Mumbai. It lies between 19° 51′ N and 21° 17′ N latitude and 75° 57′ E and 76°59′ E longitude. It has a total area of 9,745 km2 (3,761 square miles).

Buldhana district has different geological conditions in which Rohda and Khadakpurna Canal has lush green deciduous areas that are home to a variety of flora and fauna. There is a sudden fall in elevation and a healthy climate.

The climatic condition of this area is characterized by a hot summer, well-distributed rainfall during the southwest monsoon season, and generally dry weather during the rest of the year. There is the cold season is from November to December. The average annual rainfall in the area is 796.6 mm (31.37 inches). During summer, the mean daily maximum temperature was 42.3°C and the minimum was 27.4°C, and it decreased toward winter with a mean daily maximum temperature of 27.6°C and a minimum of 15.1°C

PLATE 1- -Study Area

Fig.1-Map showing locations of study sites -1) Khadakpurna canal 2) Rohda

Specimen collection

The specimens were collected from different areas of Buldhana district through active search with the use of the hand net. The specimens were captured from two ecological belts (Rohda (Agricultural land), Khadakpurna dam area Chikhli of the Buldhana district.

Preservation of the specimens

The killed specimens were transferred to bottles having 75% ethanol, cyanide and ethyl acetate. Then they were placed for 1 or 2 days in freezer to prevent fungal contamination. Then dead specimens were labeled and pinned with the entomological pins.

Specimen identification

The collected wasps were observed and identified up to species level with the help of pervious published literature Das and Gupta.

Measurement

The measurements of the body length of the specimens were done.

RESULTS AND DISCUSSION:

The present study was conducted in district Buldhana, Maharashtra. A total of 51 specimens **(TABLE-1)** of vespids were collected from the study areas. Out of 51, 18 belong to sub family *Eumeninae*, 31 belongs to sub family *Polistenae* and 2 belongs to sub family *Vespinae*. All the reported species and subspecies were not previously recorded in district Buldhana.

Wasps especially *polistenae* are reported to be important pollinators. During the present study all *polistenae* species should be seen in the study areas especially the garden in large number at time between 8-12 am. It is the time for flowers waiting for pollinators. While the vast majority of wasps play no role in pollination, a few species can effectively transport pollen and therefore contribute for the pollination of several plant species, being potential or even efficient in pollination. During the present study it was noted that, the nests of vespid wasps is occupied with many insect larvae such as beetles, moths, butterflies etc., The wasp were found utilize these insect larvae for feeding their young ones. So, wasps exhibited role in biological control. And are the best agents in biological control. They eliminate the pests of agriculture and garden plants also. This observation is supported that Vespids are predators of almost all insect larvae, which attack forest, agriculture and plantation crops. They feed on the larvae of butterflies, beetles, moths and other wasps, which are serious pests of useful crops.

Table-1 Diversity of Wasps with Their Classification

Sub family	Genus	Species	No. Specimen collected
Eumeninae	***Delta***	*pyriforme*	5
	Delta	*esuriens*	6
	Delta	*conoideum*	4
	Eumenes	*fraternus*	3
Polistenae	***Ropalidia***	*fasciata*	12
	Ropalidia	*marginata*	15
	Polisties	*metricus*	4
vespinae	***Vespa***	*tropica*	2
Total			51

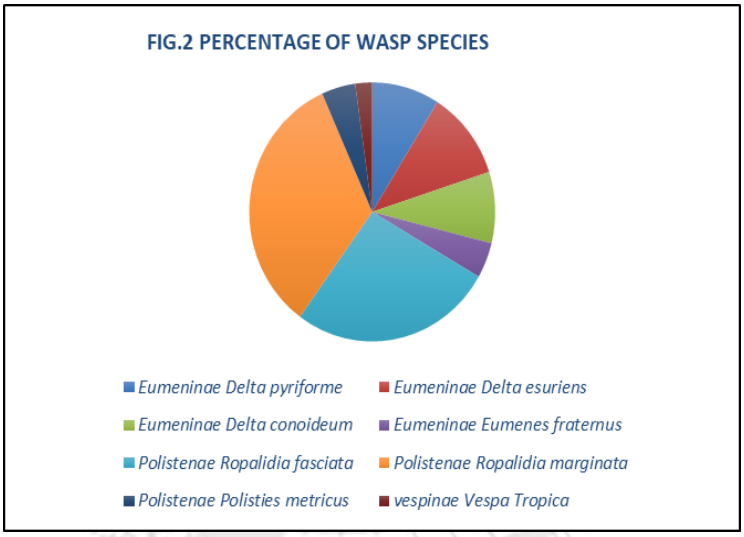

Fig-2. Percentage of Wasp Species Collected

TABLE-2. NUMBER AND DIVERSITY OF SPECIMEN COLLECTED FROM THE STUDY AREAS

Sub family	Genus	Species	No. specimens collected area	
			Khadakpurna dam area	Rohda area
Eumeninae	***Delta***	*pyriforme*	3	2
	Delta	*esuriens*	4	2
	Delta	*conoideum*	3	1
	Eumenes	*fraternus*	2	1
Polistenae	***Ropalidia***	*fasciata*	8	4
	Ropalidia	*marginata*	10	5
	Polisties	*metricus*	2	2
vespinae	***Vespa***	*tropica*	2	0
Total			34	17

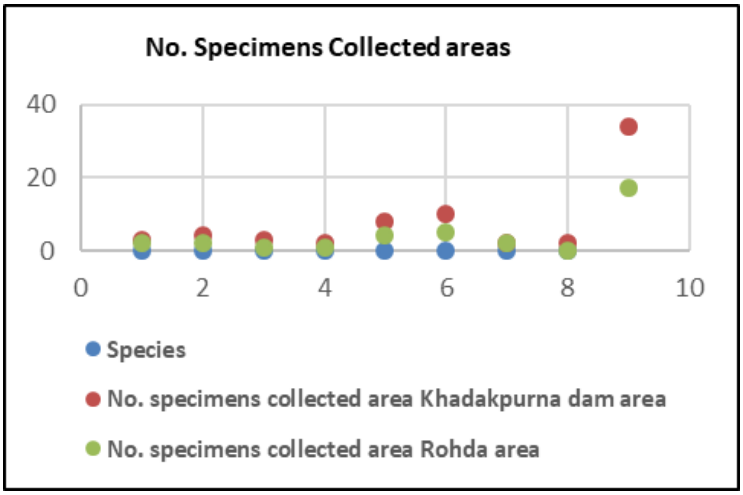

Fig-3. Number and diversity of specimen collected from the study areas.

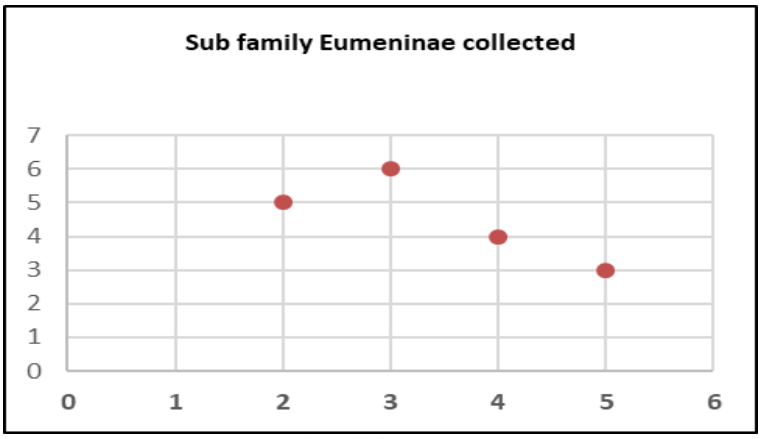

Fig-4 Number of Species Collected from Sub Family Eumeninae.

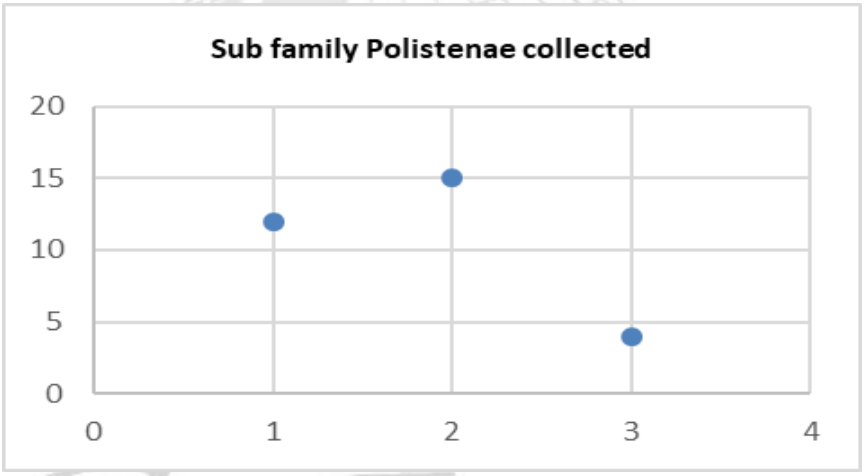

Fig-5 Number of Species Collected from Sub Family Polistenae.

Nest patterns

Sub Family Eumeninae (Plate 2)

The small pitcher nest made up of mud. They kind of look like a pot. It was found in muddy places where building materials were easily available. It has a smooth outer surface attached from the lower side. it contains up to 10 cells for larvae. It has an opening on upper side for entry or exit. They close their nest opening up to maturation of their larvae. They are present on the wall of the building or on leaves etc. In the present study my observation is also supported the observation that eumeninae nest consist of a linear row of cell separated by transverse partition made up of soil mastics.

Sub Family Polistenae (Plate 3)

The nest of polistes found among branches or open torus. Structurally it was oval shape and attached with a minute but strong stalk. It was formed with a single layer of hexagonal cells, which open directly to the outside with increasing number of wasps, the worker starts to build new layer beneath the old ones, they reached a maximum of five layer. There nest was hexagonal in shape

and made up of cellulose.

Sub Family Vespinae (Plate 4)

The spherical nest was mostly found attached downward towards the roof of the veranda. The attached portion of the nest was flat and continuously by a protective layer. Inside 1-11-layer layers were found, depending on increasing number of wasps. The first starts from the upper side by a strong attachment which leads to a layer of hexagonal cells. One main opening was found for the entry and exit. Many small tubes like routs were also found in each layer which lead to the main opening. Nest were used for many years until they were destroyed.

Nests are in tree cavities or underground. using a variety of wood fibers, mixing them with saliva, and constructing their nests that way. The nests can be as large as a basketball but are shaped more like a football. If excavated, nests are brittle and bowl-shaped.

Systematic List

Order Hymenoptera

Family Vespidae

Subfamily Eumeninae

Genus: Delta de Saussure, 1885

1. Delta pyriforme (Fabricius, 1775)

2. Delta esuriens (Fabricius, 1787)

*3. Delta conoideum (**Fabricius 1787**)*

Genus: Eumenes Latreille,1802

4. Eumenes fraternus (Say, 1824)

Subfamily polistenae

Genus: Ropalidia, Guerin-Meneville, 1831

1. Ropalidia fasciata (Fabricius 1804)

2. Ropalidia marginata (Fabricius 1793)

Genus: Polistes Latreille,1802

3. Polisties metricus (say 1831)

Subfamily vespinae

Genus: Vespa Linnaeus, 1758

1. Vespa Tropica (Linnaeus, 1758)

Subfamily Eumeninae (Plate 2)

1. Delta pyriforme (Fabricius, 1775)

Body measurement

The length of the female is 23-28.4 mm and the length of the fore wing of female is about 22.1-22.3 mm.

Distribution: Pakistan, India, Nepal, Vietnam, Thailand, China, Sri Lanka, Bhutan and Myanmar.

2. Delta Esuriens (Fabricius, 1787)

Body measurement

The length of the female is 17.1-18 mm and the fore wing length of female is 13-14.3 mm.

Distribution: India: Assam, Bihar, Chhattisgarh, Diu, Goa, Gujarat, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Odisha, Puducherry, Rajasthan, Sikkim, Tamil Nadu, Telangana, Uttar Pradesh, West Bengal.

Global: Arabia, Bhutan, China, Malaysia, Myanmar, Nepal, Pakistan, Sri Lanka, Thailand.

3. Delta Conoideum *(Fabricius 1787)*

The length of the female is 20-22 mm and the fore wing length of female is 16-17.2 mm.

Distribution: India: Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Diu, Goa, Gujarat, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Odisha, Puducherry, Rajasthan, Sikkim, Tamil Nadu, Telangana, Tripura, Uttarakhand, Uttar Pradesh, West Bengal. Global: Arabia, Bhutan, China, Malaysia, Myanmar, Nepal, Pakistan, Sri Lanka, Thailand.

4. Eumenes Fraternus (Say, 1824)

The length is about 15-20 mm.

Distribution: India: Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Odisha, Puducherry, Rajasthan, Sikkim, Tamil Nadu, Telangana, Tripura, Uttarakhand, Uttar Pradesh, West Bengal.

Global: Canada, U.S.A. Nepal, Pakistan

Subfamily Polistenae (Plate 3)

1. Ropalidia fasciata (Fabricius 1804)

Body measurement

The length of the female is 15-17 mm and the fore wing length of female is 14-15.3 mm.

Distribution: Bhutan (Wangdi Phodrang), China, Bali, Bangka, Borneo, Flores, India, Myanmar, Nepal, Sumatra, Timor, Palawan, Ryukyu Islands, Philippines, Sri Lanka, Taiwan, Thailand.

2. Ropalidia marginata (Fabricius 1793)

Body measurement

The length of the female is 15-16 mm and the fore wing length of female is 14-15.3 mm.

Distribution: India: Punjab, Uttar Pradesh, West Bengal, Rajasthan, Gujarat, Madhya Pradesh, Orissa, Maharashtra, Andhra Pradesh, Kernataka, Kerala, Tamil Nadu.

Global: Pakistan, Sri Lanka, Myanmar, Vietnam, Malay Peninsula, Borneo, Bangka, Sumatra, Java, **Sumba, Sulawesi, Talud Islands, Tukang Besi New Guinea.**

3. Polisties metricus (say 1831)

Body measurement

The length is about 14-20 mm.

Distribution: India: Punjab, Uttar Pradesh, West Bengal, Rajasthan, Gujarat, Madhya Pradesh, Orissa, Maharashtra, Andhra Pradesh, Kernataka, Kerala, Tamil Nadu.

Global: Canada. Pakistan**,** Sri Lanka, Myanmar, Vietnam, Malay Peninsula, Borneo, Bangka,

Sumatra, Java, Sumba, Sulawesi, Talud Islands, Tukang Besi New Guinea.

Subfamily vespinae (Plate 4)

Genus: Vespa Linnaeus, 1758

1. Vespa Tropica (Linnaeus, 1758)

Body measurement

The length is about 24-26 mm.

Distribution: India: Uttar Pradesh, West Bengal, Rajasthan, Orissa, Maharashtra, Andhra Pradesh, Kernataka, Kerala, Tamil Nadu.

Global: Pakistan**,** Afghanistan, Sri Lanka, Myanmar, Vietnam, Malay Peninsula, Borneo, Bangka, Sumatra, Java, Sumba, Sulawesi, Talud Islands, Tukang Besi New Guinea

CONCLUSION:

The current study reported taxonomic description Eumeninae, Polistenae, Vespinae and fauna collected from district **B**uldhana, Maharashtra.

A total of 4 species and under 2 genera of subfamily Eumeninae are reported. The recorded species are *Delta pyriforme, Delta esuriens, Delta conoideum*. And A total of 3 species and under 2 genera of subfamily Polistenae are reported. The recorded species are *Ropalidia fasciata, Ropalidia marginata, Polisties metricus.* A total of 1 species and under 1 genera of subfamily Vespinae are reported. The recorded species is *Vespa tropica*. All the reported species are first time recorded from district Buldhana.

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PLATE 2- SUBFAMILY EUMENINAE

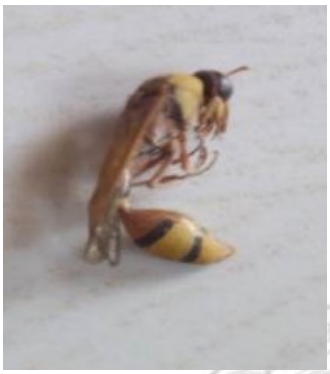
Species	Nest
	
Delta pyriform	**Nest of Delta pyriform**
	
Delta esuriens	**Nest of Delta esuriens**
	
Delta conoideum	**Nest of Delta conoideum**
	
Eumenes Fraternus	**Nest of Eumenes Fraternus**

PLATE 3- SUB FAMILY POLISTENAE

Species	Nest
	
Ropalidia fasciata	Nest of Ropalidia fasciata
	
Ropalidia marginata	Nest of Ropalidia marginata
	
Polisties metricus	Nest of Polisties metricus

PLATE 4- SUB FAMILY VESPINAE

Species	Nest
	
Vespa tropica	Nest of Vespa tropica