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RECENT TRENDS IN CONSERVATION AND MANAGEMENT OF ECOSYSTEMS

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PREFACE

It gives us immense pleasure to write preface for this research book published with ISBN number. We congratulate N. E. Society's D. B. J. College, Chiplun, Dist. Ratnagiri (MS), Prof. (Dr.) D. V. Muley Felicitation Committee, Kolhapur and Board of Studies in Zoology, University of Mumbai for showing alacrity & taking laborious efforts to accelerate this challengeous task of publishing research topics in such a elated book. This was a purposeful attempt & collective wisdom of organizers of the National Conference to publish research book to cater to the need of society in general & of research community in particular on the eve of felicitation of Eminent Ecologist of India, Prof.(Dr.) D. V. Muley on his retirement. Looking at the progressive development in the field of Science & Technology and anthropogenic activities; & their adverse impact on the biotic & abiotic components of the ecosystems, it has become necessary to evaluate their outcome and suggest remedy. In this context, the theme of the conference- "Recent Trends in Conservation & Management of Ecosystems" is well suited with the nagging environmental crisis and made the community compatible to accept challenges emerging out of alarming situation, which adds to the value of this book.

Researchers across the country have contributed various topics & presented their views in elaborative manner in the book. Respected members of Peer Review Committee have thoroughly reviewed research papers & given valuable suggestions to maintain quality of book. Their timely help has made this endeavor successful.

In a very short duration "Bhumi Publishing, India" has ablated and memorized talent of researchers and also gracious moments in the life of Prof. (Dr.) D. V. Muley by publishing this masterpiece book.

Mr. S. S. Waghmode ***Dr. G. B. Raje*** ***Dr. Sagar A. Vhanalakar***

Associate Editor ***Editor-in-Chief***

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The last week of October 2017 was cheerful & fascinating to all the research students of Hon. Prof. (Dr.) D. V. Muley, when they conducted a meeting in Shivaji University, Kolhapur and constituted Prof. (Dr.) D. V. Muley felicitation committee to salute their beloved guide on his retirement by organizing National Conference. This evaluating idea was really an abreaction for Prof. (Dr.) D. V. Muley and his students. When Prof. (Dr.) D. V. Muley felicitation committee met & requested beneficent Mr. Mangeshji Tambe, Chairman of N. E. Society, Chiplun & Dr. Shyam Joshi, Principal, D. B. J. College, Chiplun to host this academic task, immediately they accepted proposal of felicitation committee & hosted this National Conference. It was the blessing of N. E. Society's D. B. J. College, Chiplun & Board of Studies in Zoology, University of Mumbai, due to which this conference & publication of research book would be a grand success national event.

We are indebted to eminent academicians Honorable Prof. (Dr.) Naganath Kottapalle (Former Vice Chancellor, Dr. Babasaheb Ambedkar Marathawada University, Aurangabad); Prof. (Dr.) N. J. Pawar (Former Vice Chancellor, Shivaji University, Kolhapur), Prof. (Dr) V. N. Magare (Pro-Vice Chancellor, University of Mumbai), Prof. (Dr.) D. V. Muley (Former Registrar, Shivaji University, Kolhapur), Prof. (Dr.) Baban Ingole (Senior Scientist, NIO, Goa) and Prof. (Dr.) Vijaykumar, (Gulbarga University) for accepting our invitation & enlightening the August gathering in the conference. Our heartily thanks are due to all the Honorable Members of National Advisory Committee & Local Organizing Committee for taking day-round efforts for grand success of the Conference.

Our thanks are also due to Bhumi Publishing, India for such a fabulous & memorable publication of the research book. We are thankful to Honorable members of Peer Review Committee Prin. Dr. Nisar Shaikh, Dr. Rahul Jadhav, Dr. Surekha Gupta, Dr. Sagar Vhanalkar for reviewing research papers, giving suggestions and timely completing the task.

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Harekar, Mr. Akshay Advilkar, Mr. Rupesh Shinde, Mrs. Arti Manorkar, Teaching staff of Zoology & Biotechnology Department of D. B. J. College, who shouldered maximum responsibility of the Conference.

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Mr. S. S. Waghmode ***Dr. G. B. Raje*** ***Dr. Sagar A. Vhanalakar***

Associate Editor ***Editor-in-Chief***

And Editorial Team

Recent Trends in Conservation and Management of Ecosystems

2018

Content

SOME NOTES ON THE CONSERVATION OF BIODIVERSITY OF JAMMU AND KASHMIR STATE (INDIA)

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ABSTRACT:

Biodiversity provides a wide range of goods, services, business opportunities and healthy economic system. Being the life-line of societies, some of its by-products include building materials, wood products, fibres, dyes, resins, rubbers, oil, soil formation, protection of water resources, food, medicinal resources, pharmaceutical drugs, ornamental plants, diversity in genes, etc. Although Jammu & Kashmir is a biomass state, yet the economic value of its bio-wealth has so far neither been fully recognized nor explored and documented. Instead due to varied reasons, it has suffered badly and is now under tremendous pressure. The important economic sectors of the state like agriculture, horticulture, fisheries, forests, wildlife, sericulture, livestock, tourism, food industry, etc are all dependants on biodiversity and contribute around 30-40% to State Gross Domestic Product (SGDP). A comprehensive strategy having an interdisciplinary approach involving planners, policy makers, researchers, experts etc, needs to be chalked out which besides highlighting the prospects of biodiversity in the development of state, will simultaneously help in the conservation of the rich biological diversity of the region. Conservation of biodiversity at local community level with the creation of Local Biodiversity Cells (LBC) at district/tehsil/village/town level with emphasis on role of students and local people is proposed.

KEYWORDS: Biodiversity, J&K State, Importance, Challenges, Local Biodiversity Cells

INTRODUCTION:

Biodiversity is variety of life and its processes and sustains the web of life. It includes all life forms from bacteria, fungi and protozoa to higher plants, insects, fishes, birds, countless millions of races, sub-species and local varieties of species and the ecological processes and cycles that link organisms into population, communities, ecosystems and ultimately the entire ecosystem. According to RIO Convention (1992), biodiversity means the variability among living organisms from all sources

including *inter alia*, terrestrial, marine, and other aquatic ecosystem and the ecological complexes of which they are part. This includes diversity within species, between species, and of ecosystem. Being the product of over 3.5 billion years, it offers one of the widest spectrums of livelihood, goods and services and business opportunities and benefits humankind in numerous ways by providing wide range of ecological, economic, social, cultural, educational, scientific and aesthetic services. The dependence of human beings on biological diversity is undoubted, as evident in everyday life [1]. Biological resources are used to fulfill the basic requirements of man viz. food, clothing, shelter, fuel and natural medicines. Three plant species namely wheat, rice and maize provide half of the world's food [2]. To date, about 1.7 million species have been described while many more await discovery. India is a megadiversity country and accounts for 7-8% of the recorded species of the world and till date over 46,000 species of plants, 89,000 species of animals and 5,650 microbial species have been described so far [3]. Biodiversity manifests itself at three levels namely species diversity, genetic diversity and ecosystem diversity. All three levels of the biological diversity are necessary for the continued survival of life, and all are important to people [4].

Biodiversity requires our attention for two reasons. First, it provides a wide range of direct and indirect benefits to humans. Second, human activities have contributed, and still contribute, to unprecedented rates of biodiversity loss, which threaten the stability and continuity of ecosystems as well as their provision of goods and services to humans [5].

As per United Nations (2015), billions of people continue to live in poverty and are denied a life of dignity. Among others, natural resource depletion, desertification, drought, land degradation, freshwater scarcity, loss of biodiversity, and related humanitarian crises remain key challenges which add to and worsen the list of challenges which humanity faces and threaten to reverse much of the development progress made in recent decades. The United Nations General Assembly at its 65th session declared the period 2011-2020 to be the "United Nations Decade on Biodiversity" with a goal to mainstream biodiversity at different levels and promote its overall vision of living in harmony with nature. Further among the 17 Sustainable Development Goals (SDGs) of United Nations, agenda for 2030, 14 & 15 SDGs, lay emphasis on the need and necessity to conserve and manage bio-wealth and other natural resources while talking about achieving of Sustainable Development.

STUDY AREA (JAMMU AND KASHMIR STATE):

The Jammu and Kashmir State is situated in the north of the Indian subcontinent and forms the north western range of the Himalayas. The exceptional biological diversity of the Himalaya is mainly due

to the multiple biogeographic origins [6]. The state has strategic location and is bordered on the north by China (with a very small portion of the northwest border touching Afghanistan), on the east by Tibet, on the west by Pakistan and on the south by the Indian states of Himachal Pradesh and Punjab. The State forms an important part of Indian Himalayan Region (IHR), which represents nearly 3.8% of total human population of the India and supports over 1748 (23.4% of India) plant species of known medicinal value. The administrative capital of the state is Srinagar in summer and Jammu in winter [2, 7]. Geographically the state is divided into three regions, viz., Jammu, Kashmir & Ladakh [8]. The state is divided into 22 districts *viz*. Jammu region 10 districts (Doda, Jammu, Katra, Kishtawar, Kuthwa, Reasi, Rajouri, Ramban, Samba, Udhampur), Kashmir region, 10 districts: (Anantnag, Bandipora, Baramulla, Budgam, Ganderbal, Kulgam, Kupwara, Pulwama, Shopian and Srinagar) and Ladakh region 2 districts (Kargil & Leh). The state has four National Parks, 16 Sanctuaries and 35 Conservation Reserves covering an area of 15912 Sq Kms. 19.95% of the geographical area (Jammu region 45.89%, Kashmir region 50.97% and Ladakh region 0.06%) on the Indian side is under forest [7, 9] (Anonymous, 2009, 2011). The statistics and data on floral and faunal biodiversity/wealth of this rich and unique but still fully unexplored region has not been fully compiled and documented as compared to other parts of the India & world. As per the preliminary estimates 3064 plant and 1737 animal species have been reported from the region and among them angiosperms (2000 species) form the major documented groups [2, 10] and around 106 plants have medicinal properties [2].

Economics of biodiversity:

Due to substantial topographical, altitudinal and climatic variation, Jammu & Kashmir State harbors a rich and diverse flora and fauna and is considered a biological paradise. The people living here have always remained in close association with and dependent on its biodiversity. The region rightly called as “Biomass State” [11] is famous for its bio-products like fruits, timber, furniture, wood carving, medicinal plants, flowers, carpets, silk, honey, wool, game animals, fishes, butterflies, birds, etc.

The important economic sectors of the state like agriculture, food industry, fisheries, forests, handicrafts, handlooms, horticulture, livestock, sericulture, tourism, wildlife, etc are dependent on biodiversity and their contribution in State Gross Domestic Product (SGDP) is estimated to be 30-40%. The contribution of agriculture, livestock & its derived foods and horticulture in State Gross Domestic Product (SGDP) is estimated to be 8-9%, 11% and 7-8% respectively [9]. The other economic sectors like tourism, apiculture, sericulture, floriculture, handicrafts, handlooms, etc which provide employment

opportunities to a sizeable number of people are all directly or indirectly linked to the bio-wealth of the region.

Threats to Biodiversity (Issues & Concern):

Every human activity has some effect on the natural environment as a whole, and over the past few decades, there has been a growing recognition and concern that increasing economic activity and development carry environmental costs. With the result, biodiversity is under threat worldwide including the J&K State. In spite of providing employment opportunities to a large number of population and contributing in the State GDP both directly or indirectly, the biological wealth is still poorly identified and documented. Instead due to varied reasons, it has suffered badly and is now under tremendous pressure. The rapidly increasing population of the state will put more demands on the natural environment and can be a major challenge to biodiversity conservation and it may directly affect the quality of life of people living in the region. According to a rough estimate about 40% of the endemic plant species in Kashmir Himalaya are currently threatened. Around 09 species of birds and 17 species of mammals have already been listed as threatened and among them *Cervus elephus hanglu* (Kashmir Stag), *Eupetarus cinereus* (Kashmir Wooly Flying Squirrel), and *Panthera uncia* (Snow Leopard) are declared as Endangered [2]. The main causes and threats to biodiversity of the region have been broadly are as under:

- Fragmentation, degradation and loss of habitats
- Global warming and climate change
- Invasive alien species
- Desertification
- Shrinking of genetic diversity
- Pollution and ozone depletion
- Deterioration of landscape quality
- Overexploitation & depletion of resources
- Population Pressure, Migration and Urban congestion
- Less Protected Area Network (PAN)
- Soil erosion & deforestation
- Impact of development projects
- Increasing waste production and inadequacies of waste disposal
- Legal, Cultural and Political issues

- Encroachments, Constructions & New Settlements
- Grazing, Poaching, Smuggling
- Limited local community participation/awareness
- Conflict
- Natural Disasters
- Change in People's Life Style & Generation Gap
- Dilution of Traditional Values &Erosion of indigenous Knowledge
- Poor institutional and governance system

Conservation Approach:

From time to time several efforts / strategies both *in-situ* and *ex-situ* have been taken for the protection and conservation of biological wealth of the region. Project Hangul, Markhor conservation, conservation of Dal & Wular Lakes, etc are some of the activities in this direction. The IUCN& WWF assisted Project Hangul in 1970 to save endangered Kashmir Stag (*Cervus elephus hanglu*) is one of the important *ex-situ* initiative by the government to save this European cousin [12]. In fact the importance of biological wealth and its conservation has been one of the focal point of our ancestors/saints etc. The famous saying of the great and revered 14-15th century (1378-1438 AD) Kashmiri mystic / Saint, Sheikh Noorudin Wali (RA) popularly known as Sheikhul Alam/Alamdar-i-Kashmir/Nund Reshi that: Un Posh Teli Yeli Wan Posh meaning that *Food will only Last till Forest Lasts* is quite revealing and has universal relevance and describes the importance of biological wealth in a very touching way.

However, overall the conservation strategies adopted so far have been fragmentary and there is still large work to do which is challenging but inevitable. One finds least coordination between different departments working under same government setup. This casual approach is making tremendous deleterious effects on the overall development of the State and also ruins the state resources. Since the economy of the J&K state is essentially biomass based [11], the documentation of its biodiversity is an urgent requirement and need of the hour.

A proper State Tourism Policy having due regard and consideration for the biodiversity and sustainable development of the state and its implementation in letter and spirit is need of the hour. Prevailing of peace and harmony is an essential part for any developmental and conservation programme in the region. Without peace no scheme/funding/project on any developmental activity including biodiversity conservation or species recovery will be successful. The last more than 20 years old turmoil in Kashmir Valley particular and J&K State in general has created uncertainty, law and order

problem, confusion, fear, and political instability. This dark period however became the golden era of smugglers, poachers, timber traders, land grabbers, animal/plant exporters, etc who fully explored the situation. During this period dense forests got converted into open areas, forest land converted into public property, huge illegal constructions raised in otherwise prohibited area e.g., around Dal Lake, agricultural land converted into factories/houses/hotels and habitat of wildlife got badly affected. Since the situation of J&K state directly affects the ties and relationship of India and Pakistan. It is impressed upon all the concerned to work for the peace in the region because conflict situation gives birth and nurtures to every such mind/idea which is against the prosperity and development of humanity. Since the ultimate aim of conservation of biodiversity is to safeguard the existence of every living entity, there is urgent need to bring researchers, intellectuals, policy makers, scientists, scholars, students etc at a same platform where they can work hand in hand for the sustainable existence of all the types of living creatures distributed in various ecosystems including *Homo sapiens*.

The involvement of local people, students, NGO's, volunteers, media, and modern techniques is mostly seen on papers. Till date no concrete effort has been taken to include student/youth community in the biodiversity conservation of the region. The outcome of this negative attitude is ruining the bio-wealth of the region. Students/Youth are the corner stone of any region/area/country. The present scientific but challenging age belongs to them, hence their involvement in any developmental or conservation programme is a prerequisite. The student/youth shall be playing a major role in checking/minimizing/controlling the loss of the natural wealth of this popularly known paradise on earth in the times to come provided their power, strength, importance and talent is properly identified and nurtured. At the same time, the modern scientific and technologically advanced, fast and changing life has created generation gap between older and young minds. In a way it has affected the life style of people and traditional values and knowledge have got diluted. We can neither progress by leaving our decades old values and knowledge aside nor by relying only on present technology. Both of them have to be taken together. The old people (which are familiar with the traditional concepts and infact are the living fossils of our decades of old traditions) and youth (which are the precursors of the present social setup) have to work in tandem to tackle the burning global issues like biodiversity conservation, environmental degradation, climate change, poverty, pollution etc. Further, most of the biodiversity of the region is represented by the villages/rural areas, the main focus of any conservation and developmental programmes should be these natural hotspots and proper participation and consultation of people from these villages should be made possible

In order to document and conserve the biological diversity of the region and explore its socio-economic aspects, creation of Local Biodiversity Cells (LBC) at district level with emphasis on role of students and local people is proposed.

Local Biodiversity Cells (LBC):

The present approach of the biodiversity conservation is top to bottom which has proved to be less effective and lacks any unanimous coordination and consensus. There is hardly any involvement of schools, colleges, students, public representatives {Member of Legislative Assembly (MLA), Member of Legislative Council (MLC), and Member of Parliament (MP)}, teachers etc. In order to document the unexplored bio-wealth having great economic value of the state, it is observed that there should be an interdisciplinary and multidimensional approach with wider involvement of all the stakeholders for proper monitoring, documenting, conserving and exploring the rich & unique Biodiversity of the State for which creation of Local Biodiversity Cells (LBC) is proposed. There shall be a Local Biodiversity Cells (LBC) at the level of districts/tehsils/villages/towns with one designated college/school as "Model College/School". Each LBC shall be under the control of a Monitoring Body. These LBCs shall be having a Coordinator, Assistant Coordinators, Secretary and Volunteers and shall be semiautonomous bodies to act as *ex-situ* conservation centres representing members from:

- ✓ Schools, colleges, other educational institutions,
- ✓ People from district administration, media, law enforcing agencies
- ✓ Religious people from each area,
- ✓ Subject experts,
- ✓ Teachers from Schools/colleges,
- ✓ Local Public Representatives (Panchayat Members/MLA/MLC/MP),
- ✓ Renowned personalities/citizens, etc from the area (s).

Role of Local Biodiversity Cells (LBCs):

- To work for the documentation and conservation of Bio-wealth of the state.
- To aware public about biodiversity and its conservation.
- To raise voice against any act of deforestation, smuggling, timber trade, poaching, hunting, etc in the area.
- To help government in any of its programmes meant for biodiversity/environment conservation, lake conservation, pollution control, species recovery, etc.

- To collaborate with research institutions/bodies for conducting research, field trips, expeditions etc (at district/tehsil/village/town level)
- To aware public about the global challenges/issues like resource depletion, global warming, ozone layer depletion, pollution, etc their effect on humanity and role of each citizen/person to control them.
- To propose any such measure/step which they deem fit or necessary for the sustainable development of the area in particular and whole state in general.
- To organize seminars, conferences, symposia, workshops, quizzes, art shows focusing on the biodiversity of the area.
- To launch a website having information from district with regular updates.
- To help in preparing books, reports, documentaries, pamphlets, books, field notes, etc on the biodiversity of the region.
- The members of the LBC shall on rotation be given some basic training before taking any assignment.
- The term of each member/volunteer shall be fixed (upto 2-3 years) with the extension provision.

The ignorance and lack of awareness and limited local community participation is a big challenge in conservation activities. Steps need to be taken for generating awareness among the general public about the significance of biodiversity and its conservation. The research on the biodiversity of the region has to be strengthened and prioritized. There is urgent need for an inter-disciplinary approach of various stake holders where proper coordination and consensus is taken so that any loop holes which directly or indirectly harm the biodiversity of the region can be checked, minimized and controlled. The proposed LBCs can be an effective tool in the outreach & awareness programmes at local level. The proposed approach is people centric, with involvement of a large number of stakeholders (Fig. 1) in an interdisciplinary way. Biodiversity shall be included as a compulsory, elective or open elective subject in curricula at School, College and University levels. The state universities can play an important role in this area but there should be proper support and funding from the government as well.

CONCLUSION:

Biodiversity is sometimes called “the wealth of the poor” [4] because rural people living close to the land depend upon biodiversity to provide natural goods and ecological services. Biodiversity has economic value and its contribution in the GDP of places like J&K is enormous and unavoidable in the

times to come. There is urgent need to recognize the wide range of ecological, economic, social, cultural, educational, scientific and aesthetic services of biodiversity in the State's socio-economic development at the administrative/political level so that a stable economy with sustainable development can be achieved and maintained. There should be a "State Vision Document" on Sustainable Economic Development covering all areas including Biodiversity. Again, since biodiversity is a global issue and affects everyone, it becomes imperative for everyone including all of us to join hands and work in tandem for its conservation, so that we can handover this natural and millions of years old wealth to our future generations.

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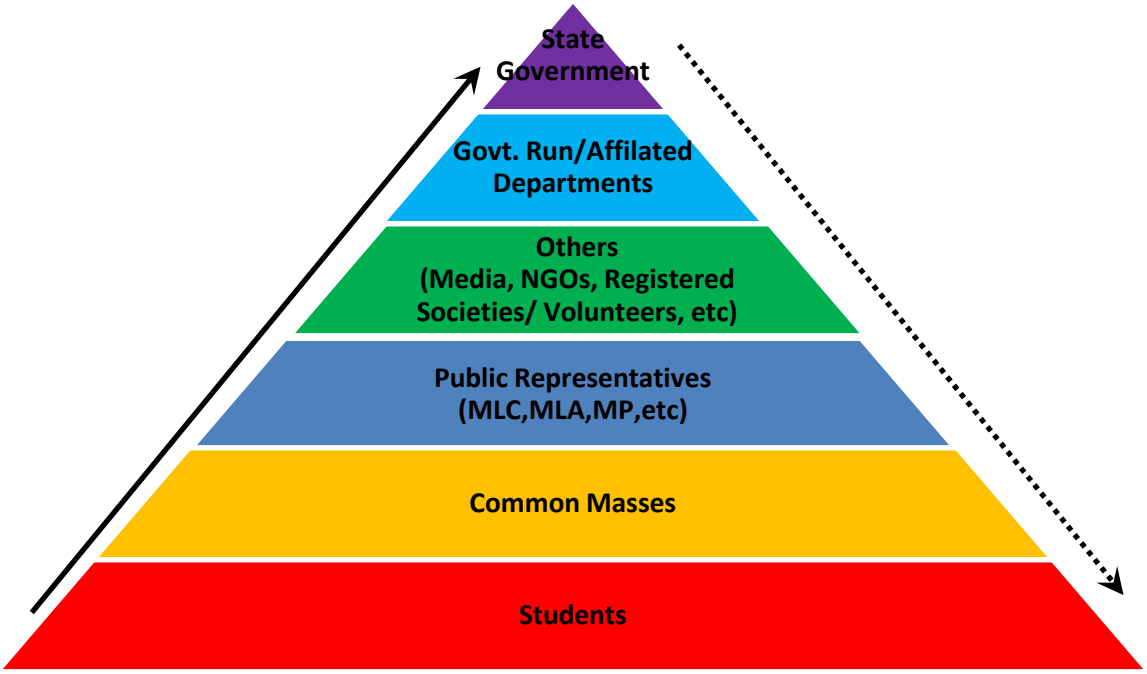

Figure 1: Approaches to study Biodiversity Conservation (Upward dashed line depicts the present approach while downwards dotted line shows the proposed approach)

RECOGNITION OF PROMINENT SPECIES AND THEIR Z-TRANSFORMED TRENDS AT ALIBAG LANDING CENTRE, MAHARASHTRA

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ABSTRACT:

Identification and knowledge about the behavior of the prominent species are of utmost importance to every fishing zone. Knowing the behavior of prominent species can help policy makers to take decision for better performance and sustainability. This paper studies the thirty-year marine landings of various species landed in Alibag fishing zone from 1982-83 to 2011-12. Pareto's 80/20 rule was applied on the observed total landings of various species to identify the prominent species in Alibag fishing zone. Non-Penaeid Prawns, Penaeid Prawns, Ribbon Fish and Golden Anchovy provided 80% of the landings. There was a sizable difference observed between the landings of Non-Penaeid Prawns and other prominent species. Z-transformation was used for simultaneously comparing time series trend graphs of these prominent species. In the first decade, of the study period non-penaeid prawns showed positive covariance with penaeid prawns and ribbon fish while portraying negative covariance with Golden Anchovy, in the second decade non-penaeid prawns showed positive covariance with penaeid prawns and Golden Anchovywhile negative covariance was observed with ribbon fish. In the third decade, howevernon-penaeid prawns showed negative covariance with penaeid prawns, Golden Anchovy and ribbon fish.

KEYWORDS: Pareto 80/20 rule, Z-transformation, Time series, Trend, Covariance, Fish Landing Alibag

INTRODUCTION:

Alibag is the number XII fishing zone situated in Raigad district of Maharashtra. There are thirty-three varieties of commercial fishes which are landed at Alibag (18.6554° N, 72.8671° E). It is very important for such a multi-species fishery landing center to understand the trends and which species are prominent and which are not. The prominence of a species may vary from zone to zone. By identifying

species, according to prominence, resource management and relative strategic decisions can be prioritized. To carry out such operations the behavior of the prominent species group should be critically studied. This work stresses on studying trends and identifying prominent species using Pareto 80/20 rule and Using Z-score transformation to standardize prominent species landings. These standardized landings were used for comparing trends of the prominent species simultaneously.

MATERIALS AND METHODS:

The data was collated from the annual fisheries production reports of the Maharashtra State Department of Fisheries, Government of Maharashtra. The scope of the study is limited to analyzing the landings of various species in Alibag fishing zone for a period of thirty years i.e. from 1982-83 to 2011-12. The data analysis was performed using Microsoft Excel 2013 and R software.

Pareto Chart:

The Pareto chart is based on Pareto's 80/20 principle. Applying this rule to fish landings can help to define prominent species of a particular fishing zone as these species will contribute to 80% of the total observed landings. The procedure for Pareto chart was followed as explained by Muralidharan [1].

Z-Score Transformation:

The Z-score transformation was used for better visualization of prominent species landings, which provided better comparative inference.

The formula for Z-score transformation is given by.

$$Z_{ij} = \frac{X_{ij} - \mu_i}{\sigma_i} \qquad (1)$$

Where,

i=1, 2, 3,. . . ,p

j=1, 2, 3,. . ., n

Zij= Z-score of the ith prominent species and jth observation

Xij=observed landing of the ith prominent species and jth observation

μi= Mean landing of the ith prominent species; σi= Standard deviation of ith prominent species

p=total number of prominent species; n=total number of observations

Covariance:

The sample covariance among most prominent species and other prominent species were calculated for three decades explaining proportionality relation between them for each decade.

The sample covariance formula is given as follows,

$$\mathrm{Cov}(X'_{ij}, X_{ij}) = \frac{\sum(x'_{ij} - \bar{x'})(x_{ij} - \bar{x_i})}{n-1} \quad (2)$$

i=1, 2, 3,. . . ,p

j=1, 2, 3,. . ., n

Xij'= observed landing of the most prominent species and jth observation

Xij=observed landing of the ith prominent species and jth observation

Anderson-Darling Test of Normality:

The Anderson-Darling test for testing the hypothesis of normality of the data was performed as performed by Thode [2]. The test statistic is,

$$\mathbf{A} = -\mathbf{n} - \frac{\mathbf{1}}{\mathbf{n}}\sum_{\mathbf{i=1}}^{\mathbf{n}}[\mathbf{2i-1}][\ln(\mathbf{p_{(i)}}) + \ln(\mathbf{1} - \mathbf{p_{(n-i+1)}})] \quad (3)$$

Where p(i) = Φ([x(i) − x]/s). Here, Φ is the cumulative distribution function of the standard normal distribution, and x and s are mean and standard deviation of the data values. The p-value is computed from the modified statistic, According to Table 4.9 in Stephens [3].

$$Z = A(1.0 + 0.75/n + 2.25/n2) \quad (4)$$

The Anderson-Darling test was applied using the R software by selecting the 'nortest' package developed by Juergen Gross and Uwe Ligges [4].

Hypothesis was tested at 99% level of significance, H0: The data is normally distributed

Against,

H1: The data is not normally distributed

Table 1: ANOVA Table

Source of Variation	D.F.	Sum of Square	Mean Sum of Square	F-ratio	p-value
Between Groups	p-1	$SST=n\sum(\bar{y}_{i.} - \bar{y}_{..})^2$	$MSS = \frac{SST}{p-1}$	$\frac{MSS}{MSE}$	F.dist(F-ratio,p,p-n-1)
Within Groups	n-p	SSE = TSS -SST	$MSE = \frac{SSE}{n-p}$		
Total	n-1	$TSS=\sum\sum(y_{ij} - \bar{y}_{..})^2$	-		

Where, p=number of treatments, n=total number of observations, SST=Treatment sum of square, ESS=Error sum of square, TSS=Total sum of square, MSS=Mean sum of Square, MSE=Mean Sum of Errors

ANOVA:

Analysis of variance (ANOVA) was carried out to test the hypothesis at 99% level of significance,

H0: There is no significant difference between the mean landings of i^{th} prominent species across three decades.

Against,

H1: There is a significant difference between the mean landings of i^{th} prominent species across three decades.

ANOVA procedure was performed as suggested by Montgomery [5].

RESULTS AND DISCUSSION:

Species Prominence:

Identification and knowledge about the behavior of the prominent species are of utmost importance to every fishing zone. Knowing the behavior of prominent species can help policy makers to take better performance and sustainability oriented decisions. Pareto's 80/20 rule helps us to identify the prominent species at Alibag fishing zone.

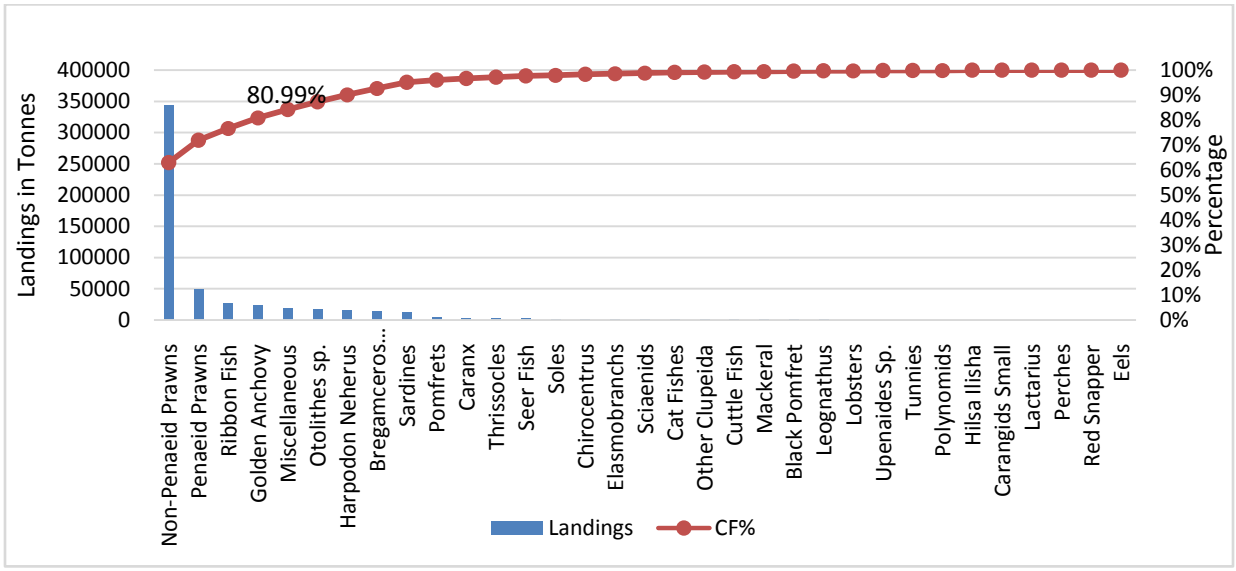

Fig.1: Pareto Chart for 30 years of fish landings at Alibag

The Pareto chart in Fig.1 suggests that less than 20% of the variety of fish contribute to 80.99% of the cumulative landings i.e. only 4 out of 33 varieties of fish cumulatively contributes 80.99% of the

total marine landings of thirty years. Therefore, we term these 4 varieties of fish as prominent species which are Non-Penaeid Prawns, Penaeid Prawns, Ribbon Fish and Golden Anchovy.

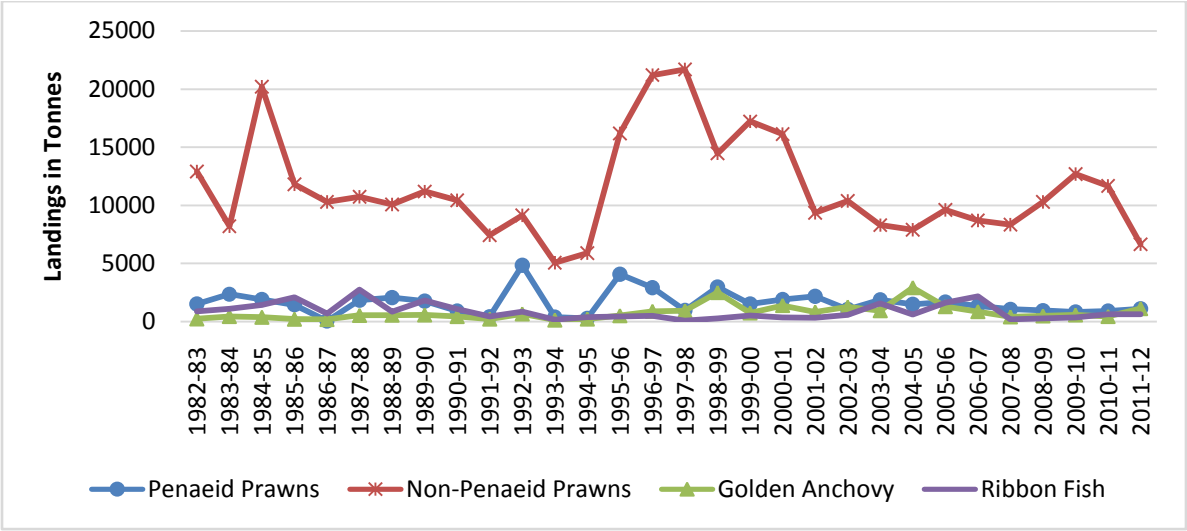

Fig. 2: Trend of thirty-year landings of prominent species

There is a visible quantitative difference as seen in Fig.2 between the Non-Penaeid prawns and other prominent species. Thus, by empirical evidence, the Non-Penaeid prawns are the most prominent species of the Alibag fishing zone.

Z-Transformation:

In such situation, it becomes difficult to simultaneously compare the most prominent species with the other species having overlapping trend due the scale at which the most prominent species lands. Therefore, Z-score transformation is being applied to standardize the landings of prominent species. By standardizing, data becomes independent of its scale and brings various attributes on the same plane. Applying Z-score transformation improves visualization of varying scale data for comparison. Since the data has become independent of scale the trends tend to overlap with each other and make it difficult to interpret patterns as shown in Fig.3.

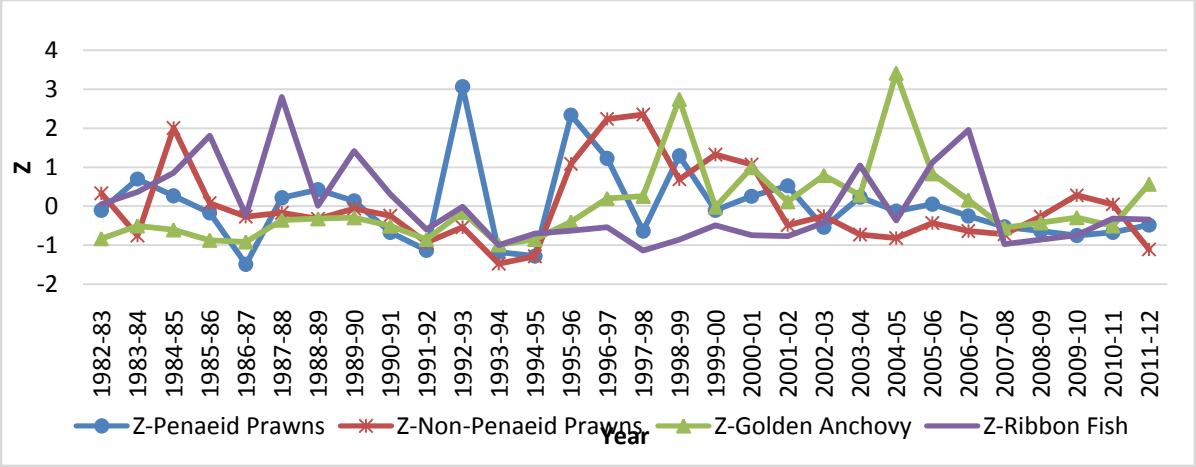

Fig. 3: Standardized (Z Transformed) trend of prominent species

To avoid confusion, we plot the most prominent species, i.e. Non-Penaeid prawns one by one with other prominent species for trend comparison which revealed that the trends of both Penaeid and Non-penaeid prawns matches with each other Fig.4 while that of Golden Anchovyis rising Fig.5 whereas ribbon fish Fig.6 is decreasing when compared with the Non-penaeid prawns. There is therefore scope to believe that the most prominent species may be replaced in future.

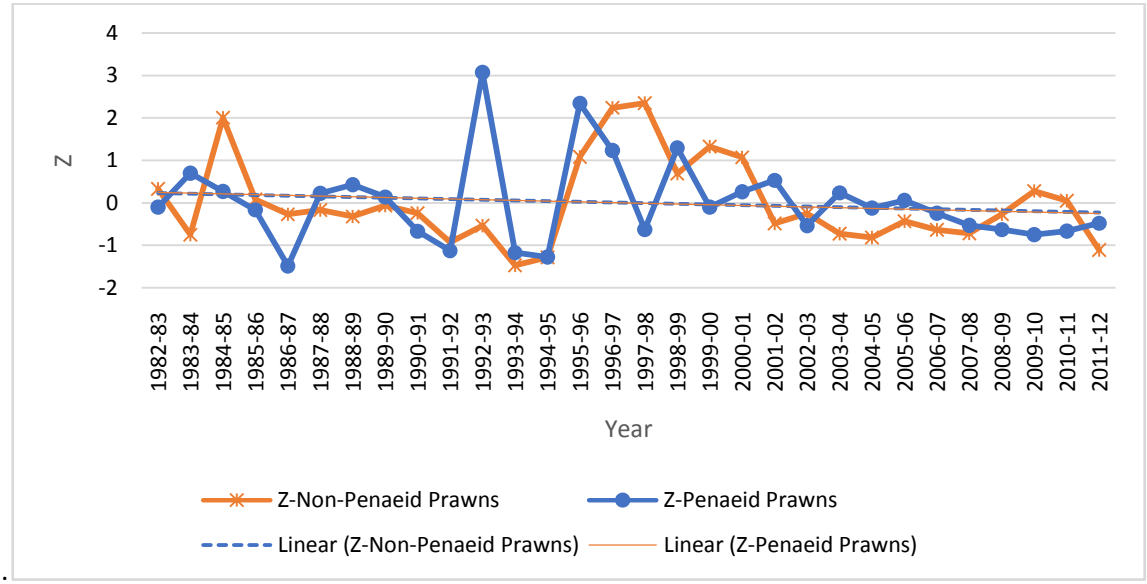

Fig. 4: Standardized (Z Transformation) trends of Non-Penaeid prawns and Penaeid prawns

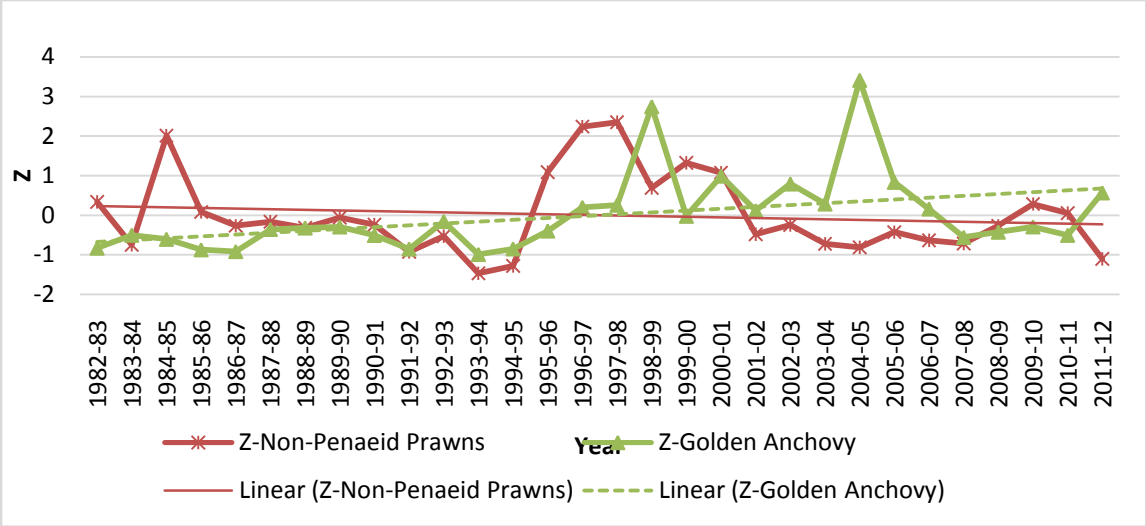

Fig. 5: Standardized (Z Transformed) trends of Non-Penaeid prawns and Golden Anchovy

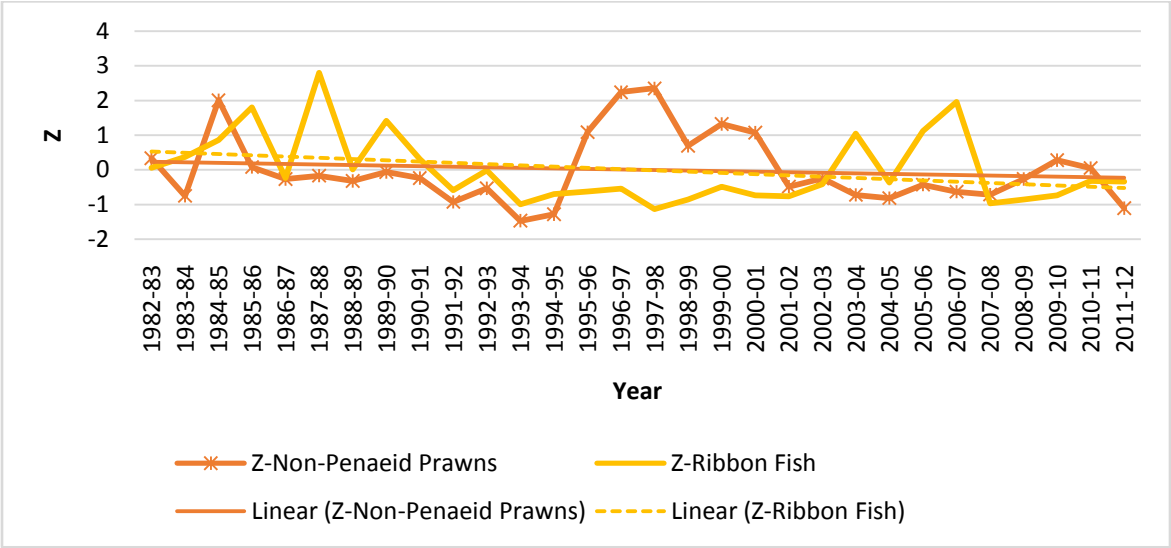

Fig. 6: Standardized (Z Transformation) trends of Non-Penaeid prawns and Ribbon fish

Table 2: Decade wise covariance of Non-Penaeid Prawns with other prominent species

Decade	Penaeid Prawns	Golden Anchovy	Ribbon Fish
1982-83 to 1991-92	673240.7	-11798.3	585015.1
1992-93 to 2001-02	1800805	1579881	-134955
2002-03 to 2011-12	-336353	-581099	-310385

Table 2 and Fig.4, 5, 6 shows in the first decade, i.e. from 1982-83 to 1991-92 that Non-Penaeid prawns show directly proportional relation with Penaeid prawns and Ribbon fish, whereas it shows inversely proportional relationship with Golden Anchovy. In the second decade, i.e. from 1992-93 to 2001-02 the Non-Penaeid prawns shows directly proportional relation with Penaeid prawns and Golden Anchovywhereas it shows an inversely proportional relationship with Ribbon fish and in the third decade, i.e. from 2002-03 to 2011-12 the Non-Penaeid prawns showinversely proportional relationship with all other prominent species.

Table 3: Species wise and decade wise Anderson-Darling test for normality

Species	A(D1*)	p-value (D1*)	A(D2*)	p-value (D2*)	A(D3*)	p-value (D2*)
Non-Penaeid Prawns	0.8542	0.0176	0.3288	0.4465	0.2134	0.7944
Penaeid Prawns	0.4049	0.2847	0.1917	0.8601	0.4182	0.2627
Ribbon Fish	0.3687	0.3535	0.2841	0.5512	0.8105	0.0230
Golden Anchovy	0.4966	0.1613	0.6296	0.0712	0.8487	0.0182

*D1:1982-1983 to 1991-92, D2: 1992-1993 to 2001-02, D3: 2002-03 to 2011-12

Table 3 Suggests that, at 99% level of significance, the p-value of Anderson-Darling test is greater than 0.01 for all species and in all decades. Therefore, at 99% level of significance the landings data follows normal distribution in all decades.

Table 4: ANOVA table for Non-Penaeid Prawns

Source Of Variation	SS	df	MS	F	P-value	F crit
Between Groups	8740695 4	2	4370347 7	2.56626 8	0.09542 3	3.35413 1
Within Groups	4.6E+08	27	1702997 1			
Total	5.47E+08	29				

Table 5: ANOVA table for Penaeid Prawns

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	5215691	2	2607846	2.642601	0.089508	3.354131
Within Groups	26644894	27	986847.9			
Total	31860586	29				

Table 6: ANOVA table for Golden Anchovy

Source of Variation	SS	Df	MS	F	P-value	F crit
Between Groups	2346563	2	1173281	3.419063	0.047471	3.354131
Within Groups	9265286	27	343158.7			
Total	11611849	29				

Table 7: ANOVA table for Ribbon Fish

Source of Variation	SS	Df	MS	F	P-value	F crit
Between Groups	4256620	2	2128310	6.410287	0.005272	3.354131
Within Groups	8964400	27	332014.8			
Total	13221021	29				

As shown in Table.4, 5, 6, 7 ANOVA was performed for testing the mean difference for each prominent species to test if there is any significant difference in the mean landings of each prominent specious throughout in the three decades. At 99 % level of significance for Non-Penaeid Prawns, Penaeid Prawns and Golden Anchovythe p-value of ANOVA table was greater 0.01thus; there is not enough evidence to reject our null hypothesis. Therefore, there is no significant difference in the mean landings of Non-Penaeid Prawns, Penaeid Prawns and Golden Anchovy throughout the three decades, which can be seen in Fig.7, 8 and 9. Whereas for Ribbon fish the p-value of ANOVA table was less than 0.01 thus we reject our null hypothesis. Therefore, there is a significant difference in the mean landings of Ribbon fish throughout in the three decades, which can be seen in Fig.10.

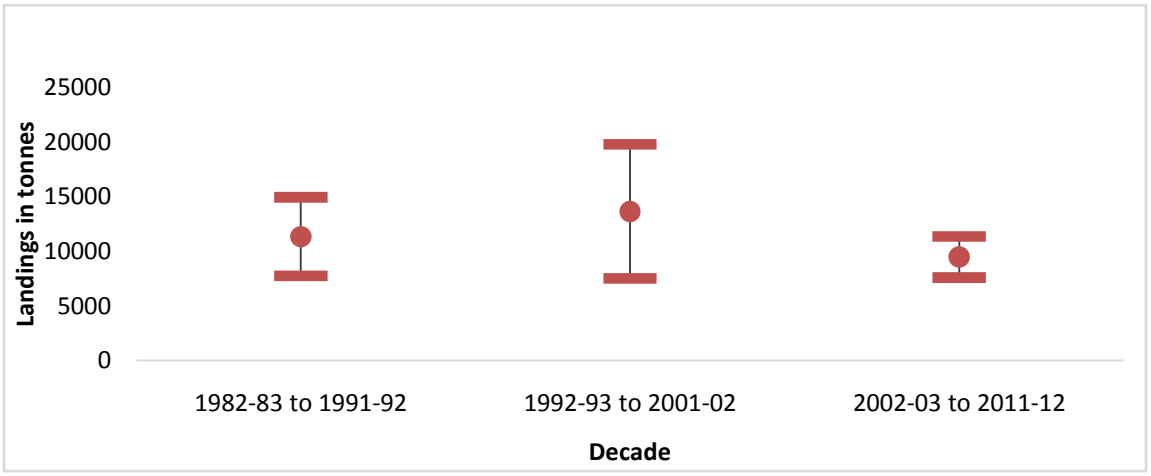

Fig. 7: 99% Mean confidence interval of Non-Penaeid Prawns

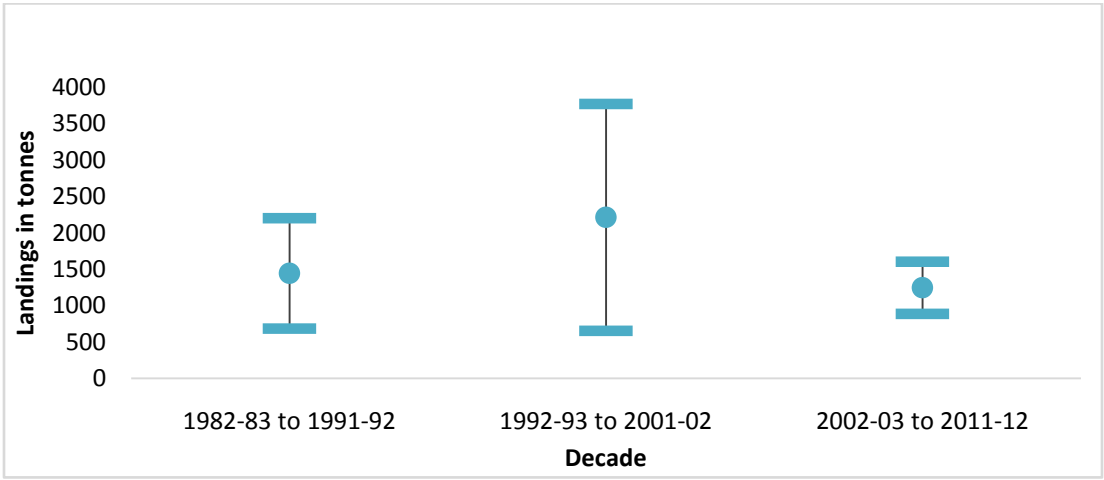

Fig. 8: 99% Mean confidence interval of Penaeid Prawns

Fig. 9: 99% Mean confidence interval of Golden Anchovy

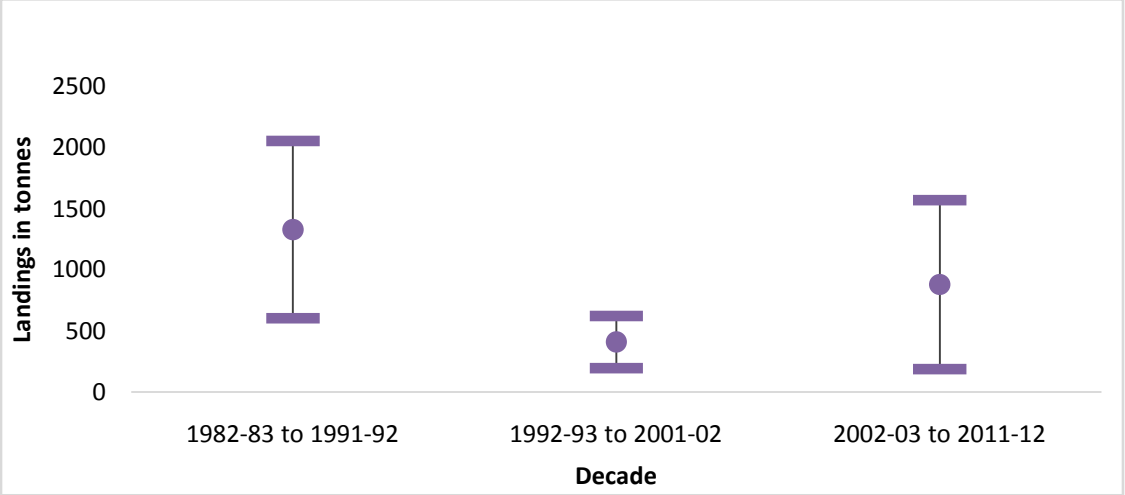

Fig.10: 99% Mean confidence interval of Ribbon Fish

CONCLUSION:

The Pareto chart turns out to be a good method for identifying prominent species. The Pareto chart explained that at Alibag fishing zone Non-Penaeid prawns, Penaeid prawns, Golden Anchovy and Ribbon fish are the prominent species. Covariance of various prominent species also helps in providing the empirical direction of relationship thus inference on landing behavior specific to the decades could be made. The Z-score transformation helped in improved visualization of trends of landings of various species which otherwise portrayed vast difference in the magnitude. Accordingly, it may be concluded that if proper monitoring is not done then the most prominent species which mainly are the prawns, fetching foreign exchange, may be replaced in long run as revealed by the comparative trends after Z

transformation, though in real life situation the difference in the landings between the two is very vast and hence there is no threat to the prominent species of prawns in the near future. The same is endorsed by ANOVA which revealed that there is no significant change in the landings of Prawns and Golden Anchovy. The landings of Ribbon Fish alone have demonstrated significant difference in the last three decades.

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DIVERSITY OF BIVALVE MOLLUSCS FROM KALBHADEVI ESTUARY, RATNAGIRI (MS): A SYSTEMATIC SURVEY

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ABSTRACT:

The present work deals with the systematic survey of bivalve molluscs of Kalbhadevi estuary. The survey revealed a total 15 species of bivalve molluscs, these bivalves belonging to 4 families and 14 genera were recorded. The observation indicates the fragility and productivity of estuary.

KEYWORDS: Kalbhadevi estuary, Bivalve molluscs, Systematic, Diversity.

INTRODUCTION:

Being a very specialized environment, estuaries supports a wide assemblage of animal communities. It is the life habitats of many groups of animals which live entirely within. Many suspension feeding marine bivalve molluscs live in variable environments, such as estuaries and shallow coastal waters.

Many ecological and faunal survey studies have been carried out on the back waters and mangroves all over the world; some are Ganapati and Rao [1] in the Godavari estuary. Berry [2, 3, 4] studied the distribution of molluscs in the Malaysian mangrove swamp, Macnae [5] has described the general account of the fauna and flora of mangrove swamp and forests in Indo west pacific region, Subba Rao and Mookherjee [6] in Mahanadi estuary Orissa, Hutchings and Recher [7] has studied meiofauna of Malayan mangrove shore and Ashton [8] studied biodiversity and community ecology of mangrove plants, molluscs and crustaceans in two mangrove forest in peninsular Malaysia. Subba Rao *et.al.* [9] studied the malacofauna of Muriganga estuary, Sunderban.

Present work has been carried out with a view to catalogue the bivalve molluscs living in intertidal sandy and muddy region of the Kalbhadevi estuary.

MATERIALS AND METHODS:

Samples of bivalve molluscs were collected at fortnight intervals during low tide period. The sampling procedure consist of placing series of quadrates of nylon rope of one meter square and one

foot depth, by laying randomly just over the bed. The sand in the quadrates was dug out with the help of shovel and spade and sieved through different sieves having different mesh sizes for different animals. They were thoroughly washed and passed with different grades of alcohol. Then they were preserved in 70% alcohol. Some animals were preserved in 10% formalin. Bivalve molluscs were identified according to [10, 11, 12, 13, 14].

RESULTS AND DISCUSSION:

Total 15 species of bivalves belonging to 4 families and 14 genera were recorded in survey viz. *Crassostrea cuttuckensis, Saccostrea cucullata,, Meretrix meretrix, Meretrix casta, Katelysia opima, Paphia laterisulca, Gelonia proxima, Sanguinolaria diphos, Dosinia prostata, Venerupis microphylla, Gafrarium divaricata, Arca granosa, Perna Viridis, Modiolus metcalfei, Pinna sucatta* (Table-1). The abundance of bivalves indicates the rich productivity of estuary.

Most dominant macro faunal group recorded for Maharashtra coast are given molluscs group was represented by many important species of bivalves such as *Perna viridis*, *Crassostrea cuculata*, *Pinctada* sp. *Meretrix casta*, *M. Meretrix*, *Gafrarium* sp. etc. [15].

The bivalve molluscs play a vital role in converting the organic matter together memo benthos into biomass which in turn is consumed by fishes. Thus the molluscs help in the secondary productivity and form an important component in the food web of the estuarine ecosystem [16]. Due to a good food quality they are widely exploited by local fishermen's. Many factors, both natural and man-made have been responsible for limiting the distribution of bivalve species and causing them to become rare or even extinct.

Table 1: Checklist of molluscan fauna (Bivalvia) from Kalbhadevi estuary

Order	**Family**	**Genus**	**Species**
I. Arcoidea	1. Arcidae	*Arca*	1) *granosa* (Linnaeus, 1758)
II. Eulamellibranchia	2. Veneridae	*Meretrix*	2) *meretrix* (Linne, 1758) 3) *casta* (Chemnitz) (Preston, 1915)
		Katelysia	4) *opima* (Gmelin)
		Paphia	5) *laterisulca* (Roding)
		Gelonia	6) *proxima* (Gmelin)
		Sanguinolaria	7)*diphos* (Linnaeus, 1758,1771)
		Dosinia	8) *prostata* (Linne, 1758)

		Venerupis	9) *microphylla* (Deshayes)
		Gafrarium	10) *divaricata* (Chemnitz)
	3. Ostreidae	*Crassostrea*	11) *gryphoides* var *cattuckensis* (Newton & Smith)
		Saccostrea	12) *cucullata* (Born, 1778)
III. Mytiloidea	4. Mytilidae	*Perna*	13) *viridis* (Linne)
		Modiolus	14) *metcalfei* (Hanley)
		Pinna	15) *succatta*

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HAEMATOLOGICAL ALTERATIONS INDUCED BY BIOCIDE TOBACCO (*NICOTIANA TOBACCUM*) ON THE HAEMATOLOGY OF FRESHWATER FISH (*CHANNA PUNCTATUS*)

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ABSTRACT:

The use of biocides constitutes a very important group of environmental pollutants as they are potent metabolic inhibitors. *Channa punctatus* is an edible fish abundantly available in River Godavari, District, Nanded. The present investigation was carried out to study the impact of tobacco dust extract on haematology of Freshwater Fish, *Channa punctatus*. The fishes were exposed to different concentrations of tobacco dust extract for 24, 48, 72 and 96 hrs period of exposure. The total erythrocyte and total leucocyte count were done on the experimental fish, *Channa puntatus*. The results were compared with the results obtained from control set fishes. The resulted obtained showed that decline in TEL count and incline in TLC count in freshwater fish exposed to tobacco extract as compared to control.

KEYWORDS: Tobacco Leaf Dust, *Nicotiana tobaccum,* Freshwater Fish, *Channa punctatus*, Total Erythrocyte Count, Total Leucocyte Count.

INTRODUCTION:

Tobacco, *Nicotiana tabacum*, is an herbaceous plant in the family Solanaceae [Night shade], grown for its leaves. It is annual or perennial traditional use of history medicinal plant of remarkable benefits. It is of natural origin, cheap, easily available and eco-friendly narcotic plant. It acts as sedative, antispasmodic, and vermifuge. It contains an alkaloid substance mainly nicotine. It has been used effectively to protect and heal when abused it has ability to harm. The use of Tobacco acts as an effective and less expensive sedatives and anaesthetics [1].

The enormous uses of tobacco leaf dust on various fish species have been studied. The dry green leaf of tobacco dust is used widely in aquaculture as pesticide and in food. It is also used as health as

medicine for the treatment of earache, toothache, as a poultice and to scare snakes from the environment. It controls fungal attack; protozoan infections etc. on a wide variety of fish and other aquatic organisms. The *Nicotiana tobaccum* leaf dust is used to clear fish ponds of predators and fish weeds before stocking [2], [3], [4].

Haematology is the study of blood. The haematological studies is widely accepted and considered to be routine procedure in diagnoses. Information on the condition of organisms obtained when blood is studied through physiological, biochemical or other methods. The haematological parameters determine the liquid part of the blood [plasma and serum] as well as morphological composition of the blood [5].

The blood is fluid connective tissue which acts as the main transporting system of the body in all animals. In poikilotherms (fishes) it plays vital role during every movement for maintaining the physiological nature of the body with respect to the fluctuating environmental parameters [6]. It acts as principal transport medium of the body, carrying oxygen, nutrients and chemical messages to the tissues and waste products and synthesized metabolites away. The circulatory system provides access to all cells of the body for materials ingested or prepared elsewhere in the organism. The blood plays in coordination of individual cells into a whole complex organism. Along with dissolved nutrients, metabolites, electrolyte, hormones, substances to counteract infection and haemorrhage, it acquires a significant place to maintain an equilibrium condition between blood cells and blood stream.

The use of biocides and anaesthetics has been practicedgreatlytoday by the fish farmers. The biocides and anaesthetics used are few toxic and inexpensive while some are expensive and less toxic. To avoid adverse effects of these anesthetics, it is necessary to take the knowledge about optimum concentration of such anesthetics before using it on the biological indicators [7], [8]. The fish farmers use the tobacco leaves (*Nicotiana tobacco*) for controlling unwanted organisms and pests. The tobacco leaves used as a biocide agent. The farmers prefer to use of tobacco because of its inexpensiveness, local availability and easy degradability. Tobacco is also widely used as a biodegradable insecticide to predators and pest in pond water.

The physical properties of blood are very sensitive to environmental changes. Hence the objective of the present study is to investigate effect of tobacco dust extract on haematological parameter i.e. Total Red Blood Corpuscles and White Blood Corpuscles on freshwater fish i.e. *Channa punctatus*.

MATERIAL AND METHODS:

They were brought to the laboratory and kept in glass aquarium Murrels, commonly called snakeheads belonging to the family *Channidae (Ophiocephalidae)*, constitute the most common and dominant group of air breathing freshwater fishes and are highly regarded as food fish in the India. The freshwater fish, *Channa punctatus* used for present studywere collected from the Godavari River, Nanded (Maharashtra). The fishes were acclimated at room temperature for 7 days before experimentation with continuously aerated tap water. The water in the aquarium was replaced daily with fresh tap water. Healthy uninjured fishes ranging from 60- 70 grams were selected for present study.

Collecting Blood from Fish:

Blood sample in fishes were obtained directly by puncturing the caudal vessel. The blood collected using 2 ml sterile disposable syringe with No. 21 needle. The use of glass syringes avoided because it may quicken coagulation [9]. The syringe rinsed with anticoagulant (potassium salt of ethylene diamine tetra acetic acid, EDTA).The needle inserted in the caudal vessel and very slightly aspirated during penetration. Blood was taken under gentle aspiration and then the needle withdrawn. After detaching the blood mixed well in a vial containing anticoagulant (EDTA) at the concentration of 5 mg EDTA per ml of blood [10]. The collected blood of fish was used for the determination of Total RBC and WBC Count in freshwater fish, *Channa punctatus*.

The erythrocytes and leucocytes possess nuclei due to which clinical measurements are not possible for red and white cell number in fish blood. The Neubauer-hemocytometric method of blood dilution and counting in ruled areas in a microscope field is in common use. The collected blood of fish was used for the estimation of TEC. Total erythrocyte count was done by using improved Standard Neubauer's Haemocytometer [11]. The total number of corpuscles counted multiplied by 10,000 (volume factor x dilution factor x 200) to get the total number of red blood cells in 1 mm^3 for whole blood. The total erythrocyte count expressed in lakhs/mm^3. The collected blood of fish was used for the estimation of total count of WBC. Total Leucocytes count was done by using improved Standard Neubauer's Hemocytometer [12]. The total leucocytescount expressed in x $10^3/mm^3$.

RESULT:

The freshwater fish, *Channa punctatus* selected for the present research showed variations in the total erythrocyte count when exposed to tobacco extract. The tobacco extract were prepared (1 gm

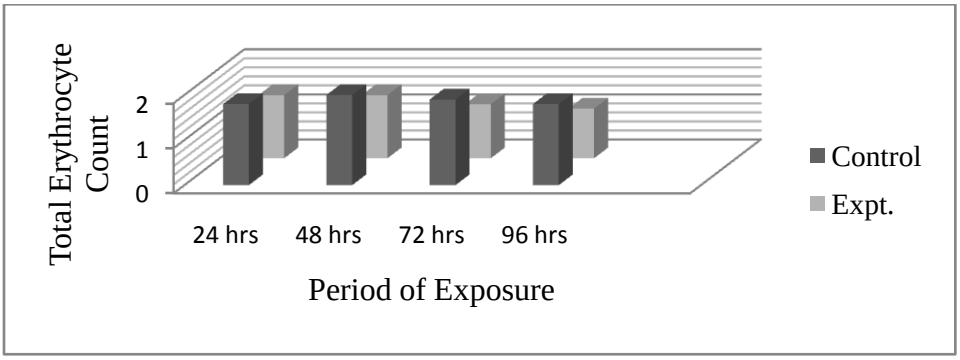
of tobacco leaves dust: 10 ml distilled water) and boiled. The diluted form of extract (1: 10 ml) is used for present study. The freshwater fish *Channa punctatus* were exposed to tobacco extract stress up to 96 hrs. The total counts for RBC were observed on 24, 48, 72 and 96 hrs of continuous exposure. The TEC was found to be decreased up to 96 period of exposure. The results were compared with control set. Overall it was observed that, as period of exposure increases the RBC content declined in *Channa punctatus* up to 96 hr period of exposure.

The total leucocyte count was observed for 24, 48, 72 and 96 hrs period of continuous exposure. The TLC was found to be increased at the end of exposure period. The results were compared with control set. Overall it was observed that, as period of exposure increases the TEC declined and TLC content was found to be inclined in snake headed freshwater fish, *Channa punctatus.* The obtained results are given in following table and plotted graphically.

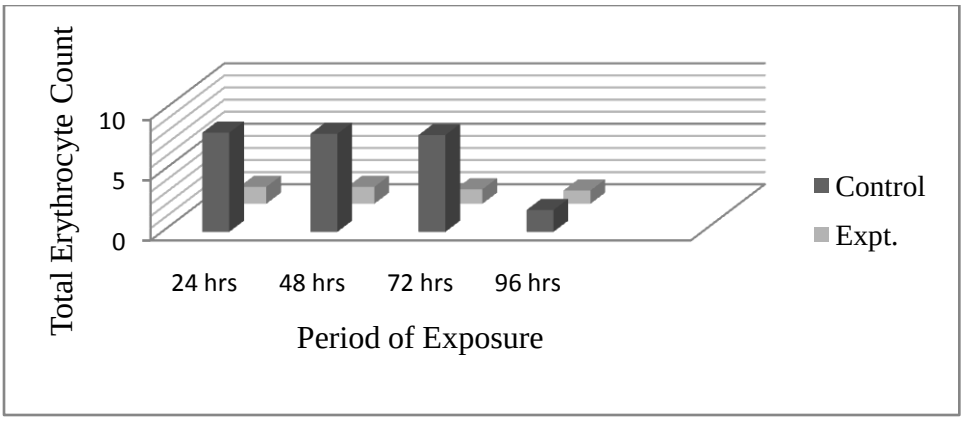
Table 1: Effect of Tobacco Extract on TEC and TLC in *Channa punctatus*

Sr. No.	Period of Exposure (Hours)	Total Erythrocyte Count (TEC) (X 10^6 /mm ^{3})		Total Leucocyte Count (TLC) (X 10^3 /mm ^{3})	
		Control Set	Experimental Set	Control Set	Experimental Set
1.	24 Hours	1.8 ± 0.10	1.4 ± 0.14	8.2 ± 0.18	9.0 ± 0.14
2.	48 Hours	2.0 ± 0.12	1.4 ± 0.12	8.1 ± 0.12	9.1 ± 0.20
3.	72 Hours	1.9 ± 0.14	1.2 ± 0.16	8.0 ± 0.18	9.5 ± 0.16
4.	96 Hours	1.8 ± 0.10	1.1 ± 0.20	8.1 ± 0.20	9.6 ± 0.20

(Each Value is Mean of Six Observations ± S. D.)



Graph 1: Effect of Tobacco Extract on Total Erythrocyte Count in, *Channa punctatus*



Graph 2: Effect of Tobacco Extract on Total Leucocyte Count in, *Channa punctatus*

DISCUSSION:

The profile of blood acts as an important tool for diagnosis of diseases and physiological or metabolic alterations in fishes. Haematological parameters are considered as patho-physiological indicator of the whole body of organisms. They are important to investigate structural and functional status of the fishes under various stress condition [13].

RBC are most common type of blood cell in all vertebrate animals and some invertebrates delivers the oxygen to the body tissues via the blood flow through the circulatory system. They take up oxygen in the gills and release it through the body's capillaries. The cytoplasm of RBC possesses haemoglobin, an iron-containing metalloprotein that can bind oxygen forming oxyhaemoglobin which impart the red colour to blood.

The white blood corpuscles are also called as leucocytes. They are present in thousand in the blood. The count varies with activities of fish. The leucocytes possess proteins, lipids, glucose, organic substances, inorganic salts, certain hormones, vitamins and enzymes. The several types of leukocytes found in fish blood, such as neutrophils, eosinophils, basophils, monocytes, lymphocytes, thrombocytes. The sizes of lymphocytes are species specific. They are dominated by the nucleus, with only a narrow rim of basophilic cytoplasm in which there are a few mitochondria and ribosomes. WBCs are less abundant than RBCs in fish blood. The leucocytes of Pisces are chiefly involved in specific and nonspecific defence mechanisms. The various enzymes found to be localized in leucocytes where they control and regulate antigen trafficking and thus assist in the defence mechanism. Diagnosis of Blood chemistry is useful for the assessment of physiological status of fish. The enzymes present in leucocytes involved in defence mechanism. Measurements of change in total WBC number or in the percentages of

the various types can often lead to a better understanding of the physiological or pathological state of the animal [14].

The variations in total RBC (TEC) and WBC (TLC) count have been identified as an efficient stress response mechanism, to compensate for reduction in oxygen availability. Thus, the present experimental design is directed towards the haematological responses in *Channa punctatus* to study effect of tobacco extract on the Total Erythrocyte (TEC) and Total Leucocyte Count (TLC) in fish. The results of the present investigation showed that as period of exposure increases the TEC decreases and TLC increases. The decrease in TEC count is due to to decline in haemoglobin content. It was may be due to variations in the oxygen demand of the fish, *Channa punctatus*. The decreasing level of haemoglobin leads to a deteriorated oxygen supply and hence TEC found to be decreased [15].

The decrease in Total Erythrocyte Count in snake headed fish, *Channa punctatus* was observed due to stress condition affects the metabolism and normal functioning of fish. Erythrocytes contain haemoglobin which is surrounded by a flexible protein membrane and an outer lipid bilayer. The energy is supplied by Adenosine Triphosphate (ATP) for maintenance of red cell shape, flexibility and osmotic pressure. This energy generated by anaerobic glycolysis. The fish exposed to stress condition faces the problem of ATP depletion due to which transport of excess sodium out of the cell membrane diminished results in the haemolysis of the red cells. Thus, life of RBC's shortened, which results in the destruction of RBC's than the formation of RBC's [16].

White blood cells play a major role in the defense mechanism of the fishand consist of granulocytes, monocytes, lymphocytes and thrombocytes.Granulocytes and monocytes function as phagocytes to salvage debris from injuredtissue and lymphocytes produce antibodies [17]. The leucocytes number is one of the important indicators of generalphysique of the fish. The number of WBC increased in blood it indicates the good tolerance of species.

[18] in 2011studied the haematological effects of sublethal concentrations of tobacco leaf dust on the African catfish, *Clarias gariepinus* [19]. The results show proportional decrease in haematological parameters with an increase in the toxicant concentration during the exposure period. The haematological parameters (mean erythrocyte volume, mean erythrocyte hemoglobin) showed insignificant differences in the exposed fish compared to the control. Hematological examination showed that there was destruction of the erythrocytes production and the concentration of hemoglobin in the RBC was much lower in the exposed fish compared to the control depicting an anaemic condition. Number of authors were studied the effect of tobacco on blood of fish [3], [20]. Similar results were

noted as anamemic response on fish, *Oreochromis mossambicus* may be due to destruction of erythrocytes or hemodilution [21].

The overall observation of the result shows thatvariations in TEC and TLC count in freshwater fish, *Channa punctatus* exposed under varying stress reveals that the total erythrocyte count decreases and total leucocyte count increases. The alterations of number of red cells are due to destructions of RBC in stress conditions. Anything that alters the white cell count reveals the defence mechanism in the fish.

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IMPACT ASSESSMENT OF ENTOMOPHAGUS FUNGUS AS A BIOLOGICAL CONTROL MEASURE

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ABSTRACT:

The present study deals with isolation of Entomophagus fungi and its use as a biological control. Entomophagus fungi are a fungal group pathogenic to insects and their larvae. They infect wide range of insect pests in nature. Fungus like *Beauveria spp*. causes white muscardine disease in Lepidopteran insects. By using this characteristic of the fungus *Beauveria bassiana*, fungal suspension was prepared and tested on Lepidopteran caterpillars. Results indicated 80%mortality in laboratory conditions during 72 hours. An effectiveness of fungus was more dependent on environmental factors**.**

KEYWORDS: Entomaphagus fungus, *Beauveria bassiana,* lepidopteran larvae.

INTRODUCTION:

The study was aimed to test effectiveness of fungal growth of *Beauveria bassiana* on Lepidopteran pest larvae. *B. bassiana*- is mesophilic [1] and naturally growing parasite causing infection to athropod spp. and induces disease white muscardine in them. It causes infection at wide range to insects belonging to class Lepidoptera, coleoptera etc [2]. Their target site is the spiracles of larvae. *B. bassiana* has widely regarded as one of the most promising species known for potential development into a practical insect bio-control agent [3]. Among the many bio-control methods being explored for use against insects, the fungal entomopathogen *Beauveria bassiana* 9 Balsamo) Vuillemin (Ascomycota: Hypocreales) remains one of the most promising [4]. Looking at severe pollution of soil & food grains due to indiscriminate use of chemicals, it was thought to invent new, eco-friendly & cost effective bio-control method, hence, study was undertaken.

MATERIALS AND METHODS:

Isolation of White muscardine fungus from infected lepidopteran larvae:

White muscardine infected lepidopteran larvae were collected from DBJ College, Chiplun (MS) campus on visual examination. Collected samples were examined under microscope (Inverted Biological Microscope, Magnus – 10X) to confirm the presence of spores of entomophagus pathogen. On

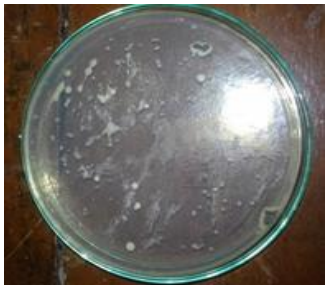
confirming the presence the *Beauveria bassiana* spores, they were isolated aspectically following standard isolation method [5].

Standard isolation method:

The infected larvae were cut into pieces using sterilized surgical blade and surface sterilized with 70% ethanol rinsed thrice with water and transferred to sterile petriplates containing Sauboured Dextrose Agar (SDA) aseptically. Inoculated plates were incubated at room temperature (27°C±1oC) and observed at regular interval of 24 hours for three days [6]. The fungal growth observed on SDA plates were taken on glass slide to observe under microscope (10 X) for the confirmation of presence of conidiophores using lactophenol cotton blue stain. After confirmation of spores, using single spore isolation technique, they were purified. The fungus was sub cultured on Sabourauds Dextrose Agar and allowed to grow at room temperature.

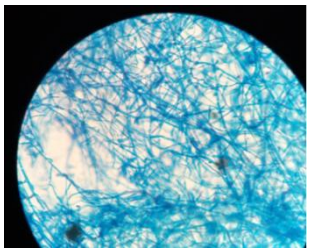
OBSERVATIONS:

Infected lepidopteran larvae



Colony after 24 hr of inoculation

B. bassiana **colony after 72 hr**



B. bassiana **mycelial structure (lacto phenol cotton blue stain) under (40X)**

Larva showing hair loss after exposure to fungal suspension

Control: Alive larvae. Test: 80% mortality of larvae

Preparation of fungal suspension to treat larvae:

Beauveria bassiana conidia were harvested from cultured SDA plates using camel brush and three sets of suspension were prepared. In first test tube (T1) one loop of conidia were suspended in 10

ml sterile distilled water added with two drops of 0.01% tween 20. In second test tube (T2) two loops of conidia were suspended in 10 ml sterile distilled water added with two drops of 0.01% tween 20, while in third test tube (T3) entire matured colony was suspended in 10 ml sterile distilled water added with two drops of 0.01% tween 20. All the suspensions were mixed using magnetic stirrer for 10 minutes. Further, three sets of 10 larvae each were run by exposing them to fungal suspension from T1, T2 and T3, maintained in rearing trays at room temp.

RESULTS:

Isolation of white muscardine from infected larvae:

The *B. bassiana* fungal growth was observed on sterile SDA plates on incubation. Initially the colony was observed to be whitish in colour (Plate-II) and later showed colour change to yellowish and powdery in nature (Plate-III).

Effect of fungal suspension:

The pathogenicity of *B. bassiana* on three sets of pest larvae was tested using fungal suspension. On exposure to fungal suspension T1 (absorbance at 560 nm) for three days and to T2 for two days, 50% mortality was encountered, where as exposure to T3 for three days, 80% mortality was reported (Table). After 4 to 5 days, larvae exhibited loss of hair and mycelia growth on their body surface.

Larval mortality:

Fungal suspension	**Absorbance (560 nm)**	**No. of days**	**Mortality observations (out of 10)**
B. bassiana (t1)	0.015	3	5
B. bassiana (t2)	0.060	2	5
B. bassiana (t3)	0.278	1	8

DISCUSSION:

The colour of colony of *B. bassaina* grown on S.D.A plate after 24 hr of inoculation was reported to be white, but as it grows and became matured after 72 hr of incubation, the colony became yellowish in colour and powdery in form. Vanitha and Parthasarthy (6) reported similar results while working on *B. bassaina* on mulberry silkworm. Further our results are strengthened by the observations of various researchers [1], [7],[8]. In the present study there was no mortality in the control group due to fungal growth either by *B. bassiana* or fungal contaminants, but diluted suspension (T1) and moderately

diluted suspension (T2) of *B. bassian* induced 50% mortality in the test larvae on third and second day of exposure, respectively. High rate of mortality in the test larvae was reported on the first day of their exposure to concentrated fungal suspension (T3). While working with *B. bassiana* Francisco and Fernando [4] reported spore germination at 24 hour for the first germination test, range from 0-95% in coffee berry borer insect. Pathogenesis in insects & their larvae begins with the formation of germ tube that penetrates cuticle and further invades body of insect leading to death. According to Francisco and Fernando [4] death of insect is followed by saprogenesis phase wherein initially mycelium begins to appear through the cuticle and further cover most of the corpse. Then, spores develop and get discharged. Like *B. bassiana,* the conidia of *Penicillium citrinum* also germinate on the silkworm body integument in 68 hours under favorable condition [9]. This indicates that the fungus grows saprophytically and forms mycelia mass that covers the body of host, produces infectious conidia and induces death in the host. Therefore, it is one of the cheapest, handy, eco-friendly and result oriented method to control lepidopteran pest species in the field.

RECOMMENDATIONS:

Since, chemical pesticides are harmful & most of them are carcinogenic, it is recommended not to use them, but to use fungal suspension of *B. bassiana* as a biological control measure for Lepidopteran pest larvae in the optimum dose of 3 loops /10ml D/W along with 2 drops of tween 20.

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CLAM RESOURCE IN THE BHATYE ESTUARY RATNAGIRI: A NEED OF CONSERVATION AND MANAGEMENT

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ABSTRACT:

Bhatye estuary, Ratnagiri is known for its mussel and clam fishery. Clam fishery is primarily supported by Meretrix meretrix, Katelysia opima and Paphia laterisulea. The clam fishery lasts for about 8 – 10 months. During lean period of open sea fishery, it provides protein rich food and livelihood to local population... Its shells are utilized as raw material in lime and cement cottage industries. Considering its food and economic value they are over exploited. In the present study, economic and food value of clams, clam fishery, management and conservation aspects are discussed.

KEYWORDS: Clams, Bhatye estuary, Biochemical composition

INTRODUCTION:

Bhatye estuary provides valuable resources like fishes, bivalves, crabs, and shrimps. It has become a source of livelihood for fishermen communities from nearby 10 villages. Thus, it plays pivotal role in rural livelihood and constitutes socio-economic entity. The commercially important bivalves are mussels and clams. Estuary is cradle bed for clams *like Meretrix meretrix (*Linnaeus), *Katelysia opima* (Gmelin) *and Paphia laterisulea* (Dilluuyan). Fishing methods for clam are simple with non-mechanised gears. For fishery mainly women are involved and are carried out during low tide period. Due to its better taste, abundance during lean open sea fishery period, simple method of collection and involvement of children and women, they are over exploited. Fishery lasts for about 8 – 10 months. During monsoon they are over exploited due to ban on open sea fishing.

MATERIALS AND METHODS:

Study Area: Bhatye estuary, Ratnagiri, Maharashtra

Bhatye estuary, Ratnagiri, Maharashtra is situated between $73^{o}.15^{l}$ East and $16^{o}.51^{l}$ north. It is formed due to merging of Kajali river in to Arabian sea near Ratnagiri.It has water spread of 2820

hectors and its mouth covers about 18 hectors.Its perennial opening permits an ideal estuarine zone for local fishermen.

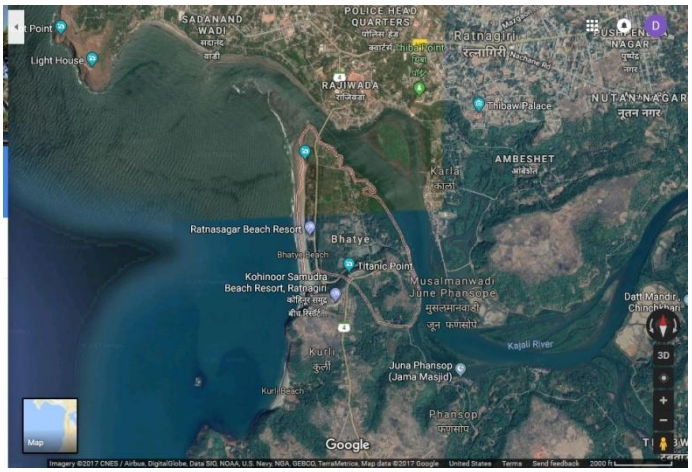

Figure 1: Satellite image showing Bhatye estuary, Ratnagiri.
(Source: http/www.mapIndia.com/India/maharashtra/ratnagiri)

Collection of clams and biochemical estimation:

For quantitative analysis, clams were collected by simple hand picking and chisel method. Adult clams with moderate size were selected and juvenile and small sized clams were released back in their natural habitat. Selected clams were brought back to the laboratory and shells were brushed to clean fouling biomass and mud. Length was measured by vernier calliper. Few clams were dissected and soft tissue was separated, dried in an oven (70^{0C}). Dried tissue powder was used for biochemical analysis. Clam tissue powder was analysed for estimation of total glycogen [1], protein [2] and lipids [3]. The ratio between total glycogen and protein was calculated. Few specimens were preserved in 70% alcohol for taxonomical identification.

RESULTS AND DISCUSSION:

Table 1: Species family, habitat zones and salinity zones of clams of Bhatye estuary

Species	Family	Habitat zone	Saline zone
Meretrix meretrix	Veneridae	Intertidal	Polyhaline
Katelysia opima	Veneridae	Intertidal/subtidal	Mesohaline
Paphia laterisulea	Veneridae	Intertidal/subtidal	Mesohaline

The role of the Bhatye estuary in economic development and livelihood of the local communities is pivotal. , It is most productive part which covers about 2820 hectors. The sediment is

rich with nutrients which is cradle bed for clams like *Meretrix meretrix, Katelysia opima, Paphia laterisulea, Meretrix casta,Paphia textile, Arca granulosa*. The survey made in December 2015 revels that first three species are abundantly fished in fishery period. Similar observation was noted by [4].

In Maharashtra, clams are fished and utilized mainly in Ratnagiri. Three species are abundantly found in Bhatye estuary. They are *M. meretrix, K. opima and P. laterisulea*, belong from family – Veneridae*. M. meretrix* is found in intertidal zone while *K. opima and P. laterisulea* are found in intertidal and subtidal zone. *M. meretrix* is polyhaline and mesohaline in nature.

Table 2: Species, length composition and fishing period of clams from Bhatye estuary

Species	**Length composition (mm)**	**Fishing period (months)**
M. meretrix	22 – 64	April – September
K. opima	32 – 45	January – September
P. laterisulea	16 - 47	January - November

Food value:

Table 3: Glycogen, protein and lipid content of *M. meretrix, K. opima,* and *P. laterisulea*

Clam species	**Glycogen (mg/100mg)**	**Protein (mg/100mg)**	**Lipids (mg/100mg)**
M. meretrix	37.063 ±0.012	19.025 ± 0.220	6.042 ± 0.068
K. opmia	35.112 ± 0.618	21.016 ± 0.036	9.437 ± 0.0362
P. laterisulea	30.713 ± 0.020	26.532 ± 0.092	9.660 ± 0.134

While sampling, size of *M. meretrix* was ranged from 22 to 64 mm in length. It's fishing season onsets on April and lasts up to September. The size of *K. opima* ranged from 32 to 45 mm in fishing period of January to September. In a fishing period January to November, the size of *P. laterisulea* ranged from 16 to 47 mm in length.

Clams from Bhatye estuary represent major source of nutrients for human consumption. It makes it essential to find out important facts about nutritive value. In the present study clam tissue powder was analysed for estimation of total total glycogen [1], protein [2] and lipids [3]. The study of proximate composition helps to find out the nutritional quality of food. The ratio between protein and carbohydrates changes with the season and reproductive cycle [5]. Glycogen content was more (37.063)

in *M. meretrix* while *P. laterisulea* showed less (30.713). Protein content was more (26.532) in *P. laterisulea*, while it was less in *M. meretrix*. Lipid content was more (9.437) in *P. laterisulea* while it was less in *M. meretrix* (6.042). Beninger and Stephan [6] observed that lipids are main energy reserves in the adult bivalves, being used in the gametogenesis and in the condition of nutritional stress.

The amount of glycogen stored in the tissue at the given moment is the balance resulting from glycogenesis and glycolysis. The glycogen has been considered as a principle energy source of adult bivalves especially under condition of nutritional stress [7].

Table 4: Table showing meat quality (ratio of protein to glycogen)

Clam species	Protein	Glycogen	Ratio
M. meretrix	19.025	37.063	1 : 1.94
K. opima	21.016	35.112	1 : 1.67
P. laterisulea	26.632	30.713	1 : 1.15

The ratio between protein and glycogen decides taste and meat quality. In *P. laterisulca*, the ratio of protein to glycogen was 1 : 1.5, indicated better meat quality as compared to *K. opima* (1 : 1.67) and *M. meretrix* (1: 1.94).0 It changes according to species, season, reproductive cycle and environmental parameters.

Dried Clam Meat:

Surplus catch of clams is preserved by drying process. These clams are washed either in estuarine water or potable water and boiled. The boiling may last for about half to one and half hour or more, that depends on the quantity in the boiling pot. After boiling, shells are removed and flesh sundried for 4-5 days. The shelf life of dried meat is about one year. The cost of one kilogram of dried meat was about Rs.400-600, that depend on the season and demand.

Shell value:

Shells are used for preparation of lime and cement. There are about 6 lime cottage industries in nearby villages (local sell of Rs.2/Kg). Generally shells of Turbo, Trochus, Xanthus, Strombus, Cyprass, Conus, Tibia, Babylonia are used in preparation of ornamental articles. Unfortunately shells of clams are not used for preparation of ornamental articles, although having utility.

Management and conservation:

Clams are providing rich and cheap source of protein rich food about 8-10 months. As clam fishery is simple and operated with non-mechanised gears, clams are over exploited over. Over

exploitation and sand mining diminishing clam catch and damaging their natural habitats. It is affecting traditional occupation of locals. Similar types of damages and disturbances are seen in other Indian estuaries [8].

For scientific and sustainable management following steps should be taken-

1. For these clam species spawning period is October-January. Clam fishing should be banned for the said period.
2. Small sized clams should not be collected.
3. State fishery department should issue licence to well informed and trained local fishermen.

CONCLUSION:

The Bhatye estuary is known for its clam fishery. The fishery mainly constitutes *Meretrix meretrix, Katelysia opima , Paphia laterisulea* and it support for 8 to 10 months As fishing methods are simple and with least risk, women and school children are involved in clam collection and sale. Clams are not collected by gredging**.** It has ensured continuous and sustainable source, however during lean period of open sea fishery, they are collected indiscreetly. Due to better price, small sized clams are collected and utilized. It is hampering future stock of clams. Biochemical study reveals that protein to total glycogen ratio is better which states its nutritive value. The study has thrown light on management concern. Few recommendations have been made for the judicious exploitation, regulation of fishing and conservation of clam resource to ensure sustainable clam fishery in Bhatye estuary.

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TRADITIONAL METHOD OF LIME PREPARATION FROM DEAD MOLLUSCAN SHELLS, AT RATNAGIRI COAST, MAHARASHTRA

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ABSTRACT:

Traditional methods and techniques are vital as point of ecosystem due to its sustainable utilization of limited natural resource. Traditional practicesare transmitted from generation to generation among community and such techniques are used by inhabitant community for their livelihood. In this paper, we have documented the how coastal community of Juve village Ratnagiri coast prepared the lime by traditional technique. During investigation, we have visited to lime processing units of Juve village and collect the detail information oftraditional technique from owner and labour through individual interview and special questionnaire. After survey and discussion, we reported total 09 lime processing units at Juve village, in which 02 lime processing were carried out on large scale whereas 07 were on small scale.In this lime processing unit, the lime making method is purely based on old-age knowledge andlocally available pre-requisite materials. In limeprocessing technique, initially they collect dry shells from various habitats of Ratnagiri coast. Collected shells were dry in open sunlight, than it was used for burning in heating chamber or pit. The burned shells were kept for cooling, after that burned shellswere thrashed with cudgel in to powder. Through straining the lime powder convert in very fine lime. Such lime has wide application and used on large scale. Through this traditional method, the coastal community is getting livelihood and employment opportunity.

KEYWORDS: Molluscan dead shells, Traditional technique, Lime, Ratnagiri.

INTRODUCTION:

Along coastal area's the aquatic organisms like fishes, prawns, clams, mussels, oysters etc. are the chief source of food and revenue to the coastal rural communities. Therefore, the inhabiting rural people are mainly performing various fishing practices and fished the aquatic resources.

The West coast of Maharashtra has long 720 km coastline with immense, diverse and dynamic for aquatic animals. The communities which are living along the coastal area are mainly depending for their livelihood on aquatic living resources like finfishes, crustacean and mollucan etc. Molluscan species like clams, oysters, mussels and gastropods are benthic, sedentary, filter feeder and sessile organism. These species are functionally distributed throughout intertidal and sub-tidal region of coastal habitats. Molluscan species are soft bodied animal, externally protected by hard protective shell made with calcium carbonate ($CaCo_3$) [1].

Along Ratnagiri coast, molluscan species are significantly distributed from various habitats and mainly fished for bread and butter. Fished molluscan species soft tissue is mainly used as food. Whereas remaining hard or dead shells are used in variety of purpose like preparation of decorative piece, ornamental, cement industries, colour industries and lime industries etc.

In this attempt, we have documented the coastal community of Ratnagiri were performing the traditional based techniques for preparation of lime (pandra chuna) from dead molluscan shells. Review literature conclude that, so far no one has reported or documented the traditional based preparation of lime preparation along the west coast of Maharashtra. Hence, our main focus and aim of this study to highlight the traditional or cultural based practice lime of preparation at Ratnagiri coast.

METHODOLOGY:

Along the Ratnagiri coast, Bhatye estuary, Shirgaon creek, Sakhartar creek and Kalbadevi estuary are the major coastal habitats for molluscan species. The people living in and around these coastal habitats are chiefly engaged in collection of molluscan species by traditional knowledge or old age practices. Collected molluscan species were sold at major fish market of Ratnagiri city and minor market at Rajiwada, Mirkarwada, Mirya, Shirgaon, Sakhartar and Kalabadevi.

At Ratnagiri coast, the Juve village is situated in vicinity of Bhatye estuary. The some rural communities of this village, were using own traditional based knowledge in lime preparation (pandhara chuna) from dead shells of molluscs. In Juve village, total 09 lime processing small units are engaged in preparation of lime powder. Out of this, 02 major and 07minor lime processing units were identified. Lime processing units were categorised into major and minor on the basis of production of lime powderduring per month.

The present investigation was carried out from October, 2011 to May, 2012. During this study, we have made visits to Juve village and interact with owner of each lime processing unit. We have also discussed with labours of processing unit. We collect all information through personal and grouped

interview. Information also collected by preparing special questionnaires for owner and labour as well. The information like, method of shell collection, collection sites, transport, number of labour etc. were collected. In addition, information of lime processing method also collected such as process of burning the dry shell, quantity of wood,burning duration, heating chamber (bhatti), and post heating processing (thrashing and straining, packaging and weighing etc.).

RESULTS:

In this study, mainly four groups of molluscan species (clams, oysters, mussels and gastropods) were collected such as, *Meretrix meretrix, Meretrix casta, Katlaysia opima, Paphia laterisulca, Paphia malbarica* as clam (locally it called as mule), *Saccostrea cucullatta and Crassostrea cattuckensi s*as oyster (Kalave), *Perna viridis* as mussel (Vakhunde) and *Cerithidea and Telescopium sps.* as gastropod (Shank). Out of these, clam resources was maximally harvested along the Ratnagiri coast and followed by oyster than mussel and gastropod species respectively. Gastropod species were given less attention by coastal people, due to less food value. However, harvested gastropods mainly used in lime processing.

At Juve village of Ratnagiri coast, some community were prepared lime from remaining dead shells using traditional method from harvested molluscan resources. The detail process of lime preparation is highlighted in several steps as below.

Collection of shell:

In study area (Juve), total 09 lime processing units were mainly reported. Juve village is situated along the Bhatye estuary near to Ratnagiri city. The owner of lime processing units were collected the dry or dead shells directly from the molluscan fishers. Fishers were collected the molluscan resource from various molluscan habitat like Bhatye estuary, Mirya, Shakhartar, Shirgao creek and Kalbadevi estuaryof Ratnagiri coast. (Plate 01- A).

Fishers were stored the dry or dead shells in small or large heap (Ras or Dhig). (Plate 01- B& C).The average weight of each heap was 130-150 kg. Such heaps were sold on the basis of auction (lilav) to the owner of lime processing unit. The average cost of each heap was approximately 250 Rs. Through vehicle like truck the shells were brought to lime processing unit (Juve).

Drying of shells:

After collection of shells, dead shells were kept in equal size of heap for few days, than each heap of shell wasspread uniformly over earth surface for sun drying. Two to three days were required for sun dry. However, gastropod species required more time for drying due to flesh present inside the

shells. Beside, few labourswere busy in separating the fleshy shells from dry shells and also removing the flesh physically from shells.

Heating of shells:

Heating of shells were carried out in heating chamber (Bhatii). Structurally heating chamber is circular shaped with 8 feet in diameter and 2½ to 3½ feet in height. Heating chamber is constructed with brick (veet), sand (walu), cement or dry sand (mati).

During heating process, initially heating chamber (Bhatii) was prepared for heating. In this process, woods were spread circularly throughout the inner storage area of chamber. Over this woods layer, the shells were spread with charcoal. Again second layer of woods were circularly arranged over shells and again shells were spread over the wood with charcoal. Likewise two to three layers of fire wood and shells were arranged in the heating chamber or burning pit (Plate 01- D). For heating or burning, the locally available fire wood of mango, jack fruit, mangrove plants were used. Heating processing was carried out for 4-5 days. It was very slow and steady processes (Plate 01- E).

Cooling and Thrashing:

After heating, the shells become to ash; this ash was kept 2-3 days for cooling. Some time they spread water over the ash for fast cooling. (Plate 01- F).After cooling of burned shell (ash), the ash was completely excavated from heating chamber and spread over flat surface. The spread ash was thrashed by wooden cudgel to make ash in to powder i.e. lime powder (Plate 01- G).

Straining, Packaging and Storing:

Straining processes was carried out by fine mesh sized sieve. Some labour may also use the muslin cotton cloth for straining. After straining, the fine lime powder was packed in bags. Weighing was carried out by manual weight balance. The bags were packed at average weight of 10 kg and then sealed by thread.Packed bags were stored at processing unit and according to the requirements or demand they were distributed in and around areas of Ratnagiri. (Plate 01- H).

DISCUSSION:

Indigenous classical knowledge plays a very vital role in constraining the betterment of our cultural practices. Along the Ratnagiri coast, coastal communities are mainly performing traditional fishing practices for bread and butter. Molluscan species are the major source of livelihood to coastal community of Ratnagiri coast. Bivalve resources like clams, oysters, mussels and gastropods are traditionally exploited from Bhatye estuary for their livelihood [2]. Bivalve species contributes 10 % of

source of animal protein out of total aquatic resources fished [3]. According to the authors, the bivalves are having high edible and commercial value [4].

On the other hand, the remaining dead or hard protective shells of molluscan species were utilized for lime preparation by coastal community using old age based method [5]. Similarly, along the Ratnagiri coast, at Juve village total 09 lime processing units were recorded. The some fishers community of Juve village were prepared lime from dead shells through indigenous practice. This indigenous method is purely based on past knowledge. This technique was transmitted among coastal community from generation to generation. This indigenous or traditional technique was carried out by heating of shells, thrashing and lime making. Along east coast of Orissa, India, some coastal community also making lime from dead molluscan shells using old based method [6,7].

In lime preparation, the main essential material i.e. dead shells were mainly collected from coastal habitats like Bhatye estuary, Sakhartar, Shirgaon creek, Kalbadevi estuary of Ratnagiri coast. Bhatye estuary is one of the more dynamic and potential for molluscan resources along the Ratnagiri coast [8]. In dead shells, the major composition of oyster shells was observed followed by clams, gastropods and mussels respectively.

Along Ratnagiri coast, particularly at Juve village the lime preparation activity was performed every year from October to May, except monsoon season. Because during monsoon, the heavy rainfall and low shell fishing activity are may be main reason for no lime production during monsoon season. The major influence on lime processing is the raw material i.e. dead shells. The magnitude or quantity of dead molluscan shells is made major impact on productivity of lime. Besides, this the market value and demand of lime also plays significant role on lime production. In and around the Ratnagiri, lime is used for multipurpose activity such as cement industry, colour and paint industry, construction sector and other purpose. However, the lime is highly demanded from builder and construction sector for primary colouration and putty purpose.

CONCLUSION:

On the West coast of Ratnagiri, the fishers community are principally busy in traditionally collection of molluscan resources (renewable resource).They have excavated the molluscan shells in huge magnitude mainly for source of food. After using the flesh of shells as a food, the remaining dry shells (non-renewable resource) are utilized for making the lime product through traditional method. Such old-age method of lime preparation from molluscan shells provides economic support to the local

people and provides employment. Due to its multipurpose use the lime has high market demand. Therefore, some rural community of coastal area are engaged in lime preparation.

At last we would like to suggest that, the local organisation or government sector (Fishery Department) may take initiative step in this lime processing through support, encouragement, awareness and financial help among coastal community for proliferation of traditional knowledge. So, that the lime processing unit (small scale industry) should get uplift and provides more revenue and job opportunity. In addition, our cultural or traditional knowledge may boost in future or advance (Technology) generation.

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PLATE 01

Traditional method of lime preparation from dead molluscan shells

A = Collection of molluscan shells, B= Raw martials i.e. Heap of clam shell and fire wood C= Heap of oyster shells and sun dry of molluscan shells, D= Heating chamber or burning pit and Preparation of heating chamber, E= Burning of dead shells, F= Cooling of burned shells i.e. ash, G= Lime powder (Chuna) after Thrashing and Straining, H= Packing and Storing.

IMPACT ASSESSMENT OF ROAD WIDENING ON CO_2 SEQUESTRATION BY TREES

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ABSTRACT:

Economical wealth of country depends upon development strategy formulated by considering various aspects including social, educational, health & hygiene, transportation, biodiversity & many others. Since last two decades India is one of the rapidly developing countries in the world, where transportation routes including Airways, Waterways & Roadways have been improved for rapid communication and exchange of goods whereby National Highways contribute a lot. There are 18 National highways passing through Maharashtra with total length of 33,705 Km. Amongst 18 National Highways NH-66 is one of the National Highways under consideration of Government of Indian for its widening & strengthening. Its total length between Panvel (Maharashtra) and Kanyakumari (Tamilnadu) is 1622 Km, of which 482 km lies in Western Ghats region of Maharashtra which is hottest hotspot eighth in world. Plants utilize CO_2 generated through combustion activities and minimize load of pollution & also manufacture food for all animals on the earth. In the widening of NH-66 many trees have to be cut that cause great threat to the ecosystem. In this scenario a piece of 1 Km length of NH-66 from Chiplun to Kapsal was selected for the present study. The study was conducted from 1st July 2016 to 31st October 2016. Measurements of trees were done by using standard methods & the impact of road widening on CO_2 sequestration was calculated as per standard method (University Of Nebraska).The result indicated 139 medium & large sized trees belonging to 18 species are to be sacrificed that have sequestered 595.27 tones of CO_2 so far. Considering this fact, along the entire length of 1622 km of NH-66 around 225458 trees are to be cut would have sequestered 965527.94 tones of CO_2.

On burning of 139 trees in 1 km section of road 614.747 tones of CO_2 will be generated and along the total length of 1622 km when 225458 trees are burnt will generate around 997119.63 tones of CO_2. This huge amount of CO2 if added to the atmosphere, it may adversely influence the global climate. Hence, it is recommended to conduct extensive plantation programs before cutting trees to maintain ecological health of the country.

KEYWORDS: CO_2 sequestration, CO_2 generation, Road widening

INTRODUCTION:

The idea of development in western countries is based on the indicators of health that reflect the quantity of resources available to a society. It is also concerned with the quality of standard of living [1]. Development of any country requires development in sectors like transportation, social, industrial, economical, educational, health and hygiene [2]. India needs development in the field of transportation for travel, migration or carrying goods from place to place. Due to this, transportation is known as means of communication. Transportation is carried out by many ways like railways, ships, aeroplanes, roads, etc. State of Maharashtra, India has a good network of roads including 18 National Highways passing through with 33,705 Km length [3]. Among them, NH 66 lies in konkan region between Panvel (Maharashtra) and Kanyakumari (Tamil Nadu) with total length of 1622 Km. Its piece of 482 km lies in Maharashtra, 139 Km in Goa, 139 km in Karnataka, 669 km in Kerala and 56 km in Tamil Nadu [4].

Currently, NH 66 is comparatively narrow and without dividers, which amounted the incidence of collisions between vehicles. At many places, guard railings and signboards are either damaged or missing. Along with its narrow span, there are no guard railings along the sides of the highway. The sides of the road are at times at a lower level than the road [5].

Compared to NH 44[6], average speed of vehicles on NH 66 is far lesser than what could be attained due to heavy human settlement close to it.

The NHAI (National Highways Authority of India) has undertaken to widen complete stretch of NH 66, for which land acquisition and tendering process has initiated at brisk pace. Its sections in Karnataka and Maharashtra will have 60-meter width with four lanes [7]. The route of NH-66 is parallel to the Sahyadri ranges belonging to the Western Ghats that is identified as one of the hotspots declared by the UNESCO [8]. The road under expansion encompasses 39 properties including national parks, wildlife sanctuaries and reserve forests [9]. The area of Western Ghats covers five percent of India's land with over 7,402 species of flowering plants, 1,814 species of non-flowering plants, 139 mammal species, 508 bird species, 179 amphibian species, 6,000 insect species and 290 freshwater fish species; while many of the undiscovered species too live in it [10]. About 325 globally threatened species of animals occur in the Western Ghats [10]. Of 15000 species of higher plants, 4000 are reported in Western Ghats, of which 1800 are endemic that create a wide range of biodiversity. These higher plants (trees) help in maintaining CO_2 and CO_2^{eq} emissions created by vehicles on NH-66.

In the context of ecological threat due to tree cuttings, it has become significant to undertake this work to analyze the pollution control which had been carried out by the trees along the NH 66 up till now and what would happen after cutting them that sequester CO_2 and CO_2^{eq} gases.

MATERIALS AND METHODS:

The research study was conducted in a patch of 1Km area from Chiplun to Kapsal.

CO_2 Sequestration (Fixation) by trees was calculated as per formula introduced by University of Nebraska, USA [11]. For determining total CO_2 fixation, average height, diameter and age of tree were considered to deal with the following parameters.

1) Determination of the total (green) weight of the tree:

W = Above-ground weight of the tree (lbs); D = Diameter of the trunk (inches)

H = Height of the tree (feet); For trees with D < 11: $W = 0.25D^2 H$; For trees with D >= 11: $W = 0.15D^2 H$

Depending on the species, the coefficient (e.g. 0.25) could change, and the variables D^2 and H could be raised to exponents just above or below 1. However, these two equations could be seen as an "average" of all the species' equations.

The root system weighs about 20% as much as the above-ground weight of the tree. Therefore, to determine the total green weight of the tree, multiply the above-ground weight of the tree by 120%.

Therefore, Total green weight (W) = $0.15D^2 H$ x 120%

2) Determination of the dry weight of the tree:

Taking all species in the table into account, the average tree has 72.5% dry matter and 27.5% moisture.

Therefore, Total dry weight (W_1) = W x 72.5%

3) Determination of the weight of carbon in the tree:

The average carbon content is generally 50% of the tree's total volume.

Therefore, Total Carbon Contain (C) = W_1 x 50%

4) Determination of the weight of carbon dioxide sequestered in the tree:

CO_2 is composed of one molecule of Carbon and 2 molecules of Oxygen.

The atomic weight of Carbon is 12.001115 and that of Oxygen is 15.9994.

The weight of CO_2 is C + (2 x O) = 43.999915.

The ratio of CO_2 to C is 43.999915 / 12.001115 = 3.6663.

Therefore, Total CO_2 Sequester (C_1) = C x 3.6663

Total Annual CO_2 Sequester (C_2) (lbs) = C_1 x age

Above values are in pounds, hence to convert into kilograms, multiply C_2 by 0.454

thus, Annual CO_2 sequestered in kg = C_2 x 0.454

5) Emission of CO2 due to burning of sacrificed trees can be calculated as,

CO_2 evolved = C x 3.67, Where C is in lbs [12].

RESULTS AND DISCUSSION:

Table 1: CO_2 Sequestration by trees and CO_2 emission on burning of sacrificed trees in 1 Km patch of road between Chiplun to Kapsal

Name of Tree	Parameters				CO_2 sequestered		CO_2 generated on burning (lbs)
	No.	Height (feet)	Age (year)	Diameter (inch)	(In total lifespan) (lbs)	Per year (lbs)	
Mangifera indica	21	20-55	10 -50	16-59.5	172823.06	5760.76	172997.77
Ficus benghalensis	3	60	40-100	68-100	326170.4	4659.57	326499.56
Royal poiciana	11	20-55	10-75	14-45	61322.44	1442.88	61409.41
Tamarindus indica	1	45	75	47	23780.26	505.96	23804.26
Neolamarckia cadamba	10	25-70	15-80	12.5-22	36826.28	780.21	36863.44
Anacardium occidental	1	20	12	30	688.97	22.96	689.66
Tectona grandis	59	12.5-71	9-81	6-79	267677.86	6015.23	266511.27
Milletia pinnata	6	25-52	28-60	17-120	327876.08	7451.72	328206.97
Syzygium cumini	7	30-50	22-53	15-40	33815.56	901.74	53007.08
Garciana indica	2	11-25	16-35	8-23	2660.67	104.34	2663.35
Terminalia peniculata	1	50	45	40	19138.08	425.29	19157.4
Cullenia exarillata	3	37-47	38-45	70-26.5	14472.87	348.74	14487.48
Senegalia catechu	6	14-25	12-23	8-17	3754.64	220.86	4058.82
Artocartus eterophyllu	2	22-55	20-40	17.5-35	3229.64	3229.64	17747.53

Polyalthia longifolia	2	22-35	20-25	8-9	1015.03	45.11	1016.06
Cocus nucifera	2	50-60	22-25	20-27	6248.26	265.88	15263.65
Areca nut	1	40	15	10	956.90	63.79	957.87
Leuceana leucocephala	1	50	10	27	8719.79	871.97	8728.59
Total	**139**	**-**	**-**	**-**	**1311176.7**	**33116.6**	**1354070.25**
					595.27 tones		**614.74 tones**

Present study reports that 139 trees of 18 species are to be sacrificed from a patch of 1 Km during road widening. Various parameters of trees, CO_2 sequestration by them and generation of CO_2 on their burning are depicted in Table. Study reported that 139 trees belonging to 18 species are on the verge of scarification in a patch of 1 Km for road widening. Most of the trees are old with age over 30 years and height more than 30 feet. The number of major trees to be cut were in following order *Tectona grandis* (59) > *Mangifera indica* (21) > *Royal Poinciana* (11) > *Neolamarckia cada*mba (10) > *Syzygium cumini* (7) > *Senegalia catechu* (6). However, the number of *Ficus benghalensis* was only 3, their diameter was ranged from 68-100 inches. *Milletia pinnata* were found to have maximum diameter (120 inches) followed by *Ficus benghalensis* (100 inches) and *Tectona grandis* (79 inches).

The capacity of Carbon dioxide sequestration during entire life span of tree was reported to be different for different species, which was in order of *Milletia pinnata (*327,876.08 lbs) > *Ficus benghalensis* (326,170.4 lbs) > *Tectona grandis (*267,677.86 lbs) > *Mangifera indica (*172,823.06 lbs). These four major trees contribute 64.02% of total trees (89 out of 139) and have sequestered 1,094,547.40 lbs of CO_2, out of total 1,311,176.73 lbs, which amounts to be 83.47 % of the total CO_2 sequestered by 139 trees in 1 Km patch of study road.

After sacrificing, if trees are burned they may generate 614,747.76 Kg of CO_2. The major trees that generate maximum amount of CO_2 are in the order of *Milletia pinnata* (149,005.96 Kg) > *Ficus benghalensis* (148,230.80 Kg) > *Tectona grandis* (120,996.12 Kg) > *Mangifera indica* (78,540.98 Kg). After the burning of all sacrificed trees, around 6,14,747.76 Kg of CO_2 may be generated, of which 4,96,773.86 Kg would be the contribution of only four species such as *Milletia pinnata*, *Ficus*

benghalensis, *Tectona grandis* and *Mangifera indica*. These four species of trees may together generate 80.80% of total CO_2 on their burning.

Trees along the roads not only contribute to the aesthetic value but also influence climate along with climate change process. They absorb CO_2 from atmosphere, store carbon in their various parts, and become carbon sinks [13]. Sequestered Carbon released back as CO2 into the atmosphere on burning of sacrificed trees. According to FAO [14], the world's forest ecosystem store more carbon than the entire atmosphere. Extensive work on the assessment of carbon stocks based on carbon density of vegetation and soils have been done by various researchers [15, 16, 17]. According to one estimate an average Carbon stock of 86 tones / hectare have been reported [18] in the vegetation of the world's forests for the mid-1990. They have also reported 82 tones of Carbon per hectare in biomass and Dead wood in forests during 1990 and 81 tones / hectare during 2005.

In the present study 139 trees in 1Km of road patch have so far sequestered 1311176.73 lbs (595.27 tones) of CO_2, but on their burning they may generate 1354070.25 lbs (614.74 tones) of CO_2 which would contribute to global climate change. The compounded annual growth rate of CO_2 ^{eq} emission in India is 4.2% [19]. As per the guidelines of Indian Road congress, number of trees per Kilometer should be 666 [20]; but in the present study it was reported only 139 in 1 Km patch of road. National Highway Authority of India (NHAI) has computed total Carbon Sequestered for Various National Highways. Highway-wise data related to CO_2 sequestration is as follows.

About 28.76 tones/Acre with 23 trees for NH-71A, 24.06 tones/Acre with 32 trees for NH-31, 24.24 tones/Acre with 27 trees for NH-37, 6.48 tones/Acre with 15 trees for NH-4, 2.24 tones/Acre with 10 trees for NH-6, 8.51 tones/Acre with 18 trees for NH-7 and 1.83 tones/Acre with 21 trees for NH-65. Further, the NHAI has opined that the total stretch in four agro climatic zones such as Trans Gangetic plain region, Eastern Himalaya region, Southern Plateau & Hill region; and Western Plateau & Hill region is approximately 31600 Km and total carbon sequestered in these zones lies in between 0.675 million tones to 0.780 Million tones. The present study reveals that total 595.27 tones of CO_2 have been sequestered so far by 139 trees in the road patch of 1 Km of NH-66.

The past studies and present study related to CO_2 Sequestration by trees and removal of these trees during road widening indicates threat to the climate. To minimize this ecological threat it is necessary to plant and rear 666 trees / Km of road along NH-66.

CONCLUSION:

The result indicated 139 medium & large sized trees belonging to 18 species are to be sacrificed that have sequestered 595.27 tones of CO_2 so far. Considering this fact, along the entire length of 1622 km of NH-66 around 225,458 trees have sequestered 965,527.94 tones of CO_2. On their burning about 997,119.63 tones of CO_2 will be generated. This huge amount of CO_2 if added to the atmosphere, it may adversely influence the global climate. Hence, it is recommended to conduct extensive plantation programs before cutting trees to maintain ecological health of the country.

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NUTRITIVE VALUE OF *ASPARAGUS RECEMOSUS* ROOT MEAL IN PELLETED FEED FOR *CYPRINUS CARPIO* FINGERLINGS

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ABSTRACT:

A 120 days feeding trial was conducted to evaluate the potential of *Asparagus racemosus* root meal as dietary protein source in the diet of *Cyprinus carpio* fingerlings. Six experimental diets were formulated to contain 20%, 30%, 40%, 50%, 60% and 70% *A. racemosus* leaf meal to partially replace other protein ingredients in the *C. carpio* diet. The diet containing 0% leaf meal served as the control. Each dietary treatment was tested in triplicate groups of 10 fingerlings. The results of the growth and feed utilization responses show that there were no significant differences among the fish fed diets 1 – 3 but were significantly different from fish fed on diet 4 which had lower growth and feed utilization values. The present findings show that *A. racemosus* root meal has good potential for use as one of the protein sources in *C. carpio* diet up to 30% level without compromising growth.

KEYWORDS: *Asparagus racemosus; Cyprinus carpio;* growth; feed utilization.

INTRODUCTION:

Fish, like any other animal require nutrients to stay alive, healthy, active and grow. Nutrients are the building blocks of all tissues of the animals and they are involved in all the chemical reactions that make up "life". The types of nutrient required by fish are the same as those required by other animals. Nutrients can be provided by various products of plant, microbial or animal origin or can be chemically synthesized. In nature, fish obtains nutrients from various types of food items, these being determined both by the feeding behaviour or preference of the animal and the availability.

From nutritional point of view, the nature or origin of the ingredients generally does not matter. Fundamentally, the animal is only looking at meeting its requirement for specific nutrients. To do so, it is equipped with a variety of digestive enzyme that allows it to harvest these nutrients from variety of

sources, whether it is of plant or animal origin. No ingredients contain all the nutrients required by fish. The use of a combination of ingredients is therefore necessary to combine ingredients to obtain a mixture that fulfils all the requirements of the animal.

There is a developing interest in using medicinal herbs as a kind of dietary supplement in aquaculture and in showing the positive effects on growth and the immune response [1, 2]. Medicinal herbs can improve the quantity of micro-flora in the intestine by increasing some good microbes and inhibiting increased digestion capacity [3].

Many nutritionists tried to incorporate medicinal herbs in fish diet. They showed the positive results regarding growth performance and feed utilization of fish. Inclusion of medicinal plant material in fish diet showed better protein and lipid contents after long term feeding. Various medicinal plants like obosan [4], Chinese herb [5], *Quillaja* [6] and *Glycyrrhiza glabra* [7] were used in fish feed formulations.

In the present work we used *Asparagus racemosus* as a protein source in formulation of fish feed to assess its potential in fish growth.

MATERIALS AND METHODS:

The feeding experiment was conducted in triplicate for 120 days. Fingerlings of *Cyprinus carpio* were used for the experiment. Six types of pelleted feeds were formulated using different ingredients such as rice bran, groundnut oilcake, fishmeal, guar gum binder, Vitamin – Mineral mixture, fine leaf powder of *Asparagus racemosus* in different proportions (diet 1 - 6). A diet with all above ingredients except leaf powder is kept as control (Table 1). The diets were analyzed for their proximate nutrient composition.

Fishes were fed at the rate of 5% body weight in two equal rations daily. At fortnightly intervals a minimum of 50% of fishes were sampled to record the growth. At the end of experiment, the growth parameters like mean body weight, specific growth rate (SGR), feed conversion ratio (FCR) and protein efficiency ratio (PER) were estimated. Difference between means of treatments was tested to find out the level of significance by ANOVA.

Table 1: Formulation and proximate composition of fish diets containing increasing levels of *Asparagus racemosus* root meal

Diet							
	Control	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**
Ingredients (%)							
Groundnut oilcake	43	35	29	24	19	13	08
Rice bran	36	27	23	18	13	09	04
Fishmeal	10	09	09	09	09	09	09
Guar gum Binder	10	08	08	08	08	08	08
Mineral – Vitamin mixture	01	01	01	01	01	01	01
A. racemosus root powder	00	20	30	40	50	60	70
Nutrient content (%)							
Moisture	7.05	8.48	7.21	7.30	7.17	6.36	6.19
Total Ash	12.13	6.82	7.61	7.48	7.13	7.93	8.20
Protein	26.24	23.67	26.62	27.98	26.14	23.85	22.47
Fat	3.81	3.08	3.86	4.72	5.38	6.19	6.49
Fibre	10.54	10.32	12.58	14.58	16.52	17.20	17.15

RESULTS AND DISCUSSION:

The growth performance and feed utilization in terms of body weight gain (WG), specific growth rate (SGR), feed conversion ratio (FCR) and protein efficiency ratio (PER) of *Cyprinus carpio* fed with different levels of asparagus diets are presented in table 2.

Fishes fed with 30% asparagus diet showed better growth. The 30% diet group showed highest final body weight (27.54 ± 0.74 gm), weight gain (25.24 ± 0.72 gm), SGR (1.13 ± 0.03) and PER (1.16 ± 0.03). The lowest growth and feed utilization was recorded from 70% diet group. The lowest final body weight (13.95 ± 0.40), weight gain (11.75 ± 0.33), SGR (0.85 ± 0.02) and PER (0.52 ± 0.01) was recorded in 70% asparagus diet. Most of the growth parameters showed their peak for 30% diet group except FCR (Fig. 5). The highest FCR value was observed for 20% diet group (2.42 ± 0.06), which is non significant with control. The lowest FCR value was associated with 30% diet group (1.66 ± 0.04).

Table 2: Growth performance and feed utilization in *Cyprinus carpio* fed diets containing *Asparagus racemosus* root meal

	Control	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**
Initial body weight (gm)	2.15 ± 0.02	2.4 ± 0.05	2.3 ± 0.05	2.3 ± 0.06	2.1 ± 0.05	2.2 ± 0.05	2.2 ± 0.04
Final body weight (gm)	17.23 ± 0.49	19.25 ± 0.55 ^{NS}	27.54 ± 0.74 ***	24.26 ± 0.70 ***	21.42 ± 0.61 **	16.58 ± 0.47 ^{NS}	13.95 ± 0.40 *
Weight gain	15.08 ± 0.43	16.85 ± 0.48 ^{NS}	25.24 ± 0.72 ***	21.96 ± 0.63 ***	19.32 ± 0.55 ***	14.38 ± 0.41 ^{NS}	11.75 ± 0.33 **
Specific growth rate (SGR) % day $^{-1}$	0.95 ± 0.02	0.96 ± 0.02 ^{NS}	1.13 ± 0.03 **	1.08 ± 0.03 ^{NS}	1.06 ± 0.03 ^{NS}	0.93 ± 0.02 ^{NS}	0.85 ± 0.02 ^{NS}
Food conversion ratio (FCR)	2.38 ± 0.06	2.42 ± 0.06 ^{NS}	1.66 ± 0.04 ***	2.02 ± 0.05 *	1.80 ± 0.05 ***	2.25 ± 0.06 ^{NS}	2.14 ± 0.06 ^{NS}
Protein efficiency ratio (PER)	0.57 ± 0.01	0.85 ± 0.02 ***	1.16 ± 0.03 ***	0.95 ± 0.02 ***	0.83 ± 0.02 ***	0.60 ± 0.01 ^{NS}	0.52 ± 0.01 ^{NS}

(Value expressed is mean of n (n=3); ±: SE)

*P<0.05, **P< 0.01, ***P< 0.001, NS – Non Significant

There was a reverse connection between the development of fish and dietary incorporation level of plant protein in their diets. This pattern was seen in exhibit contemplate. The expanding fuse of asparagus in diets demonstrated expanding development in *Cyprinus carpio* up to 30% incorporation level and past that the fish development indicated dynamic abatement. The level of fishmeal supplanting with plant or creature proteins in the eating routine of fish hampers the development. For every species of fish, consideration of plant protein exists in the particular range.

Most of the fish species tolerate the replacement or inclusion level of plant protein below 50%. Above this limit the growth retardation started due to low acceptance of feed, digestion related problems and effect of anti-nutritional factors on growth.

In the present study, the plant sources used in feed formulation proved to be a supplementary ingredient up to a remarkable level solely or in combination for selected fish species, i.e. *Cyprinus carpio.* It is evident from this study that, asparagus meal could be incorporated up to 30% level in

formulated diets for *Cyprinus carpio* without affecting fish growth and biochemical composition. Above the said limit the reduction in fish growth was observed.

The data of the present study agree with the finding of Pereira & Oliva – Teles [8], who reported that significant decreases were found for both, growth and feed utilization with the highest replacement levels of dietary fish meal with plant proteins for gilthead sea bream. There are many evidences, which support the results of present study. Ramchandran & Ray [9] successfully incorporated grass pea as a fish feed ingredient up to 40% inclusion level. The increased incorporation of grass pea above 40% resulted in reduced growth of *Labeo rohita*. Some other researchers also support the negative growth of fish with higher inclusion of plant sources in fish diets [10, 11].

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MORPHOMETRIC ANALYSIS OF FRESH WATER SNAILS WITH ASSOCIATED COMMENSALS PLANKTONIC COMMUNITY AT DHOM AND KANHER WATER RESERVOIRS OF WESTERN MAHARASHTRA, INDIA

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ABSTRACT:

Fresh water snails are widely distributed contributing an important role in the functional aqueous ecosystems. Almost no any research work has been reported on the morphometry of the fresh water snails of the region. Present study is framed to identification and morphometric analysis and associated planktonic communities of the fresh water snails at Dhom and Kanher water reservoirs in district Satara. The study was carried out from March 2015 to February 2016.

Altogether six species of fresh water snails such as *Bellamya bengalensis* (Lamark), *Indoplanorbis exustus* (Deshayes), Melonoides tuberculata (Muller), *Lymnea (pseudosuccinea) luteola* (Lamark), *Lymnea stagnalis* (Linnaeus) and *Terebia lineate* (Gray). The species identified are restricted to 02 orders (Mesogastropoda and Basomatophora) and 04 Famalies (Vivipariadae, Thariadae,Bulliniadae and Lymnaeidae). During the sampling at four different stations of both the reservoirs *B. bengalensis* were recorded in maximum number and *Melanoides tuberculata* and and *Lymnaea stagnalis* were comparatively less in number. The morphometric analysis reveals that, the shells of *B. bengalensis, Melanoides tuberculata, Lymnaea(pseudosuccinea) luteola, L. stagnalia* and *Tarebia lineate* was conical while the shell of *Indoplanorbis exustus* was disciodal. The maximum shell height was recorded in *T. lineate* and while it was observed minimum in *I. exustus*. Maximum shell width was recorded in *T. lineate* and minimum in *I. exustus*. The commensal planktonic species were recorded from both phytoplankton and zooplankton groups.

KEYWORDS: Morphometry, Fresh water, Snails, Plankton, Reservoirs.

INTRODUCTION:

The fresh water snails (Class-Gastropoda) are dispersed in various aquatic habitats such as ponds, tanks and reservoirs. Gastropoda is divided in to two subclasses the Prosobranchia with gills and Pulmonata with lungs for respiration, However, large numbers of gastropods are found in lentic

habitats contributing significant role in functional ecosystem. The taxanomic status of gastropoda includes 12 famalies, 23 genera and 52 species. Among these, family Tharidae is most dominant followed by Bathyniidae and Lymnaeidae.

In gastropoda, the body covering shell is univalve. The morphometric analysis such as shape, size, colour, concentric lines, apex etc. establishing direct or indirect relationship with many biological fields such as ecology, systematic and phylogeny. However, despite wide geographical range of gastropoda the regional morphological variations of the species is poorly known, such kind of study probably prove as a baseline information to establish link between various disciplines like taxonomic traits, regional morphological variations of the species, phyco chemical and biological features of the aquatic environment. The morphometric analysis of fresh water gastropoda providing scientific information to discriminate between species [1], it is significant to recognize intraspecific morphological variations [2] and geographical distribution.

The biotic community especially planktonic forms are highly sensitive to the physicochemical characters controlling their abundance, distribution and seasonal variations. Moreover, certain species of phytoplankton and zooplankton act as a bioindicators being used as an important tool explain the trophic status of an aquatic ecosystem. Cholonky [3] has mentioned that, the use of diatoms species to indicate the water quality of an aquatic ecosystem. Arora [4] stated the role of rotifrers as a bioindicator to determine the water quality. Verma [5] noted that, the Copepods is regarded as pollution sensitive taxa as they disappear from polluted waters, moreover, study on morphology of mollusk is significant to establish relationship with taxonomic traits, regional morphological variations, relationship between the forms and functions, adaptations and many other related aspects. Identification has been done on the basis of shape, size and other characters Moreover, the regional morphological variations of the species is poorly known and there is no any significant scientific record on the morphometry of local fresh water snails is available.

Keeping in view about scope and significance of of morphometric study and planktonic form and almost no work is carried out on the morphometry of fresh water snails. Present paper is framed to evaluate the the morphology such as shape, size, height and width of of fresh water snails accompanied with associated commensal planktonic forms at Dhom and Kanher reservoirs in district Satara, Maharashtra. However, some important contributions on the morphometric analysis of fresh water snails are [6].

MATERIALS AND METHODS:

Study Area:

Dhom and Kanher dams are located in district Satara, Maharashtra, India. Both the reservoirs are earth fill mainly constructed for irrigation and hydroelectricity purpose by the government of Maharasjtra. These are located at 17. 9814986^0 N –73.7954449^0 E and 17.7588487^0 N – 73.8742053 ^{0}E and constructed against Krishna and Wenna rivers respectively. The height of the dhom reservoir is 50 m (160ft.), Length-2,478m, dam volume-6335 $km^2$and gross storage capacity 13.80 TMC,surface area-2,498 km2and generates electricity of 4 MG. completed in 1982. The height of Kanher reservoir is 50.34 m. (162.2 ft.), Length-1,954 m. dam volume-6308 km^3, gross storage capacity-286000.00km^3, surface area-18.63 km^2.

Sampling and Identification of snails:

For the morphometric analysis, the snails were collected monthly from different habitats from March 2015 to February 2016 from both the reservoirs The snails were collected by hand picking method from exposed marginal areas and by operating dip net (30 cm x 40 cm.). The snails attached to the macrophytes were separated and stocked in plastic container and brought in the laboratory, washed and sorted and identified by comparing their characters from standard literature [7]. The identification of snails were confirmed by the Zoological Survey of India.

Morphometric analysis of snails:

The morphometric measurements of the shells were taken with Varnier Caliper, the measurements were taken in millimeters (mm). The important shell features such as height, diameter, umbilicus diameter, no of whorls, aperture shape and other parameters were considered in present study.

The sampling of associated commensals planktonic forms were by using plankton net and by scraping the shells of the collected snails and samples were observed under compound microscope, The identification of phytoplankton were done by comparing their characters as described by [8] .

RESULTS:

During the survey of fresh water snails from March 2015 to February 2016, altogether 06 species belonging to 02 orders and 04 families were identified. All the species were belonging to class Gastropoda.The snails identified are *Bellamya bengalensis* (Lamark 1882), *Indoplanorbis exustus* (Deshayes), *Melonoids tuburculata* (Muller 1774), *Lymnea (pseudosuccinea) luteola (Lamark), Lymnea stagnalis* (Linnaeus, 1758) and *Tarebia lineate* (Gray, 1828). In present study, the maximum species i.e. *B*

bengalensis, Lymnea (pseudosuccinea) luteola and *Tarebia lineate* and minimum species of *Melonoid tuburculata* and *Lymnea stagnalis* were noted from the collection.

The morphology of collected species of snails were observed the actual observations noted are, in *Bellamya bengalensis s*hell colour was greenish ,it was more or less oval and conical in shape, body whorl is convex and slightly oblique in in position. In *Lymnea luteola*, shell was thin, elongated, whitish and translucent; the body whorl was oval in position. In *Tarebia lineate*, the shell was conical with 8to 10 whrols the apex of spire was usually eroded and sides were concave in outline. *In Indoplanorbis exustus*, shell was greenish brown in colour usually with 03 whrols and aperturewas angular and raised. In *Lymnea acuminate*, shell was thin semitransparent ovale with short culminate spire, body whorl was much inflated and little angular above. The aperture was large with twisted columella.

The morphometric observations of collected snails and associated commensal plankton species have been mentioned in table no.1. the shell of *Bellamya bengalensis, Melanoides tuberculata, Lymnea (Peudosuccinea) luteola, Lymnea stagnalis* and *Tarebia lineate* was conical in shape while it was discoidal in case of Indoplanorbis exustus. The size distribution of snails were classified in different ranges viz. 0—5 mm,6---10 mm. 11---15 mm. 16—20 mm and 21—30 mm. has been shown in figure. The maximum abundance recorded was of *Bellamya, bengalensis, lymnea (Pseudosuccinea) luteola* and *Tarebia lineate* while minimum abundance was of *Malanoides tuberculata* and *Lymnea stagnalis.*

DISCUSSION:

In present investigation 06 species belonging to 02 orders and 04 families were identified at Dhom and Kanher reservoirs during March 2015 to February 2016. The morphometric analysis of the observed shells of fresh water snails revealed that, the shells of *Bellamya bengalensis*, *Melanoides tuberculata, Lymnea (Peudosuccinea) luteola, Lymnea stagnalis* and *Tarebia lineate* were conical in shape. T shell of *Indoplanorbis exustus* was disoidal in shape The shell coloration was greenish, whitish or brownish. The maximum shell height and width was observed in *Tarebia lineate* while minimum was recorded in *indoplanorbis exustus.*

Some scientist have recorded the shell morphology of fresh water snail *Gundlachia ticaga* from Brazil and recorded shell variations from the species from altered environment [9].

Madan et al [10] have recorded the morphometric analysis of 07 species of fresh water snails identified and mentioned the height, length and width of the aperture and size distribution with associated planktonic community at Dudhlee in Doon valley , Uttarakhand showing similarity with the

present observations of a particular species in case of shell morphometry and distribution. Sharma et al. [11] has recorded only three species of fresh water snails at western Uttar Pradesh.

Magare et a. [12] have recorded rich number of *Melanoid tuberculata* and abundant *Paressia corrugate* in Karanjali river, Nasik. Shejwal et al. [6] have recorded shell length, width, aperture length and width and total weight of fresh water snail *L.acuminata* and correlated it with animal shell length and all body parameters. Functional morphology analyzes the relationship between forms and function in organism. However, for comprehensive analysis requires an integrated approach to morphology [13]. The shell characters are used in the animals natural habitat, thus facilitating the interpretation of similar characters with the species of different regions. The extrinsic factors due to environmental conditions can induce the variations in shell shape and colour. Changes In addition, the environmental changes without genetic can create distinct non genetic changes in shell morphology [10].

Present study is based on the collection and identification of fresh water snails including the observations of shell morphology, their length, width aperture shape etc. Such observations are significant to correlate the taxonomic trait, regional variations in morphology, adaptations, species richness and distributions. Moreover, the morphological studies (shape and size) are significant in the fields such as ecology and phylogeny.

The associated commensal planktonic species identified were from various groups of phytoplankton like Chlorophyceae, Bascillariophyceae, Myxophyceae and Euglenophyceae and Zooplanktons from Protista, Copepoda and Cladocera. Among these groups certain pollution indicator species were noticed. Natural waters encountered with variety of pollutants resulted from human activities. The organic pollution is wide spread. Protists and other organisms have been used to monitor such pollution (Sleigh). The occurrence of pollution indicator species of phytoplankton and zooplankton revealed the effect of organic pollution and mesoeutrophic status of these reservoirs.

Table: Details about the morphometric analysis of collected snails at Kanher and Dhom water reservoir during the study period.

S. No.	Snails species	Size range		Shell of the shape	Associated biotic community
		SH	SW		
1.	*B. bengalensis*	3.01-10.2	3.71-9.62	Conical	Amoeba, Chlorella, Cilate, Euglena, Spirogyra, Ulothrix, Paramecium, Daphnia and Oedogonium.
2.	*M. tuberculata*	4.1-7.2	4.60-5.71	Conical	Paramecium, Nostoc, Cyclops, Amoeba, Daphnia.
3.	*L.(pseudosuccinea) luteola*	5.2-8.2	4.75-6.52	Conical	Diatoma, Fragilaria, Paramecium, Daphnia, Nitzshia, Oedogonium, Spirogyra, Ulothrix.
4.	*L. stagnalis*	6.2-7.1	5.1-5.12	Conical	Chara, Chlorella, Spirogyra, Cladop, Oedogonium, Spirogyra, Amoeba, Ciliate, Euglena.
5.	*T. lineate*	9.9-18.11	5.21-7.1	Conical	Amoeba, Ciliate, Euglena, Spirogyra, Ulothrix, Paramecium, Volux, Vorticella.
6.	I. exustus	3.4-7.31	1.7-6.2	Discoidal	Chloroccum, Cladophora, Microspora, Oedogonium, Amoeba, Ciliate, Euglena, Paramecium, Vorticella.

Note: [SH-Shell height; SW-Shell width]

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ASSESMENT OF QUALITY OF WATER IN SAVITRI RIVER (M.S.) INDIA

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ABSTRACT:

The monitoring of water qualities of Savitri River was carried out from December 2014 to July 2015.This period covered three seasons i.e. winter, summer and monsoon. With reference to Mahad MIDC (Maharashtra Industrial Development Corporation) two sampling stations such as S_1 and S_2 from upstream and downstream respectively, were selected for monthly collection of water sample. Water samples were analyzed for physic-chemical parameters such as Temperature, PH, D.O., BOD, Free CO_2, Total hardness, Total alkalinity, Total acidity, and Chlorides by employing standard methods. Elevated values of parameters at S_2 clearly indicated that the Savitri river was polluted by receiving load of industrial effluents and domestic sewage as compared to upstream water at S_1. Contamination of river water suggests certain control measures to protect river ecosystem for human health and hygiene along with biota living therein.

KEYWORDS: River, Physico-chemical parameters, Industrial effluents

INTRODUCTION:

Availability of good quality of water in sufficient quantity is the basic requirement for human existence and also for aquatic life. But in the rapidly advancing present era, organization and industrialization are changing physic- chemical and biological properties of water. All the rivers in India are being used as a major source for irrigation, but they are also used as repositories for disposal of domestic sewage, industrial effluents containing toxic substances and heavy metals, agricultural runoff etc. [1]. Such activities threaten the aquatic life by causing them toxicity and finally reach the human body along with riverine food sources.

Raigad district in Maharashtra has 15 tehsils of which Mahad is one of them.It is one of the historical towns in Maharashtra, gaining importance due to Satyagraha launched by Bharatrtna Dr. BabasahebAmbedkar at chavdar tale. Three major rivers such as savitri,gandhari and kalu flow through the Mahad town, Savitririver is specially gaining importance due to establishment of industrial belt on

426.39 hectreof land in 1987 and harboring of 11 villages along both the banks. Therefore, it has become adumping ground for industrial effluents and domestic sewage, there by changing the physico-chemical properties of water and also affecting aquatic life living therein. River savitri originates at the Tiger point in Mahabaleshwar and flows from east to west passing through the Raigad and Ratnagiri district and meet in Arabian Sea at Harihareshwar (Bankot estuary).Therefore, to investigate physico-chemical parameters of river water collected from upstream as well as downstream with reference to industrial belt.

MATERIALS AND METHODS:

For physico-chemical analysis of water,samples on fifth day of each month, for the period from December 2014 to July 2015, were collected monthly from two sample stations. One station was located upstream i.e.before industrial area and denoted by letter $S_{1,}$ whereas second station was located downstream i.e. after industrial area and denoted by letter S_2 .The distance between two sampling station is 14 km. Samples were collected in clean plastic containers of two litre capacity and were brought to the laboratory for analysis of physico-chemical parameters *Viz.* D.O., BOD, Free $CO_{2,}$ Total hardness, Total alkalinity, Total acidity, and Chlorides. Temperature and PH were measured at the spots. The parameters of water samples were measured as per APHA [2].

RESULTS AND DISCUSSION:

The data observed for the study period at the selected stations are depicted in table.

Among the physical parameter, the temperature values ranged between 28^0 c to 31.4^0 c, in the month of December2014 and may 2015, respectively at S_1 , whereas that at S_2 these values were 28.4^o c and 31.7^0 c in same months, which were in permissible limit of 40^0 c (IS 1981). It is reported that, there was slight increase in the temperature of water collected from S_2. The water temperature dramatically changes, the rate of chemical and biological reaction within the water and influences plant and animals [1].

PH expresses the acidic and alkaline nature of the water. In the present study though the values ranges between7.47 and 7.87; and 6.2 and 7.55 at S_1 andS_2 respectively; there was decline in the PH in three months at S_2 indicating that industrial effluents are of acidic nature, pulling the river towards acidity.

Table 1: Variations in physico-chemical parameters of water samples collected from Savitri River during December 2014 to July 2015

Month /Spot	Temp. (O^c)		pH		D.O. (mg/l)		BOD (mg/l)		Free CO_2 (mg/l)		Hardness (mg/l)		Alkalinity (mg/l)		Acidity (mg/l)		Chloride (mg/l)	
	S_1	S_2	S_1	S_2	S_1	S_2	S_1	S_2	S_1	S_2	S_1	S_2	S_1	S_2	S_1	S_2	S_1	S_2
Dec. 2014	28.0	28.4	7.67	7.55	14.07	20.10	1.21	2.62	4.4	13.2	60	340	90	100	10	20	14.2	3550
Jan 2015	28.9	28.8	7.51	6.9	9.64	7.63	2.08	2.81	13.2	22.0	120	1800	120	140	15	75	28.4	3976
Feb. 2015	28.7	28.9	7.47	7.0	8.84	7.03	1.40	1.60	8.8	22.0	100	1980	100	70	25	20	28.6	4470
Mar. 2015	29.1	30.0	7.51	6.8	7.23	5.62	1.60	2.00	13.4	26.4	110	2100	110	78	45	90	28.9	6106
April 2015	31.0	31.7	7.9	7.1	8.24	4.82	3.41	4.00	13.8	39.6	101	2300	100	96	50	105	35.5	6958
May 2015	31.4	31.7	7.87	6.2	7.83	6.23	3.01	3.61	13.5	30.8	128	3880	130	70	45	45	30.4	6887
June 2015	31.3	31.6	7.80	7.1	7.43	4.02	3.61	4.60	8.8	17.6	126	3360	100	100	55	80	35.5	7029
July 2015	29.9	30.1	7.76	7.15	4.82	4.50	12.0	15.0	12.3	20.9	80	96	69.96	93.2	48	73	18.9	119

Enhancement of pH (above 8.6) in the sewage disposal plant may induce formation of toxic trihalomethane [3]. Dissolved oxygen content of water sample at spot S_1 was between 4.82 mg/l and 14.07mg/l whereas at S_2 they were between 4.02 and 20.10 mg/l.

In comparison with S_1, D.O. values at S_2 were low during all the months of study except December 2014. Elevated values of D.O. at S_2 during December 2014 might be because of algal growth in water. Basically D.O. is an important parameter to determine the water quality in various water conditions. D.O. concentration in water body indicates its ability to support aquatic life. In natural and waste water D.O. level depends on physico-chemical, and biological activities of the body. In normal climatic condition clean surface water is saturated with D.O. (7.6 mg/l at 30^0 c). The oxygen demanding wastes are responsible for rapid depletion of D.O. in aquatic system. Marginal reduction in D.O. is also reported [4] in Godavari river.

BOD is the amount of O_2 utilized by micro-organisms for stabilizing organic material in water. Drinking water usually has BOD less than 1 ppm and water is considered to be fairly pure with BOD of

3ppm; and of doubtful purity when the BOD values reach 5ppm [5]. In the present investigation BOD values at S_1 ranged between 1.21mg/l and 12mg/l; and at S_2 between 1.603mg/l and 15 mg/l . BOD values at S_2 were higher as compared to S_1 during all the months. Similar results were reported by other researchers. [4][6][7]. High values of BOD may be due to high load of organic matter emptied by industries and municipal waste into Savitri River which were comparable with results obtained by various researchers [8][9][10]. The cause of high BOD may be excessive growth of aquatic flora in water, which could be lethal for aquatic flora [11].

Free CO_2 content determines status of aquatic body. Surface water normally contains less than 10 mg/l of CO_2 while ground water contains 30-50 mg/l [12]. Free CO_2 concentration in aquatic medium may be fluctuated due to presence of industrial waste, domestic waste, phytoplankton, microorganisms and sunlight [13]. In the present investigation free CO_2 at spot S_1 ranged between 4.4 and 13.8 mg/l those at S_2 ranged between 13.2 and 39.6 mg/l. The lowest values at both the spots were recorded in the month of December whereas the highest valuewas in April2015. The CO_2 content at S_2 was significantly higher than S_1 during all the months. Elevated levels of free CO_2 might be due to frequent release of industrial effluents and domestic sewage containing high load organic matter maximum rate of stabilizing it along with presence of planktonic and weed growth in the aquatic body [14].These observations are parallel to results obtained by other researchers [10][15][16].

Hardness as property of H_2O preventing lather formation with soap has great effect on biotic diversity hence may restrict water use. Toxicity of pollutant decreases with increasing hardness. It depends upon concentration of carbonate and bicarbonate salts of Calcium and magnesium or SO_4, chloride or other ions of mineral acids. Hardness has no known adverse effect in health however some evidences have been attributed about its roles in heart disease [17]. In the present investigation values of total hardness in terms of $CaCo_3$ at spot S_1 ranged between 60 and 128 mg/l those at S_2 ranged between 96 and 3880 mg/l. As compared to S_1 there was significant increase in hardness at S_2 during all the months of study. However, values of total hardness of all the water samples were within the desirable limit of 200 mg/l[18]. Our results well synchronize with results obtained by other workers [10][19][20].

Total alkalinity of water is due to carbonate and bicarbonate [21]. In the present study total alkalinity values at spot S_1 ranged between 69.96 and 130 mg/l those at S_2 ranged between 70 and 100 mg/l. During most of the month alkalinity values were significantly elevated at S_2 but all values except April and November 2014 were within the desirable limits of 120 ppm. This increase might be due to increase in the bicarbonate level [22][23].

CO_2 and organic acids found by the decomposition of organic matter makes the water acidic. Acidity may also rise due to presence of mineral acids produced by hydrolysis of salts of certain heavy metals such as $fecl_3$ or Al_2 $(SO_4)_3$. In the present investigation total acidity values at spot S_1 ranged between 10 and 55mg/l of $CaCO_3$& those at S_2 ranged between 20 and 105 mg/l of $CaCO_3$. Though the acidity values fall within the normal range, significant increase in total acidity at S_2 was reported as comparable to S_1.

Chloride content determines water quality and nature of biota in the aquatic body. Salinity and electrical conductivity of water largely depend upon chloride content. In the present investigation chloride content at spot S_1 ranged between 14.2 and 35.5 mg/l, those at S_2 ranged between 119 and 7029 mg/l. It was surprisingly reported that downstream water at S_2 contain huge amount of chloride which was beyond the WHO permissible limit 200mg/l [10]. The elevated values of chlorides at S_2 in comparison with S_1 might be due to release of industrial effluents, domestic sewage and back water from Bankot estuary, in SavitriRiver. Similar results were reported by many researchers from Ganga, Dickrong and Godavari rivers [10].

CONCLUSION:

The present study reported significant difference in all physic- chemical parameters at S_1 (upstream water) and S_2 (downstream water) with reference to industrial area and Mahad town. Therefore, it is very clear that downstream water is receiving huge quantity of industrial effluents and domestic water generated due to anthropogenic activities and causes pollution of this riverine ecosystem. To protect this ecosystem there sould be proper treatment and planning of disposal of municipal waste and industrial effluents to maintain hygienic conditions in the local population and also healthy environment.

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EFFECT OF TRIAZOPHOS ON LIPID CONTENT IN THE FRESH WATER FISH CYPRINUS CARPIO (LINN) AFTER ACUTE AND CHRONIC EXPOSURE

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ABSTRACT:

Extensive quantities of organophosphate pesticides are used to control different farming vermin. Triazophos is one of the organophosphate (OP) pesticides broadly utilized as a part of rural practices all through India. In the present study, the effect of Triazophos on lipid contents was studied in gill, liver, muscle and kidney of freshwater fish, *Cyprinus carpio.* The fish were subjected to 0.5 ppm (LC0) and 1.0ppm (LC50) concentrations for 96 hrs and 0.1ppm (1/10thof LC50) and 0.05ppm (1/20thof LC50) concentrations for 30 days. Significant alterations in the lipid content of fish tissues were observed. After acute and chronic exposure of the selected pesticide to fish, it was found that lipid content was decreased in all the tissues to all test concentrations over control. Comparatively less depletion in lipid content was observed at 0.5ppm (LC0) and 0.05ppm (1/20thof LC50) concentrations than 1.0 ppm and 0.1 ppm concentrations.

KEY WORDS: Triazophos, *Cyprinus carpio*, lipid, LC0, LC50.

INTRODUCTION:

In recent decades an increase in agricultural production through green revolution has been observed but on the other hand use of pesticides is also increased tremendously. Be that as it may, broad utilization of pesticides has caused a considerable measure of contamination and undermined the soundness of non-target earthly and oceanic living beings [1, 2]. The pesticides utilized for different purposes achieve oceanic sources, either specifically or in a roundabout way through spillover from rural fields, splash floats, rain water, sewage and effluents from enterprises [3].

Organophosphate pesticides are to a great extent used to control bugs as a result of their viability and simple biodegradation. Triazophos (o,o-Diethyl-o-(1-phenyl-1H-1,2,4,- triazol-3yl) thiophosphate) is one of the organophosphate (operation) pesticides widely utilized as a part of agrarian practices in India for the insurance of rice, vegetable, cotton, sugarcane, soya bean and so

forth. As the fish considered as bioindicators of water quality, the impact of pesticides can be examined by investigating its biochemical parameters [4, 5, 6]. The lipid content of fish is utilized as biomarker under stress conditions [7].

Relatively less work has been done on the harmful impacts of pesticides on biochemical substance in the tissue of *C. carpio*. Subsequently in the present examination endeavor has been made to discover the impact of triazophos on the lipid content of the fish *C. carpio*. Changes in biochemical substance are of extraordinary physiological importance, since they catalyze and control the development of different intermediates, which assume a noteworthy part in ordinary physiological procedures. Under stress conditions, changes in biochemical substance are considered as optional reaction of the fish.

MATERIALS AND METHODS:

The fish were collected from local sources and brought to the laboratory for acclimation. The fishes utilized for experimentation were having the normal length of 6-9 cm and the heaviness of around 10-14 grams. Triazophos 40% EC was utilized as toxicant for static bioassay test. A working stock arrangement of toxicant was readied (100 ppm). After 96 h intense lethality test LC0 and LC50 estimations of Triazophos to *Cyprinus carpio* was evaluated by utilizing static bioassay test. Water was renewed after every 24 hours to maintain the pesticide concentration. The total mortality in each concentration was recorded after 96 hrs of exposure. The data obtained was subjected to probit analysis (Finney, 1971). After determining values, the fish were exposed to .5 ppm (LC0) and 1.0 ppm (LC50) concentration for 96 hours .and to 0.1 ppm ($1/10^{th}$ of LC50) and 0.05 ppm ($1/20^{th}$ of LC50) concentrations for 30 days. Another group of fish was kept as a control for acute and chronic test. The fishes were sacrificed immediately at the end of the exposure period and tissues like gill, liver, kidney and muscles were used for biochemical estimations. Lipid content was estimated by by vanilline reagent method [8].

RESULTS AND DISCUSSION:

Lipid is a stored form of energy, which is utilized as per the need of body under stress condition of pesticides. Changes in the lipid content of various tissues of fish have been reported by number of researchers. Rao and Rao [9] exposed *Sarotherodon mossambicus* to methyl parathion and observed depletion in lipid quantity of muscle, gill, liver and brain. Saxena et al. [10] studied the effect of

malathion and carbaryl on *in vitro* lipid and protein synthesis of the fresh water teleost, *Channa punctatus.*

Table 1: Effect of Triazophos on lipid content (mg/100 mg wet tissue) in *C. carpio* after acute exposure

Tissue	Control	LC0(0.5ppm)	% change over control	LC50(1ppm)	% change over control
Gill	1.751 ± 0.078	1.664 ± 0.063 NS	-4.952	1.494 ± 0.084 *	-14.700
Liver	3.319 ± 0.172	2.121 ± 0.114 ***	-36.108	1.982 ± 0.116 ***	-40.300
Muscle	1.343 ± 0.055	1.143 ± 0.052 *	-14.895	1.033 ± 0.083 **	-23.024
Kidney	1.504 ± 0.061	1.275 ± 0.067 **	-15.272	1.203 ± 0.057 NS	-20.035

Values are mean ± S.D., *, **, *** indicates significance level P<0.05, P<0.01, P<0.001respectively and N.S- non significant, (n = 3)

Table 2: Effect of Triazophos on lipid content (mg/100 mg wet tissue) in *C. carpio* after chronic exposure

Tissue	Control	$1/10^{th}$(0.1ppm)	% change over control	$1/20^{th}$(0.05ppm)	% change over control
Gill	1.950 ± 0.090	1.286 ± 0.055 ***	-34.039	1.371 ± 0.084 ***	-29.680
Liver	3.692 ± 0.096	2.320 ± 0.064 ***	-37.170	3.085 ± 0.080 NS	-16.448
Muscle	1.824 ± 0.065	1.141 ± 0.030 ***	-37.473	1.133 ± 0.059 ***	-37.880
Kidney	1.938 ± 0.087	1.329 ± 0.077 ***	-31.456	1.519 ± 0.060 **	-21.627

Values are mean ± S.D., *, **, *** indicates significance level P<0.05, P<0.01, P<0.001respectively and N.S- non significant, (n = 3)

El-Elaimy et al. [11] reported pesticide poisoning to fresh water teleost, further reported the effect of three organophosphates on the total lipids, phospholipids and cholesterol content of some fish tissues. Alterations in the lipid content in different tissues were observed by Sheela et al. [12] after exposure of *Channa striatus* to fenvalerate. Decrease in lipid content of gill, liver and gonad after acute and chronic exposure of *Sarotherodon mossambicus* to endosulfan have been reported by Kamble [13]. Dhanapackiam et al. [14] reported decrease in liver and muscle lipid content in *Cyprinus carpio* after exposure to malathion. Biochemical changes in certain tissues of *C. mrigala* (Ham) were studied by after exposure to fenthion [17].

RESULTS AND DISCUSSION:

Lipid constitutes a reserve form of energy. It is metabolized whenever necessary. Due to pesticidal stress changes occurred in lipid contents have been reported by many workers. Piska et al. [18] reported significant decrease in lipid contents in the liver, gill and brain of *Cyprinus carpio* exposed to cypermethrin. Ramos and Herrera [19] reported depletion in protein and lipid levels of muscle, liver and brain of *Oreochromis niloticus* exposed to fenvalerate. Israel and Manohar [20] had observed maximum decrease in lipid content in liver of *Cirrhinus mrigala* exposed to lethal concentrations of fenthion. Nagraju et al. [21] reported decrease in total lipid contents in gill, liver, kidney and muscle of *Labeo rohita* exposed to sublechal concentrations of chlorantraniliprole for 15 and 30 days. Muthukumarvel et al. [22] reported depletion of lipid content in gill, liver, kidney, muscle and intestine of *Labeo rohita* exposed to sublethal concentration of monocrotophos.

The total lipid content in various organs of *Cyprinus carpio* in control observed after acute and chronic exposure was in the order of liver > gill > kidney>muscle. In the present study, lipid content in all target tissues was decreased after acute (96hrs.) and chronic exposure (30 days). Results obtained are presented in table 1 and 2, Comparatively, less depletion in lipid content was observed at 0.5 ppm than 1 ppm after acute exposure. In case of chronic exposure, comparatively less depletion in lipid content was observed at 0.05 ppm concentration than 0.1 ppm concentration. This decrease in lipid content varies from tissue to tissue. Present results finds in good agreement with other researchers [23, 24, 25]

In the present investigation, lipid showed a highly significant decrease ($p<0.001$) in liver tissue after acute exposure. Maximum decrease (-40.3% and -36.10%) at LC0 and LC50 in lipid content was observed in liver and non significant decrease in lipid content was observed in kidney at LC50 concentration and in gill at LC0 concentration. while minimum decrease in lipid content was observed in

kidney (20.03%) after acute exposure (1.0 ppm), In chronic exposure lipid, content was significantly decreased ($p<0.001$) in muscle and gill tissues at 0.1 ppm and 0.05 ppm concentrations respectively. More or less similar decrease in lipid content was observed in gill, liver, muscle and kidney at 0.1 ppm concentration, while non significant decrease was observed in liver (16.44%) at 0.05 ppm concentration. In the present study, depletion in lipid content was observed in gill, liver, muscle and kidney of experimental fish at acute and chronic concentrations of pesticide. Depletion in the lipid content in different fishes might be associated with decreased activity of G-6-PD [26]. Under pesticidal stress, reserve energy in the form of lipid utilized, may be responsible for its depletion [27]. Another probability for depletion of lipid was excess activity of test animal due to toxic exposure of triazophos, sevin and deltamethrin. Accumulation of these pesticides in the brain of fish might have caused the disintegration of nerve cells, clotting of blood and reduction in transport of oxygen to brain [28], which may be resulted in depletion in lipid contents. Additional energy required under pesticidal stress might be provided through utilization of lipid/ lipid peroxidation [29].

CONCLUSION:

Due to acute exposure of fishes, there was decrease in the lipid content in various organs at LC0 and LC50 concentrations of these pesticides. This decrease in lipid content was more in LC50 concentrations. Remarkable decrease in lipid content was observed after chronic exposure at both the concentrations. The decrease in lipid content may be due to its utilization for production of extra energy to cope up with pesticidal stress.

From the present findings, it is clear that an organophosphate pesticide Triazophos causes alterations in thelipid content of organs like gill, liver, kidney and muscle. Depletion in lipid content directly affects the health status of test fish.

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BIOCHEMICAL CHANGES IN BANANA (*MUSA* SPP.) PLANT INFECTED WITH BENOMYL SENSITIVE (FOC - 4) AND RESISTANT (EMS- FOC -9) ISOLATES OF *FUSARIUM OXYSPORUM* F. SP. *CUBENSE*

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ABSTRACT:

Fusarium oxysporum f. sp. *cubense* causing Panama wilt of Banana(*Musa* spp.) is most distractive disease of banana. The present paper deals with study of biochemical changes in host plant due to infection. Banana plant infected with resistant isolate of *Fusarium oxysporum* f.sp. *cubense* showed reduction in total sugar, reducing sugar, DNA, RNA, starch, total ash, calcium, magnesium, iron, manganese and zinc when compared with healthy banana plant.

KEYWORDS: *Fusarium oxysporum* f.sp. *cubense*, benomyl, Panama wilt.

INTRODUCTION:

Banana or (*Musa Spp*) is most important fruit crop in India. Banana has medicinal and nutritional properties therefore it is said as common man's affordable food. This economically important fruit crop is surfing from Panama Wilt of Banana caused by *Fusarium oxysporum* f. sp. *cubense* [1]. The concentration of total sugars, reducing sugars, nitrogen and phosphorus was decreased due to infection by early and late leaf spot pathogens of groundnut [2]. There are many reporters indicating changes in the biochemical characteristics in the host due to infection by various pathogens [3, 4, 5, 6]. But there is no report available for biochemical changes in banana plant.

Therefore the aim present work is to study biochemical changes occurred in banana plant infected with benomyl resistant and sensitive isolates of *Fusarium oxysporum* f. sp. *cubense* Panama wilt of banana.

MATERIALS AND METHODS:

Total 17 samples were collected from different districts of Maharashtra and Karnataka exhibiting symptoms of panama wilt of banana. From these samples pure isolates of *Fusarium*

oxysporum f. sp. *cubense* were isolated. These isolates were maintained in BOD incubator for further study. Sensitivity test of benomyl against *Fusarium oxysporum* f. sp. *cubense* was determined by food poisoning test [7] and obtained sensitive and resistant isolates. Biochemical changes were studied by inoculating the banana plant with mycelial suspension of sensitive and resistant isolates. Roots of plantlets were immersed in aqueous suspension of 10 ml conidia in sterile distilled water. Conidia obtained from 1week old culture of *Fusarium oxysporum* f. sp*. cubense* grown on CDA.

Inoculated by sensitive and resistant isolate and the banana plant were kept for disease development. Above sensitive, resistant and healthy plants were collected and dried at 40 °C in hot air oven after 10 days and powders were obtained after grinding. Carbohydrates were estimated according to the method described by [8]. 0.5 g oven dried plant material was homogenized in mortar with pestle and extracted with 80 % alcohol. The polyphenol were estimated following the method by [9]. For the determination of mineral elements sample extract was prepared following the method described by [10].

RESULTS AND DISSCUTION:

Table 1: Biochemical characteristics of the banana pseudostem infected with benomyl sensitive (FOC -4) and resistant (FOC -9) isolates of *Fusarium oxysporum* f. sp. *cubense*

Sr. No.	Estimation	Healthy	Sensitive	Resistant
1.	Total soluble sugar (g/100g)	3.45	1.60	1.20
2.	Reducing sugar (g/100g)	3.40	0.30	0.24
3.	Starch (g/100g)	14.51	10.26	6.34
4.	Polyphenols (g/100g)	0.311	0.374	0.386
5.	DNA (mg/ml)	0.110	0.060	0.051
6.	RNA (mg/ml)	0.229	0.104	0.103
7.	Total ash (%)	5.00	4.00	2.00
8.	Mineral Analysis (mg/100g)			
a.	Calcium	26.07	11.10	9.60
b.	Magnesium	648.00	330.00	310.00
c.	Iron	252.1	210.20	39.00
d.	Manganese	93.00	71.50	56.30
e.	Zinc	24.40	16.40	1.60

Sensitivity of isolates against benomyl was more variable among the 17 isolates. MIC on the agar plates ranged from 1 µg/ml to 400 µg/ml. Isolate FOC-15 was found to be resistant having MIC 400

µg/ml, while FOC-4 and wild FOC-9 sensitive having MIC 1µg/ml. Variation in the sensitivity of isolates of different pathogens have been reported by many workers [11, 12, 13]. Results in (Table 1) indicated that when compared with healthy banana pseudostem total sugar, reducing sugar and starch were reduced due to infection of sensitive and resistant isolates of *Fusarium oxysporum* f.sp. *cubense*. Phenols were increased in the pseudostem infected with both the sensitive and resistant isolates. Resistant isolate produced more phenols than the sensitive one.

DNA and RNA contents in the infected pseudostem were also reduced due to infection of both the sensitive and resistant isolates as compared to healthy. Total ash was slightly increased due to inoculation of sensitive *Fusarium oxysporum* f. sp*. cubense* on pseudostem than resistant one. Magnesium, iron, manganese was decreased due to inoculation of resistant *Fusarium oxysporum* f. sp*. cubense.* Calcium, zinc was decreased due to inoculation of sensitive isolate while it was highly decreased in pseudostem inoculated with resistant isolate of *Fusarium oxysporum* f.sp*. cubense.* There are many reporters indicating changes in the biochemical characteristics in the host due to infection by various pathogens [14, 15, 16].

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BIODEGRADATION OF KERATIN BY SOME KERATINOLYTIC FUNGI

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INTRODUCTION:

In almost all over the world, human hair is considered as waste material which is thrown anywhere. Many a time hairs are thrown in the water bodies which pollutes water and causes water pollution. The hair is made up of 95% keratin, a fibrous, helicoidally protein. Keratin is synthesized by keratinocytes and is insoluble in water. As if is insoluble, it remains it is in the water bodies for longer period of time. Human hair also contain 18 amino acids, such as proline, threonine, leucine and arginine keratine is rich in cysteine, (it forms disulfide bonds between molecules giving rigidity and resistance to the entire structure).

There are lot of extra chemical present in this protein that make its resistance to the degradation by most standard proteases (the enzymes which breakdown proteins). Hair degradation is necessary to prevent pollution & other several problems if we consider about Dapoli, there are 15 to 20 women parlor &27 saloons. The hair waste material is thrown into the dry garbage. But due to improper disposal they remain in the soil for longer time. And even while taking bath, the hair fall and with the flow of water it passes into the pipes and lead to choke up. So it is necessary to dispose hairs properly. It can be possible only by the degradation by using some fungus or microorganism it has low tendency of degradation. With the help of in-vitro degradation method, we can degrade the human hairs in less period of time.

MATERIALS AND METHOD:

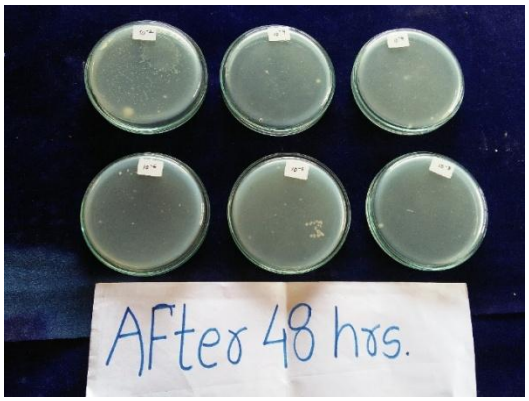
The hair sample was taken from saloon. 10 dilutions fold were prepared along with hair suspension. With the help of spread technique method agar plate were made and kept for 24 hour incubation period with methylene blue stain fungus morphology was studied and was kept for screening of pure culture medium.

OBSERVATION:

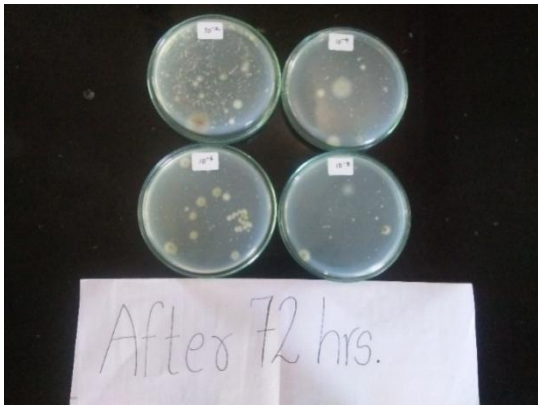
Hair sample

Inoculation of hair sample

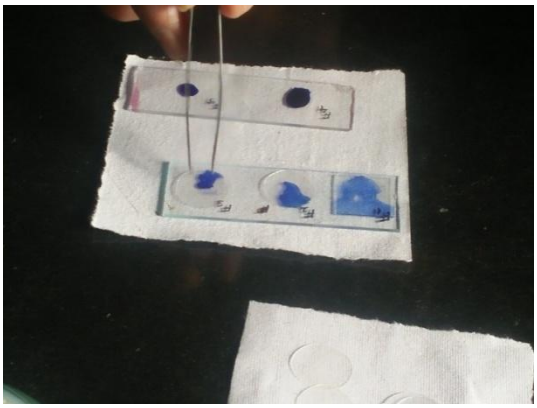
Different dilutions



Fungal colony



Fungal colony



Methylene blue staining

RESULT AND DISCUSSION:

Fungus are isolated and identified in micro biology lab.

The different isolated fungal strains show maximum activity at different temperature. The Keratinophilic enzymes were more active in temperature range of 28^0 C to 34^0 C.

Keratinophilic activity was evaluated by comparison of initially weights of hair and after 10 days of incubation.

Fungi	**Initial weight (hairs)**	**Final weight (after 10 days)**
Fusarium solani	5 g	4.06 g
Aspergillus niger	5 g	4.02 g
Penicillium chrysogenum	5 g	3.42 g
Trichoderma harzianum	5 g	3.50 g

CONCLUSION:

- It reduces the water pollution and degrades the hair in less time.
- Urban population gets relief from problem like pipe choke up due to proper disposal of hair.

FUTURE PROSPECTUS:

Indian soil contains many more keratinophilic fungi than those presently recorded and there is need for further taxonomic and ecological studies of this interesting group of organism.

ACKNOWLEDGEMENT:

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HISTOLOGY OF VITAL ORGANS OF *ICHTHYOPHIS BOMBAYENSIS*

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ABSTRACT:

Gymnophiona are limbless caecilians having cylindrical body marked with annuli. In India, out of 21 species of caecilians, six are categorized as data deficient, two are least concern, four vulnerable, eight endangered and one species, *Ichthyophis bombayensis* is critically endangered. Due to its snake like appearance and sluggish nature, it can be easily encountered on the farms and roads; and thus threatened extensively. This apodan plays vital role in the ecosystem but study of various aspects has not been conducted so far. By keeping these aspects this study was designed to explore histological structures of alimentary canal and skin of *Ichthyophis bombayensis.* The tissue preparation was done by standard methods by fixing them in 10% formalin fixative. Sectioning of tissue was done at 5-6 microns and further stained with hematoxylin and eosin stain. The microphotography of sections was done with Nikon Coolpix S3300 digital camera attached to research microscope (Micron TMC – 220). The results indicated that the histological structures of caecilian are rather similar to frog.

KEYWORDS: *Ichthyophis bombayensis,* Histology, Skin, Stomach, Intestine

INTRODUCTION:

Class Amphibia is a class of vertebrates comprising 6347 species. They became the first tetrapods that provided the basis for evolution of reptiles, birds and mammals. This class is represented by three orders, such as the Anura (frogs and toads), the Caudate (salamanders and newts) and the Gymnophiona (caecilians).

Anurans are tailless amphibians that occupy a wide variety of habitats from deserts to freshwater. Their long hind legs work as leaping equipment. Urodela or Caudata contains the salamanders having paired limbs and a long tail. Gymnophiona or caecilians are limbless, hence called apodans. They have a long cylindrical body marked with annuli. Out of 6 families of caecilians Rhinatrematidae and Ichthyophiidae are considered to be primitive; Uraeotyphlidae as intermediate and Scolecomorphidae, Caeciliidae and Typhlonectidae as advanced caecilians [1].

India is suppose to be home of many caecilians, it includes four genera belonging to three families [2]. Of 21 species of Caecilians in India, six are categorized as data deficient, two are at least

concern, four vulnerable, eight endangered & one species, *Ichthyophis bombayensis,* is considered to be critically endangered.

Ichthyophis bombayensis is the recently identified species of Caecilians by B. N. H. S. Mumbai. Detailed study on this species is still awaited. Due to secretive mode of life and nocturnal habit, caecilians are rarely encountered in the field that may be one of the reasons of having scanty information on various aspects of caecilian.

Therefore, it was necessary to study various aspects including histology of vital organs of *Ichthyophis bombayensis*. In the light of above discussion, present work was undertaken to study histology of some organs of Caecilians in the Western Ghats region in Chiplun Tehsil of Ratnagiri District (Maharashtra, India). This study will be helpful to know exact status of the ecosystem in the Western Ghats in Chiplun Tehsil of Maharashtra and will act as a milestone in the ecosystem conservation programs in India.

MATERIALS AND METHODS:

Caecilians were collected from paddy fields and decaying organic matters and by digging probable habitats weekly during monsoon season from June 2011 to June 2013. After sighting the specimen, it was identified by following standard procedures [3][4][5]. The collected specimens carried to the laboratory in well-sterilized plastic boxes for further studies. They were kept in the glass tank containing mud from their natural habitat and were acclimatized in the laboratory conditions for 96 hours. During acclimation period, they were fed with earthworms and small pieces of domestic chicken. Animals were put in a glass tube containing cotton moistened in 2 ml chloroform for one minute for temporary anesthesia to restrict their movement. Only 3 specimens were sacrificed for pulling their vital organs for histological and anatomical studies. The organs such as esophagus, stomach, intestine and skin removed from the sacrificed animals and were fixed in 10% formalin fixative. Further, fixed organs washed under running tap water for 24 hours; and embedded in paraffin wax at 60^0C to prepare blocks. Tissues then, cut by using rotary microtome with 5-6 micron thickness. Sections were further processed and stained with hematoxylin and eosin stain and finally mounted in DPX. The microphotography of sections of all the tissues was done with Nikon Coolpix S3300 digital camera attached to research microscope (Micron TMC – 220).

RESULTS AND DISCUSSION:

Skin:

The skin of caecilian was slippery, moist, smooth and without any protective devices like scales or hair. Its dorsal surface was black with rather lighter ventral surface. Transverse section of skin shows two distinct layers such as outer epidermis and inner dermis (Plate - I, Fig.1: a1 & a2). The epidermis is non-vascular and contains several layers of epithelial cells. The outermost keratinized stratum conium covers the layer of stratum malpighii or stratum germinativum. The layer of stratum malpighii is composed of columnar epithelia cells that are capable to produce new cells.

The dermis is a tough, flexible and somewhat elastic layer present underneath the epidermis. It is made up of connective tissue, blood vessels, muscle fibers and nerve fibers. The outer part of dermis has loose connective tissue while inner part has a dense connective tissue. The denser portion has several canals known as lymph spaces in the spongy layer. The skin has two types of glands, such as mucus glands and poison glands. These are epidermal derivatives but lie in the dermis. Epidermis has a covering of mucous layer secreted by mucous glands to keep the skin moist and sleeper. Poison glands secrete semi poisonous secretion to protect animal.

Oesophagus:

Transverse section of oesophagus shows four distinct layers from within outwards, such as mucosa, submucosa, muscularis mucosa and serosa. The innermost mucus membrane shows squamous epithelial cells, goblet cells and gland cells (Plate -I, Fig.2: b1 & b2) for secretion of digestive enzymes.

Stomach:

Transverse section of stomach shows comparatively thicker wall than the intestine and esophagus. Its wall has four distinct layers such as serosa, muscularis mucosa, submucosa and mucosa. The layer of serosa has simple squamous epithelial cells. The innermost layer of mucosa contains well developed gastric glands for secretion of gastric juice and simple columnar epithelial cells interspersed with the elongated tubular glands (Plate- II, Fig.3: c1 & c2).

T. S. of Small Intestine:

It shows all the four basic layers, such as mucosa, submucosa, muscularis mucosa and serosa in its wall. Transverse folds of mucosa increase the area of absorption of alimentary canal. As compared with rest of the layers, mucosa is well developed and contains scattered absorptive cells, goblet cells,

columnar epithelial cells and branched burner's glands for secretion of mucus and enzymes (Plate-II, Fig.4: d1 & d2). The mucosa has characteristic lymph spaces along with the lymphocytes.

Large Intestine:

Transverse section of large intestine also shows all the four basic layers, such as mucosa, submucosa, muscularis mucosa and serosa in its wall. Its mucosa layer is has well developed numerous simple columnar epithelial cells with lymph spaces and lymphocytes (Plate-II, Fig.5: e1 & e2).

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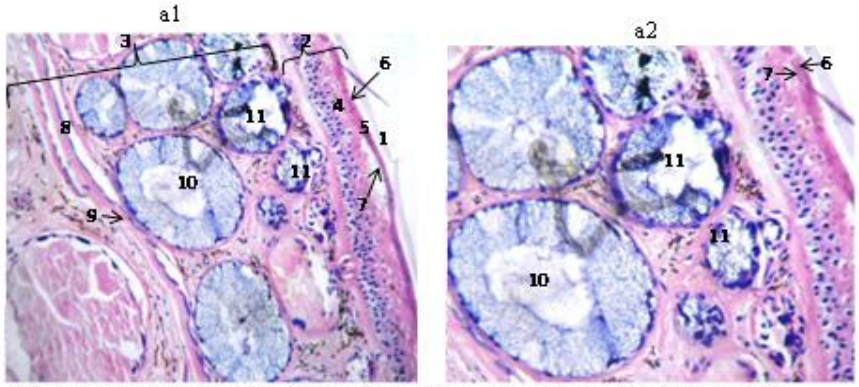
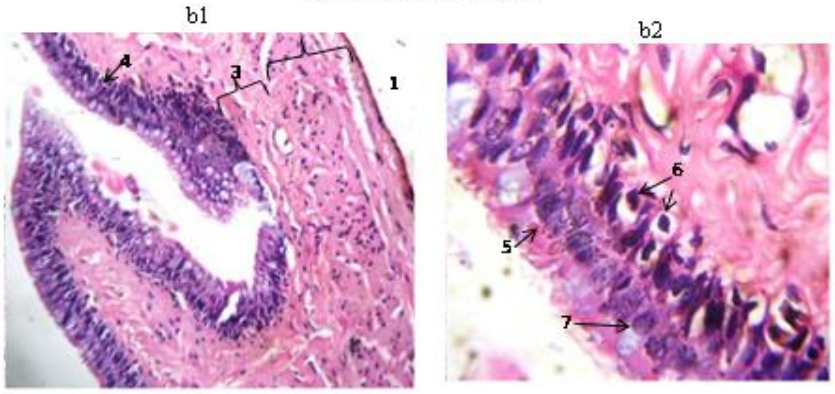
Plate – I

Fig. 1: T. S. of Skin



1-Mucus layer, 2- Epidermis, 3- Dermis, 4- Epithelial cells, 5- Squamus epithelial cell, 6- Stratum corneum, 7- Stratum malpighii, 8- Lymph space, 9- Spongy layer, 10- Mucus gland, 11- Poison gland.

Fig. 2: T. S. of esophagus

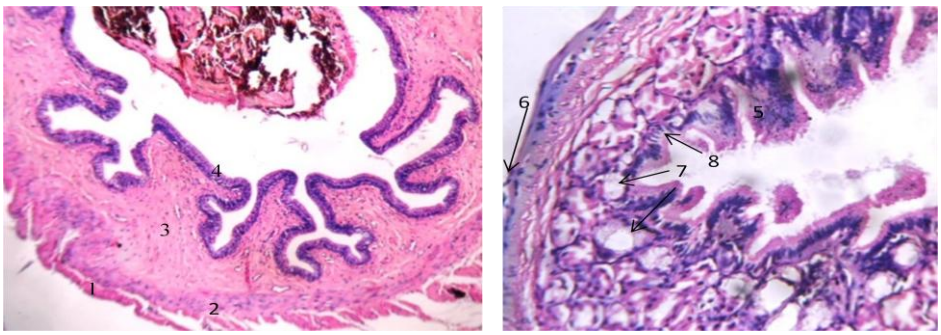


1- Serosa, 2- Muscularis mucosa, 3- Submucosa, 4- Mucosa, 5- Stratified squamus epithelialcell, 6- Goblet cell, 7- Gland cell.

Plate – II

Fig.3: T. S. of Stomach

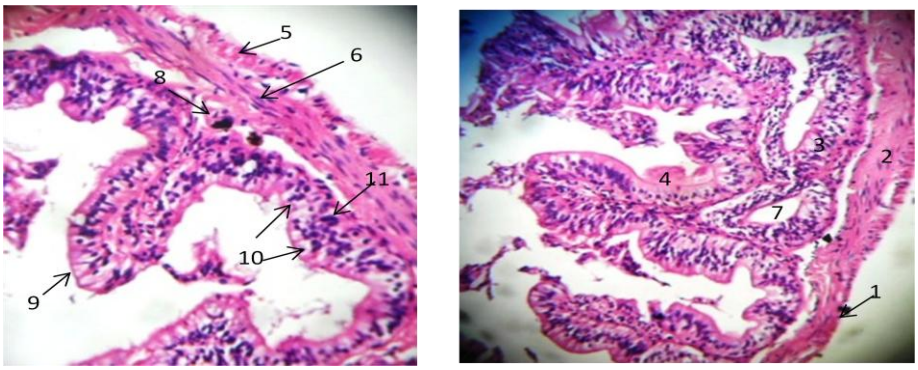
C1 **C2**



1. Serosa, 2. Muscularis, 3. Submucos, 4. Mucosa, 5. Gastric glands, 6. Simple squamous epithelium, 7. Tubular glands, 8. Simple columnar epithelium

Fig.4: T. S. of Small intestine

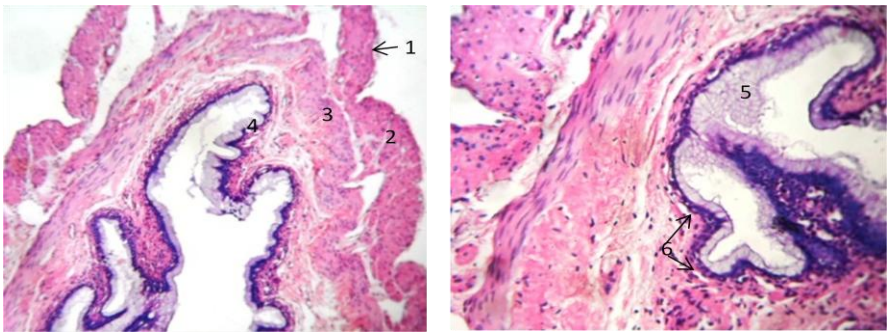
d1 **d2**



1- Serosa, 2- Muscularis, 3- Submucosa, 4- Mucosa, 5- Longitudinal muscle layer, 6- Circular muscle layer, 7- Lymph space, 8- Lymphocyte, 9- Columnar epithelial cell, 10- Absorptive cells, 11- Burners gland.

Fig.5: T. S. of Large intestine

e1 **e2**



1. Serosa, 2. Muscularis, 3. Submucos, 4. Mucosa, 5. Network of mucus cells, 6. Lymph space

STUDY OF PHYSICO CHEMICAL PARAMETERS AND FISH DIVERSITY IN AMBERNATH

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ABSTRACT:

Ambernath is a city in Thane District, Maharashtra has varied landscape. Ulhas River runs from Karjat to Thane Creek around 50 Kms and is polluted with effluents of industries between Ambernath and Dombivali. Present study was carried out to create information on certain physico-chemical characteristics and Icthyofaunal diversity along the Ambernath. Two stations were selected in Ulhas river and assessed the water parameters like pH, CO_2, Do, Temperature, Salinity and also observed fish diversity. The study revealed that river was moderately polluted and variation was observed in parameters. Fish diversity study revealed about 11 species of fishes from 4 families dominating with of Cyprinidae.

INTRODUCTION:

Fresh water habitat occupy a relatively small portion of earth's surface as compared to marine and terrestrial habitats, but their importance to man is far greater than their area [1]. Animal life is thus very widely distributed but its abundance and diversity vary greatly from place and from season to season according to the environmental condition. Fishes constitute a major portion of aquatic fauna especially in freshwater habitats. They are cold blooded, typically with gills and fins are primarily dependent on water as a medium in which they live.

Rivers experience violent fluctuation in composition, chemical characteristics and discharge. Unidirectional flow of rivers restricts the existence of certain types of fauna. Urbanization and other land water management practices have led to catastrophic changes in population of aquatic organisms. The Ulhas river, which runs from Karjat to Thane creek, a distance of over 50 km, is one of the most polluted in Maharastra. There are over 800 industries on a 20-km stretch along the river between Ambernath and Dombivli. In Ambernath Taluka streams of Ulhas river are polluted with effluents of industries. Fish diversity confined to Ambernath region is scarce in literature.

MATERIALS AND METHOD:

Water samples were collected for Physico-chemical analysis at regular intervals for 6 months from 2 station around Ulhas river flowing through Ambernath area.

Station 1 where Barvi river meets the Ulhas river and

Station 2 river flowing nearby Jambhul ghave.

The water parameters were analysed by following method

	Parameter	Method to be used
1	pH	Potentiometer/indicator
2	DO	Azide modification
4	Salinity	Salinometer
5	Free CO2	Titrimetric
7	Temperature	Thermometer

The fishes were collected by local fishermen using cast net and hand net. The fishes were identified from the field and those difficult to identify brought to laboratory and identified with the help of identification key and confirmed with fish base [2].

RESULT AND DISCUSSION:

Table 1: Physical parameters of 2 stations

Season	Temperature		pH	
	Station 1	Station2	Station1	Station2
Summer	27.6	27	6.9	6.8
Monsoon	26.4	26	7	7

Table 2: Chemical parameters of 2 stations

Season	Co2 (mg/l)		DO(mg/l)		Salinity (g/dm^3)	
	Station 1	Station2	Station1	Station 2	Station 1	Station 2
Summer	12	8	6	5.6	0.4	0.1
Monsoon	14	11	7.8	7.5	0.5	0.3

Table 3: Fish diversity at 2 stations during the study time

Sr. No.	Common Name	Marathi name	Scientific name	Family
1	Long billed half beak	Ghodomasa	*Rhynchorhampus georgii*	Hemiramphidae
2	Needle fish	Toll fish	*Belone cancilla*	Belonidae
3	Orange chromide	River pompret	*Etroplus maculates*	Cichildae
4	Pearl spot	kalundar	*Etroplus suratensis*	Cichildae
5	Walking cat fish	Magur	*Clarias batrachus*	Clariidae
6	Filament barb	Pitholi	*Puntius filamentosus*	Cyprinidae
7	Ticto barb	Kumbarni	*Puntius ticto*	Cyprinidae
8	Mullya Garra	Mullya	*Garra mullya*	Cyprinidae
9	Indian carp	Catla	*Catla catla*	Cyprinidae
10	Rohu	Rohu	*Labeo rohita*	Cyprinidae
11	Silver Carp	Silver fish	*Hypophthalmichthys molitrix*	Cyprinidae

The increasing industrialization and urbanization has resulted in pollution of water and in deterioration of its quality. As the effluent of chemical companies at MIDC Badlapur is directly in the Ulhas river it is polluting the water level in river. During study it is observed that the release of domestic waste water, agricultural run-offs and industrial effluents have resulted in deterioration of water quality and loss of its potability. The healthy aquatic ecosystem is dependent on the biological diversity and is reflected by its physico-chemical characteristics [3]. In study it is reflected that increased DO level is affecting the organism. Unfavourable physicochemical factors, especially anthropogenic factors disturb the fish diversity and the number of species was less in water body. It is mandatory to exercise precaution before water is used for any house hold purposes or it may lead to much adverse effect [4].

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ALLIUM CEPA AN EFFECTIVE REMEDY TO MANAGE LEAF SPOT DISEASE OF *ADHATODA ZEYLANICA* MEDIC

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ABSTRACT:

Adhatoda zeylanica (Adulsa) is an important medicinal plant belonging to family Acanthaceae. It has lots of medicinal uses to cure asthma, bronchitis, respiratory disorders, piles, rheumatism, dysentery, diarrhoea etc. However, due to contamination of some fungal pathogens its biochemical contents reduce in large quantity. The present work deals with the management of leaf spot disease caused by *Alternaria alternata* and *Colletotrichum capsici* to Adulsa by using various extracts of *Allium cepa*. It was found that acetone leaves extract was most inhibitory than other leaves extracts studied.

INTRODUCTION:

Adhatoda zeylanica Medic. is an important medicinal plant belongs to family Acanthaceae. In the Unani and Ayurvedic medicine systems, the entire plant is used. The plants contents like tannins, flavonoids, alkaloids, saponins, reducing sugars, minerals, etc makes the plant medicinally important [1]. This important medicinal plant is affected by different fungal pathogens, which decreases reduces the medicinal as well as market value of plant [2]. Hence, the present investigation is carried out to know the fungal pathogens infecting Adulsa viz. responsible for decrease in active ingredients of the plant. Efforts were made to analyze the changes in biochemical content due to fungal diseases. Attempts were also made to control the different fungal pathogens causing diseases.

MATERIALS AND METHODS:

Effect of acetone, alcohol and aqueous leaves extract of different plants on growth of fungi:

To determine the effect of acetone, alcohol and aqueous leaves extract *Allium cepa* plant leaves were used.

Preparation of leaves extract:

For the preparation of leaves extract, 50 gm leaves were washed by using 50 ml of Acetone with the help of mortar and pestle. The extract was filtered by using muslin cloth. Filtrate was then centrifuged at 5000 r.p.m. for 10 min at 4 °C. Supernatant was collected and treated as 100 % i.e. stock

solution. Further, different concentration of leaves extract was prepared i.e. 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0 and 4.5 %. In the same way, different concentrations of alcohol and aqueous leaves extract were prepared. Further, leaves of Adulsa of same size, at same age were collected and washed with distilled water. The leaves were dipped in different concentrations for 15 minutes. These leaves were then kept on the filter paper in sterile petriplates. Sterilised distilled water was added to petriplates time to time to maintain the moisture content in leaves, as performed by Dhavle et al. [3]. 5 mm disc of pure fungal culture was added in 1 ml distilled water in a test tube and suspension was prepared. This suspension was applied over the leaves with the help of brush and incubated at room temperature for 8 days. Effect of acetone, alcohol and aqueous leaves extract was calculated by using following formula:

$$\% \text{ inhibition} = (C - T)/C * 100$$

Where, C - Control reading and T -Treated reading

EXPERIMENTAL RESULTS:

Effect of acetone, alcohol and aqueous leaves extract of *Allium cepa* on *Alternaria alternata:* Effect of acetone, alcohol and aqueous leaves extract of *Allium cepa* on *Alternaria alternata* was studied for 8 days of incubation period. Treatment of different concentrations of leaves extract was given i.e. 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0 and 4.5 % and percent inhibition was recorded. The 0.5 % acetone leaves extract treatment shows percent inhibition from 0.9.09 to 60.37 % in 8 days. The 1.0 % concentration shows percent inhibition from 33.63 to 74.09 %. At 1.5 % concentration, least inhibition was recorded as 51.81 on 1st day and highest 89.68 % on 8th day. Intermediate inhibition was observed as 58.18, 76.45, 78.80, 89.05, 79.35 and 89.50 %. The 2.0 % concentration shows, inhibition from 67.27 to 96.29 % in 8 days. The highest inhibition observed at 2.5% concentration as 99.37 % and lowest was 89.09 on 8th and 1st day respectively. In 3.0 % concentration, inhibition range was found from 93.63 to 99.59 %. On the other hand 3.5, 4.0 and 4.5 % concentration shows 100 % inhibition from 1st to 8th day of incubation period.

During alcoholic leaves extract study, percent inhibition in 0.5 % concentration was recorded from 12.72 to 68.37 % in 8 days. At 1.0 % concentration, least inhibition was recorded i.e. 25.45 % on 1st day and 73.90 % on 8th day. Besides, intermediate was recorded from 49.09 to 71.96 %. On the other hand, in 1.5 % concentration inhibition was found from 38.18 to 79.78 % in 8 days. In 2.0 % concentration, highest inhibition was observed as 84.00 % and lowest was 61.81 % on 1st day. Intermediate inhibition was recorded from 70.90 to 83.21 %. In case of 2.5 % concentration, least inhibition was observed 70.00 on 1st day and highest was observed as 86.84 % on 8th day and remaining days shows intermediate inhibition. In 3.0 % concentration, percent inhibition recorded from 80.90 to 93.68 % in 8 days. At 3.5 % concentration treatment highest inhibition was recorded on 8th day i.e. 95.87

% and lowest was on 1st day i.e. 83.63 %. In 4.0 % concentration, percent inhibition observed from 92.72 to 99.31 %, while in 4.5 % concentration 100 % inhibition was recorded in 8 days.

In case of aqueous leaves extract treatment, at 0.5 % concentration percent inhibition was observed from 10.90 to 48.37 %. At 1.0 % concentration, least inhibition was recorded as 30.00 % on 1st day and 60.90 % on 8th day, intermediate was observed from 33.79 to 49.95 %, from 2nd to 7th day. The 1.5 % concentration shows inhibition from 50.00 to 76.21 %, besides 2.0 % concentration treatment shows 70.00 to 89.96 % inhibition in 8 days. In case of 2.5 % concentration, least inhibition observed as 80.00 % on 1st day and 91.56 % was observed on 8th day. In the 3.0 % concentration, least inhibition was observed as 83.63 % on 1st day and highest was 95.25 % on 8th day. The intermediate inhibition was observed as 85.51, 90.32, 90.47, 94.73, 94.97 and 95.17 from 2nd to 7th day of incubation period. The 3.5 % concentration treatment shows percent inhibition from 90.90 to 99.21 %. On the other hand, 4.0 and 4.5 % concentration shows 100 % inhibition in 8 days of incubation period.

From above data, it is clear that as incubation period and leaves extract concentrations increases, percent inhibition also increases.

Effect of acetone, alcohol and aqueous leaves extract of *Allium cepa* on *Colletotrichium capsici*: Effect of acetone, alcohol and aqueous leaves extract of *Allium cepa* on *Colletotrichium capsici* was studied for 8 days of incubation period. Different concentrations treatments of leaves extract treatment of leaves extract were given i.e. 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0 and 4.5 % and percent inhibition was noted. In 0.5 % concentration, percent inhibition was observed from 26.66 to 70.37 % in 8 days. In 1.0 % concentration, least inhibition was recorded as 48.33 on 1st day, and highest was 93.09 % on 8th day. Intermediate percent inhibition was recorded as 59.09, 83.91, 89.87, 89.92, 90.98 and 91.42 %. In the treatment of 1.5 % concentration, percent inhibition was observed from 64.16 to 95.59 % in 8 days. In 2.0 % concentration treatment, least inhibition was recorded i.e. 90.00 % on 1st day and highest i.e. 99.28 % on 8th day. Besides, their intermediate percent inhibition was 92.92, 97.40, 98.39, 98.71, 98.94 and 99.00 % from 2nd to 7th day. The 2.5 concentration treatment shows percent inhibition from 93.33 to 99.53 % in 8 days. On the other hand, 3.0, 3.5, 4.0, 4.5 % concentration treatment shows 100 % inhibition in 8 days of incubation period.

In case of alcoholic leaves extract concentration treatment, 0.5 % concentration shows percent inhibition from 18.33 to 68.68 % in 8 days. At 1.0 % concentration, least inhibition was observed as 48.33 % on 1st day and highest 77.43 % on 8th day while, intermediate percent inhibition was 48.48 to 68.71 % on 2nd and 7th day. In 2.0 % concentration, highest inhibition was recorded on 8th day i.e. 93.65 and lowest on 1st day i.e. 74.66 %. Whereas, intermediate inhibition was noted i.e. 84.34, 87.19, 88.87, 92.00, 92.65 and 92.95 % on 2nd to 7th day. The 2.5 % concentration treatment shows percent inhibition

from 91.66 to 99.25 % on 1st to 8th day. On the other hand, 3.0, 3.5, 4.0 and 4.5 % concentration shows 100 % inhibition in 8 days of incubation period.

During the aqueous leaves extract treatment in 0.5 % concentration percent inhibition observed from 16.66 to 55.62 % on 1st to 8th day, while 1.0 % concentration treatment shows inhibition from 33.33 to 62.56 % on 1st to 8th day. In 1.5 % concentration, lowest percent inhibition was observed i.e. 45.83 on 1st day and highest 69.00 % on 8th day while, intermediate inhibition was recorded from 55.55 to 61.90% on 2nd to 7th day. The 2.0 % concentration treatment shows percent inhibition from 61.66 to 80.15 % on 1st to 8th day. On the other hand, 2.5 % concentration shows inhibition from 73.33 to 87.12 % within 8 days. In 3.0 % concentration, highest inhibition was found 93.68 % on 8th day and lowest was 78.93 % on 1st day besides, intermediate inhibition was observed as 85.85, 87.54, 89.97, 92.00, 92.88 and 93.23% on 2nd to 7th day of incubation period. Whereas, 3.5 % concentration treatment shows percent inhibition from 91.66 to 99.25 % on 1st to 8th day. At 4.0 and 4.5 % concentration, 100 % inhibition was observed within 8 days of incubation period.

From above observations, it is clear that as incubation period and leaves extract concentration increases percent inhibition also increases.

DISCUSSION:

Dhavle et al. [4] studied the utilization of various plant extracts such as *Ployalthia longifolia*, *Datura stromonium* and *Allium cepa* against *Colletotrichum capsici*. It was observed that *Allium cepa* was most effective to control the linear growth of fungal pathogen as compared to other leaves extracts. Rajamanickam *et. al.,* screened the effect of biochemicals of plant extracts on the growth of *Colletotrichum capsici* causing anthracnose of chilli. They tested the activity of crude leaves extracts of *Andrographis paniculata, Azadirachta indica, Cissus quadrangularis, Datura metal, Hibiscus rosa-sinensis, Oscimum basilicum, Polygala elata, Solanum xanthocarpus* and bulb extract of *Allium sativum* to determine effect of colony diameter, sporulation and disease incidence caused by *C. capsici* [5]. They observed that all the plant extracts inhibited the colony growth and sporulation of pathogen.

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STUDIES ON LOW COST ADSORBANT BIOMATERIAL LIKE 'COCONUT COIR' AND 'WOOD COAL' FOR TREATMENT OF TEXTILE INDUSTRY EFFLUENT

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ABSTRACT:

Textile mill operations consist of weaving, dyeing, printing, and finishing. Many processes involve several steps each contributing a particular type of waste e.g. sizing of the fibers, kiering (alkaline cooking at elevated temperature), desizing and woven cloth, bleaching, mercerizing, dyeing and printing. All these processes generate effluent which has high suspended solids, high chemical oxygen demand, heat, colour, acidity, and other soluble substances. Discharge of such effluent in environment can affect the water bodies. In the present study, the effluent from textiles industries has been used for biomaterial adsorption treatment. Low cost adsorbent biomaterial like 'coconut coir' and 'wood coal' were used for treatment and physicochemical characteristics like pH, TS, TDS, TSS, COD, and BOD were studied to check percentage removal efficiency within 12 hours treatment. With increase in time of the treatment process, percentage removal efficiency of the adsorbent biomaterial was also increased. Maximum reduction in all physicochemical parameters was observed after 12 hours treatment for wood coal. Maximum percentage removal was achieved for turbidity and total suspended solids which were up to 62.84% and 73.74% removal respectively. BOD and COD removal after 12 hours treatment was 25% to 30%respectively. Wood coal was found to be more efficient in treatment as compared to the coconut coir treatment and Coir + Coal treatment for most of the parameters such as total solids, Total suspended solids, BOD and COD in present study for textile industry effluent.

KEYWORDS: Biomaterial, adsorption, Coconut Coir, Wood coal, Textile Effluent, treatment

INTRODUCTION:

Water consumption by various processes such as sizing, scouring, bleaching, dyeing, printing and other finishing processes in textile industry is in huge amount. Textile industry processes also require the input of a wide range of chemicals and dyestuffs, which generally are organic compounds of complex

structure [1]. Main pollutants in textile wastewater came from dyeing and finishing processes. Traditional methods which are used in the treatment of textile effluents usually are labor-intensive and costly and also bearing high operational and maintenance cost [2]. Traditional wastewater treatment technologies have proven to be markedly ineffective for handling wastewater of synthetic textile dyes because of the chemical stability of these pollutants [3]. Therefore for the control of water pollution, adsorption techniques are more applicable and better as compared to other available technologies because of its convince, easy operation and simplicity [4].

Adsorption can remove soluble and insoluble organic pollutants may be up to 99.9%. So the adsorption has been used for the removal of a variety of organic pollutants from various contaminated water sources. Adsorption involves accumulation of a substance at a surface or interface, in case of water treatment, it occurs at an interface between solid adsorbent and contaminated water [5]. Activated carbon is used widely as an adsorbant, but the activated carbon costly and cannot be used at large scale [6], it also need regeneration of it after exhausting, and the loss of adsorption efficiency after regeneration of these are the restrictions for the use of activated carbon. Therefore, there is a growing interest to search for alternative materials being relatively cost effective and at the same time having high adsorption efficiency [7].

The most common feed stocks for the production of activated carbon at commercial scale are wood, anthracite and bituminous coal, lignite, peat and coconut shell [6]. Hence, several studies on adsorption properties of low cost adsorbants, which are easily and naturally occurring such as some agricultural byproducts and natural fibers, like waste coir pith [8]. Coconut shell is a well known global precursor for the production of high quality commercial granular activated carbons [9]. Vieira et al. [10] used the coconut shell directely as the adsorbant biomass for the removal of various textile dyes. [11] also reported the feasibility of coconut tree saw dust, some other agricultural wastes as low-cost adsorbent materials for the removal of dyes and metal-ions from wastewater. Some other reviews have also been written in this area but they all are focusing on the use of these low cost biomaterials for removal of dyes [12, 13, 14, 15, 16, 17]. In the present study an attempt has been made to use Coconut coir and Wood coal as an adsorbant for removal of pollutants from textile effluent.

MATERIAL AND METHODOLOGY:

Biomaterial:

Various biomaterials can be used as Adsorbants. Each biomaterial gives different efficiencies for different parameter. Therefore, it is necessary to find out best biomaterial. For selecting the best

biomaterial, two biomaterials were collected which are easily and cheaply available in surrounding area of city, viz. coconut coir and wood coal

Preparation of biomaterial Adsorbant:

Easily available biomaterials were used as Adsorbents. All the biomaterials were collected initially in the natural form. Various impurities present over them like dust, soil, bacteria, fungi, etc. These materials were cleaned up twice with distilled water and dried at 20^0C. These dried materials were crushed and sieved to select proper adsorbent in granular form. Again these materials were soaked overnight in 0.1N NaOH solution to remove the lignin content and then again washed with distilled water. Treatment of 0.1N CH_3COOH for a period of 2-3 hrs was given to remove the traces of NaOH which was given to biomaterials. Again washed with distilled water and dried. These materials were stored, separated in vacuum desiccators to prevent the atmospheric moisture. The collected textile wastewater was treated with different biomaterial using glass column. Simultaneously **s**amples from textile industry were analysed to know the pollution level.

Column studies:

The glass column having length 70 cm and diameter 2.5 cm was designed. This column is open at upper end and lower end is having knob for maintaining the flow rate and to determine flow rate after passing the wastewater through glass column. To determine the adsorption efficiency of biomaterials, 5 gm of granular form of biomaterials containing 500 ml of wastewater was taken and was treated for different time intervals. Time interval was kept between 3 Hrs. give the exact time intervals used in the experiment.

Sample collection and preservation:

Soktas India Pvt. Ltd. Kolhapur is one of the leading textile companies amongst the Five Star MIDC, Kagal, Kolhapur (Ms. India) it is located on outskirts of historic township Kolhapur. Soktas India Pvt. Ltd is a part of Soktas Turkey. It is a world famous textile company which produces yarn dyed and fabric dyed shirting. Samples were collected in sterilized plastic can from equalization tank of effluent treatment plant of the industry at 9 a.m. Preserved in the refrigerator and then taken for analysis.

In this present study biomaterial adsorption studies were carried out. Different biomaterials were used for reducing the concentration of different parameters. Efficiency of biomaterials like coconut coir, wood coal increases as time of treatment process increases. Maximum efficiency was observed at 12 hours.

OBSERVATIONS:

Table 1: % Removal Efficiency after treatment with Biomaterial

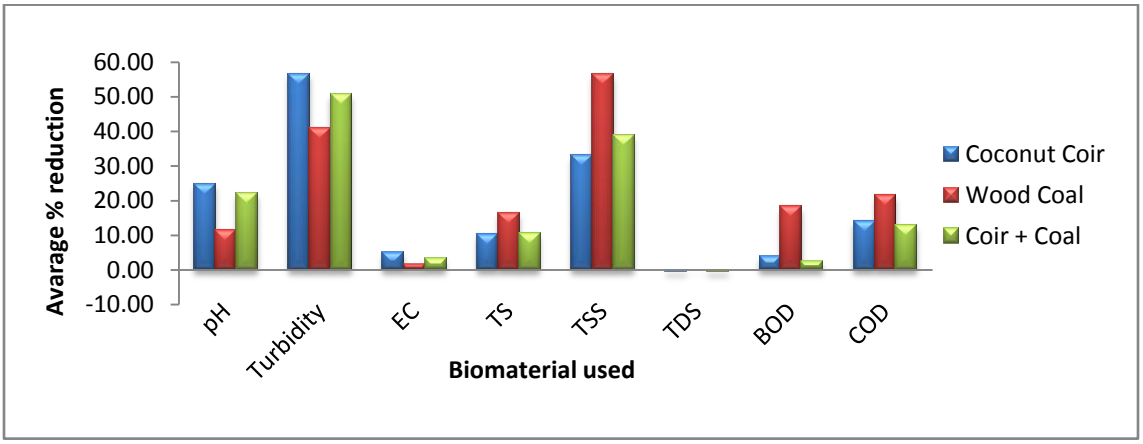
Parameter	Initial	Bio-material	Removal % Treatment				Minimum Removal (%)	Maximum Removal (%)
			3 hour	6 hour	9 hour	12 hour		
pH	12.22	Coir	22.91	23.65	25.37	26.35	10.56	26.35
		Wood Coal	10.56	11.21	11.62	12.03		
		Coir + Coal	20.62	21.44	22.67	23.90		
Turbidity (NTU)	121.1	Coir	52.02	54.25	57.47	62.84	32.04	62.84
		Wood Coal	32.04	38.40	43.85	49.55		
		Coir + Coal	39.55	45.91	57.64	59.29		
EC (µmohs/cm)	1.3696	Coir	4.21	4.21	4.50	7.05	1.00	7.05
		Wood Coal	1.00	1.30	1.50	2.70		
		Coir + Coal	2.90	3.20	3.40	3.90		
TS (mg/lit)	3500	Coir	2.86	8.86	12.51	16.71	2.86	21.66
		Wood Coal	8.00	15.46	20.57	21.66		
		Coir + Coal	5.26	8.94	13.29	14.71		
TSS (mg/lit)	990	Coir	9.09	28.79	40.40	54.04	9.09	73.74
		Wood Coal	28.08	53.54	70.71	73.74		
		Coir + Coal	18.59	31.11	45.45	59.60		
TDS (mg/lit)	2510	Coir	0.00	-0.60	-0.80	-1.20	-1.20	0.00
		Wood Coal	0.08	0.00	0.00	-0.20		
		Coir + Coal	-0.16	-0.40	-1.00	-1.20		
BOD (mg/lit)	380	Coir	0.00	1.58	5.26	8.95	0.00	25.00
		Wood Coal	7.11	16.58	23.95	25.00		
		Coir + Coal	0.00	0.79	3.95	5.00		
COD (mg/lit)	2000	Coir	10.00	12.50	14.75	18.75	9.00	30.00
		Wood Coal	9.00	20.00	27.00	30.00		
		Coir + Coal	9.85	14.40	12.00	15.00		

All values are in mg/L, except pH

Table 2: Avarage % Removal Efficiency after treatment with Biomaterial after 12 hr.

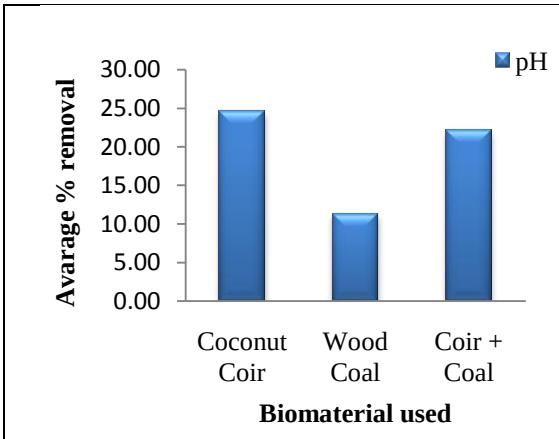
Biomaterial	pH	Turbidity	EC	TS	TSS	TDS	BOD	COD
Coir	24.57	56.65	4.99	10.24	33.08	-0.65	3.95	14.00
Wood Coal	11.35	40.96	1.63	16.42	56.52	-0.03	18.16	21.50
Coir + Coal	22.16	50.60	3.35	10.55	38.69	-0.69	2.43	12.81

All values are in %

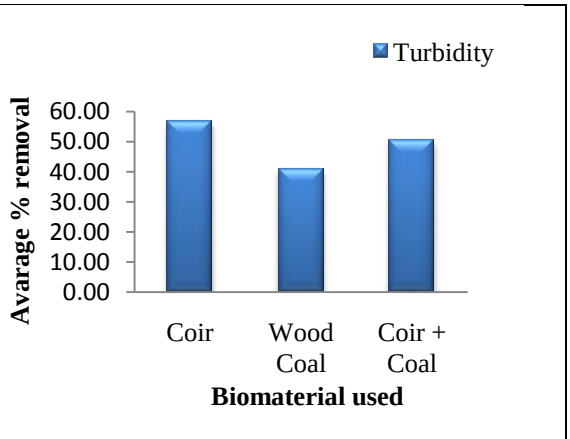


Graph 1: Average % reduction by Biomaterial after 12 hour

Average reduction observed in turbidity and TSS was more; it was found that the coconut coir was most efficient for removal of turbidity, pH and EC only. Wood coal gives maximum reduction in TS, TSS, BOD and COD. Treatment of coconut coir and wood coal mixture shows reduction in TSS and turbidity more than coconut coir.



Graph 2: Average % reduction of pH by Biomaterial



Graph 3: Average % reduction of turbidity by Biomaterial

1. pH:

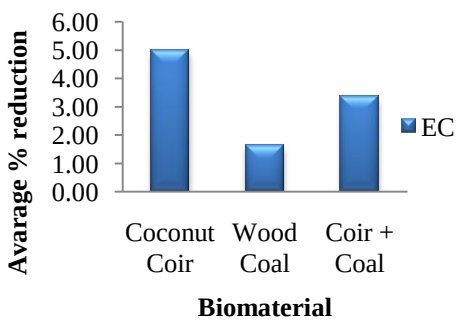
The pH factor has been recognized as one of the most important impact parameters for dye adsorption process due to influencing the surface property of adsorbent and the ionization degree and speciation of dye molecule [7]. Before treatment, pH of effluent of textile industry was 12.22. When it was treated with coconut coir it decreased up to 9 mg/lit after 12 hours and after treatment with wood coal. Similar trend of pH effect was also observed by [18]. Average reduction percentage of pH after 12 was 24.57%, by coconut coir was higher.

2. Turbidity:

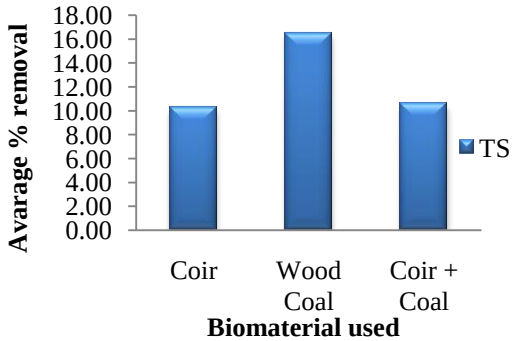
The effluent of textile industry is highly turbid and suspended particles in effluent affect the transmission of light and ultimately also affect the aquatic life. Before treatment, turbidity of effluent of textile industry was 121.1 NTU. It was observed that for the effluent treated with coconut coir turbidity is reduced with respect to and after 12 hour treatment reduction was achieved by coconut coir and that was 56.65% after 12 hour treatment. Mangale [19] has mentioned that 90-99% removal of turbidity can be achieved for water treatment using *Moringa oleifera* (Drumstick) seed as natural Absorbent.

3. Electrical Conductivity (EC):

It is the numerical expression of ability of water sample to carry electric current. This number depends on the total concentration of ionized substances dissolved in water. Before treatment, EC of effluent of textile industry was 1.369µmohs/cm. Treatment with coconut coir EC was reduced up to 1.273 µmohs / cm after 12 hours. When Coconut coir was treated with effluent about 4.99 % EC was reduced after 12 hour treatment and when treated with mixture of coconut coir and wood coal reduction percentage was up to 3.35%. Parihar [20] also found similar results for EC of textile effluent using sawdust as biomaterial.



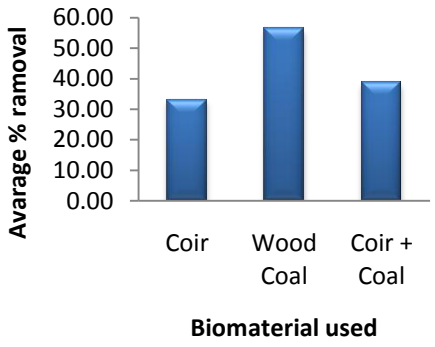
Graph 4: Average % reduction of EC by Biomaterial



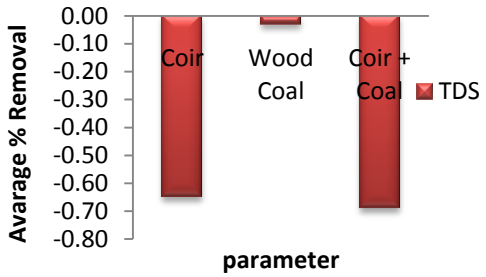
Graph 5: Average % reduction of TS by Biomaterial

4. Total Solid (TS):

Total solid depends on the amount of dissolved solid and suspended solid present in textile waste water. Before treatment total solids was observed about 3500 mg / lit. When effluent was treated with wood coal for 12 hour total solids decreased up to 2742 mg/lit. and total reduction was 16.42%. By using mixture of coconut coir and wood coal after 12 hours TS is reduced up to 10.55%. By using various biomaterials it was found that wood coal is more efficient for reducing TS at 12 hours as compared to coconut coir and mixture of coir and wood coal. Mangale [19] also found similar results for total solids of groundwater treatment using *Moringa oleifera* (Drumstick) seed as natural Absorbent.



Graph 6: Average % reduction of TS by Biomaterial



Graph 7: Average % reduction of TSS by Biomaterial

5. Total Suspended Solid (TSS):

Reduction in TSS after treatment was observed by [21]. Total suspended solids are aesthetically displeasing and provide adsorption sites for chemical and biological agents. Suspended organic solids which are degraded anaerobically may release obnoxious odour. Before treatment total suspended solid of effluent sample was 990 mg/lit. When effluent was treated wood coal reduction was 260 mg/lit. Average reduction was 56.52 % after 12 hours. When effluent treated with, mixture of coconut coir and wood coal was 38.59% reduction achieved after 12 hours. Wood coal acts as a high efficient biomaterial to reduce total suspended solid.

6. Total Dissolved Solid (TDS):

TDS refers to any minerals, salts, metals cation, or anion dissolved in water [22]. When textile industry effluent was allowed to pass through the adsorption column, observed that as the time increases, the amount of dissolved solid present in effluent also increases after the treatment [23].

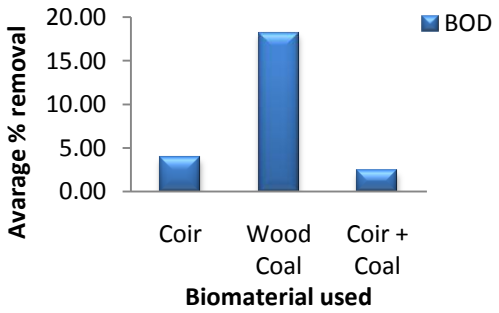
Before treatment, a total dissolved solid of effluent of textile industry was 2510 mg/lit. When effluent was treated with coconut coir and wood coal the TDS was increased up to 2545 mg/lit. While as the time interval increased TDS also increased. After 12 hours 1.37% TDS was increased. Hence, the use of such biomaterials it is not efficient for reduction of TDS.

7. Biochemical Oxygen Demand (BOD):

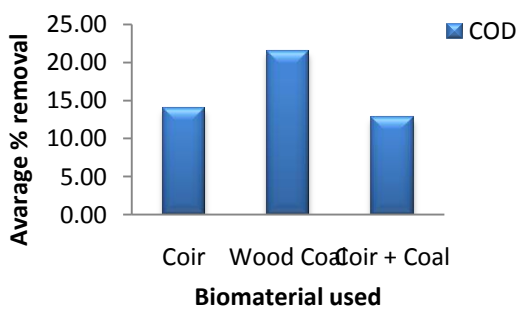
Before treatment BOD of effluent sample was 380 mg/lit before treatment. When it treated with wood coal BOD of effluent was decreased up to 285 mg/lit. after 12 hours. Average percentage reduction in BOD after 12 hour treatment was 18.16%. Among all these biomaterials, wood coal acts as a more efficient for reducing BOD at 12 hours. Kirzhner et al. [24] achieved 65 per cent to 70 per cent BOD removal of industrial effluents which was removed by using plant biomaterial after four days treatment.

8. Chemical Oxygen Demand (COD):

COD is caused by various dyestuffs in aqueous medium. Before treatment COD of effluent sample was 2000 mg/lit before treatment. When effluent was treated with wood coal COD of effluent decreased up to 1400 mg/lit, which was about 21.50% removal after 12 hours. Maximum percentage reduction in COD after 12 hour treatment with coconut coir, and mixture of coconut coir and wood coal was 14.00%, and 12.81% respectively. Among all these biomaterials, wood coal acts as a more efficient for reducing COD at 12 hours. As the time of treatment increases reduction in COD concentration was more same trend was found by [25]. Kulkarni [26] found that the coconut coir activated carbon has been found to be an effective adsorbent for the removal of COD from the effluent. Santhy [17] was found activated carbon of coir pith not only effective in removal of colour but also significantly reduced 46.5% COD levels of the textile wastewater.



Graph 8: Average % reduction of BOD by Biomaterial



Graph 9: Average % reduction of COD by Biomaterial

CONCLUSION:

The textile effluent was treated using slow cost biomaterials such as Coconut coir and wood coal as adsorbent. Physicochemical characteristics of biomaterial treated and untreated textile effluent were analyzed. Efficiency of adsorbents increases from 3-12 hrs. In pH, turbidity, EC, coconut coir acts as a best biomaterial for reduction of concentration of pollutants from effluent. As well as in total solid, TSS, COD and BOD wood coal acts as efficient biomaterial for reduction of concentration of pollutants from effluent. But in adsorption process TDS increases than before treatment, due to use of different biomaterials. Now a day in many industries there is a use of large amount of chemicals for reducing the load of pollutants and this method is very costly. But use of biomaterials for reducing pollution from effluent is very simple, less costly and easy to handle.

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DIVERSITY OF SEDGES (CYPERACEAE) IN WETLANDS OF GOA, INDIA

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ABSTRACT:

In Goa sedges are distributed in varied habitats. But most of the species are found in wetlands. Wetlands in Goa are of two kinds namely inland fresh water wetlands and the coastal saline wetlands. In present study six different wetland sedge habitats under these two categories were identified and explained along with list of species found in each habitat.

KEYWORDS: Goa, sedges, wetlands, habitat.

INTRODUCTION:

The sedge family (Cyperaceae) is one of the ten largest families of flowering plants [1] and is the third largest of monocotyledons after Orchidaceae and Poaceae [2]. The family is cosmopolitan in distribution, found in varied habitats from sea level to over 5000 m altitude in the Himalayas [3]. According to Mabberley there are 92 genera and 4450 species of the family throughout the world [4], but as per the World Checklist there are 90 genera and 5539 species of Cyperaceae [5]. Singh & Prasad estimated about 570 species of 39 genera in India [6] and the present number is estimated to be about 580 species belonging to 32 genera [7].

The United States Geological Survey (USGS) defined wetland as a general term applied to land areas which are seasonally or permanently waterlogged, including lakes, rivers, estuaries, and freshwater marshes; an area of low lying land submerged or inundated periodically by fresh or saline water [8]. As with any natural habitat, wetlands are important insupporting species diversity and have a complex of wetland values [9]. Sedges are mostly distributed in wetlands.

MATERIALS AND METHODS:

Study area:

The state of Goa is situated between the 14°53'57"–15°47'59" N latitudes and 73°40'54"–74°20'11" E longitudes on the western coast of India. It is bounded in the north by the Sindhudurg district of Maharashtra, in the north-east by Belgaum district of Karnataka, in the east and south by

Uttara Kannada district of Karnataka and in the west by the Arabian Sea The state is divided into two districts as North Goa and South Goa consisting of 12 taluks (tehsils) namely Bardez, Bicholim, Canacona, Dharbandora, Mormugao, Pernem, Ponda, Quepem, Salcete, Sanguem, Sattari and Tiswadi (Figure 1). Eastern part of the state extends to the Western Ghats – the latter is a globally known biodiversity hotspot of rich flora and fauna. This tiny state of about3806 km^2 [10] is very rich in biodiversity due to the diverse topography and favourable climatic conditions.

FIGURE 1. Map of Goa showing the 12 talukas in two districts

Data collection:

The extensive field work was undertaken for collecting specimens and to record the field data such as locality, habit, habitat, phenology, distribution, etc. Also different herbaria, viz., AHMA, BLAT, BSI, CAL [11], and herbarium at Goa University, and literature pertinent to sedges of Goa were consulted to update the inventory of Cyperaceae in Goa. Different habitats of sedges were identified during the preliminary survey, and visited again in different seasons.

RESULTS AND DISCUSSION:

In Goa sedges are distributed in very varied habitats. But most of the species are found in wetlands. In Goa wetlands are of two kinds namely inland fresh water wetlands and the coastal saline wetlands.These two categories can further be divided into different habitat types.During the course of study sixwetland sedge habitats have been identified in Goa, they are Freshwater marshy areas, Lowland grasslands, cultivated lands and harvested paddy fields, Saline marshy areas, Shallow standing water, Rocky river beds.Most of the species were noted in two or more habitats. These wetland sedge habitats are explained below along with a list of species found in each habitat.

A. Fresh water marshy areas:

This type of habitat includes the fresh water swampy areas, wet river banks, banks of streams, ponds, lakes, reservoirs, and other fresh water marshy areas or wetlands. There are 48 taxa in this habitat and this is the most preferred sedge habitat in Goa. The species and infraspecific taxa found in this habitat are:

Bolboschoenusmaritimus(L.) Palla, *Cyprus alulatus* J. Kern, *C. compactus* Retz., *C. compressus* L., *C. corymbosus* Rottb., *C. cyperoides* (L.) Kuntze, *C. difformis* L., *C. digitatus* Roxb. *C. exaltatus* var. *dives*, *C. haspan* L., *C. haspan* subsp. *juncoides*, *C. iria* L., *C. maderaspatanus* Willd., *C. nutans* Vahl, *C. nutans* var. *eleusinoides* (Kunth) Haines, *C. pangorei* Rottb., *C. paniceus*var *roxburghianus* (C.B. Clarke) Kuk., *C. pilosus* Vahl, *C. procerus* Rottb., *C. pulchellus* R. Br., *C. tenuispica* Steud**.**, *Eleocharisatro purpurea* (Retz.) J. Presl & C. Presl., *E. dulcis* (Burm. f.) Trin. Ex Hensch., *E. geniculata* (L.) Roem. & Schult., *E. spiralis* (Rottb.) Roem. & Schult., *Fimbristylisa cuminata* Vahl., *F. aestivalis* Vahl, *F. bisumbellata* (Forssk.) Bubani, *F. dichotoma* (L.) Vahl, *F. ferruginea* (L.) Vahl, *F. littoralis* Gaudich., *F. pubisquama* J. Kern, *F. schoenoides* (Retz.) Vahl, *Fuirenaciliaris* (L.) Roxb., *F. umbellata* Rottb., *Kyllinga brevifolia* Rottb., *Lipocarpha gracilis* (Rich. ex Pers.) Nees, *L. squarrosa* (L.) Goetgh., *Pycreusdiaphanus* (Schrad. ex Roem. & Schult.) S. Hooper & T. Koyama, *P. flavidus* **(**Retz.) T. Koyama, *P. macrostachyos* **(**Lam.) J. Raynal, *P. malabaricus* C.B**.** Clarke, *P. polystachyos* **(**Rottb.) P. Beauv., *P. pumilus*(L.) Nees, *P. sanguinolentus* (Vahl) Nees, *P. stramineus* C.B. Clarke, *Schoenoplectus articulatus* (L.) Palla, *S. lateriflorus* (J.F. Gmel.) Lye

B. Lowland grasslands and open grassy plateau:

Many sedge species grow in association with short grasses on moist lowland areas and on plateaus. These are mostly seasonal annual species found during and after the monsoon. About 34 taxa found in such grasslands in the state are:

Bulbostylisdensa (Wall. ex Roxb.) Hand.-Mazz., *Cyperus compactus* Retz., *C. compressus* L., *C. cyperoides* (L.) Kuntze, *C. distans*L., *C. maderaspatanus* Willd.,*C. paniceus* (Rottb.) Boeckeler, *C. squarrosus*L., *C. tenuispica* Steud**.,** *Fimbristylisal boviridis* C. B. Clarke, *F. argentea* (Rottb.) Vahl, *F. dichotoma* (L.) Vahl, *F. lawiana* (Boeckeler) J. Kern, *F. littoralis*Gaudich.,*F. merrillii*J. Kern,*F. miliacea*(L.) Vahl, *F. ovata*(Burm.f.) J. Kern, *F. schoenoides* (Retz.) Vahl, *F. tetragona* R. Br., *F. tomentosa* Vahl, *F. woodrowii* C.B. Clarke, *Fuirena umbellata* Rottb., *Kyllingabulbosa* P. Beauv., *K. nemoralis* **(**J.R. Forst. & G. Forst.) Dandy ex Hutch.& Dalziel, *Pycreusdiaphanus* (Schrad. ex Roem.& Schult.) S.S. Hooper & T. Koyama, *P. diaphanus*var. *gracilescens* (Kukenth.) S. Hooper, *P. malabaricus* C.B**.** Clarke, *P. pumilus* (L.) Nees, *P. pumilus*var. *membranaceus* **(**Vahl) Karthik.,*P. sanguinolentus* (Vahl) Nees, *P. stramineus* C.B. Clarke, *Rhynchosporawightiana* (Nees) Steud., *Scleriaannularis* Steud. And *S. tesselata* Willd.

C. Cultivated lands and harvested paddy fields:

These are the flooded rice fields, fallow fields and the land used for cultivating vegetables, cashew estates and coconut plantations. Here both annuals and perennials are found. There are about 46 found as weeds and the most common ones in paddy fields are:

Cyperus alulatus J. Kern., *C. exaltatus* Retz., *Cyperus iria* L., *Courtoisina cyperoides* (Roxb.) J. Sojak, *Pycreuspolystachyos* **(**Rottb.) P. Beauv., *Fimbristylislittoralis* Gaudich. Other sedges found in cultivated fields and fallow fields are:

Bulbostylisthouarsii (Roem. & Schult.) Govaerts (in ed.), *Cyperus compressus* L., *C. cyperinus*var. *Pictus* (Nees) Kuk., *C. difformis* L., *C. haspan* subsp. *juncoides* (Lam.) Kuk., *C. javanicus* Houtt., *C. malaccensis*Lam., *Cyperus nutans* Vahl, *C. pilosus* Vahl, *C. rotundus* L., *C. tenuispica* Steud**.,** *Eleocharisatropurpurea* (Retz.) J. Presl & C. Presl, *E. dulcis* (Burm.f.) Trin. Ex Hensch., *E. geniculata* (L.) Roem. & Schult., *Fimbristylisaestivalis* Vahl, *F. bisumbellata* (Forssk.) Bubani, *F. dichotoma*(L.) Vahl, *F. littoralis* Gaudich., *F. merrillii* J. Kern, *F. ovate* (Burm. f.) J. Kern, *F. schoenoides* (Retz.) Vahl, *F. tetragona* R. Br., *F. tomentosa*Vahl, *F. woodrowii*C.B. Clarke, *Fuirenaciliaris* (L.) Roxb., *Kyllingabrevifolia* Rottb., *K. brevifolia*var. *stellulata* (J.V. Suringar) Owhi, *K. nemoralis* **(**J.R. Forst. & G. Forst.) Dandy ex Hutch. & Dalziel, *K. squamulata* Vahl, *Lipocarphasquarrosa* (L.) Goetgh.,*Pycreusdiaphanus* (Schrad. ex Roem. & Schult.) S.S. Hooper & T. Koyama, *P. flavidus* **(**Retz.) T. Koyama, *P. macrostachyos* **(**Lam.) J. Raynal, *P. pumilus* (L.) Nees, *P. pumilus*var. *membranaceus* **(**Vahl) Karthik., *P. sanguinolentus* (Vahl) Nees, *Rhynchosporawightiana* (Nees) Steud., *Schoenoplectus articulatus* (L.) Palla, *S. juncoides* (Roxb.) Palla, *S. lateriflorus* (J.F. Gmel.) Lye and *Scleriabiflora* Roxb.

D. Saline marshy areas:

Muddy areas adjacent to the seacoast, mud flats near the river mouths, mangroves, muddy creeks and other muddy areas along brackish water provide excellent habitat for certain halophytic species. These are perennials with well-developed (usually) creeping rhizome and often with elongating stolons. In Goa there are about 14 taxa growing in this habitat. Such extensive rhizomes and stolons help the plants to hanger themselves in the loose mud and also to propagate. Hence, often we find pure stands of certain species like *Cyperus malaccensis* Lam. (Rottb.) Roem. & Schult, *Fimbristylisferruginea* (L.) Vahl, *Eleocharisdulcis* (Burm.f.) Trin ex Hensch. And *E. spiralis* (Rottb.) Roem. & Schult. in saline swampy areas towards coast. Other species found in such habitat are:

Bolboschoenusmaritimus (L.) Palla, *Bulbostylisthouarsii* (Roem.& Schult.) Govaerts, *Cyperus compactus* Retz., *C. javanicus* Houtt., *Fimbristylispolytrichoides* **(**Retz.) Vahl, *F. pubisquama*J. Kern*, F. sieberiana* Kunth, *Fuirenauncinata* (Willd.) Kunth, *Pycreuspolystachyos* **(**Rottb.) P. Beauv. And *Schoenoplectus articulatus* (L.) Palla

E. Shallow standing water:

Certain species of sedges are usually found partly submerged in shallow open water bodies of lakes, ponds and reservoirs. Heights of these plants usually vary depending on the water depth and sometimes attain a height of more than 1 meter. Also sometimes species like *Eleocharisdulcis* (Burm.f.) Trin.exHensch. grows in large population through vegetative propagation covering vast area of the water body. Other species of this habitat are*Fuirenaumbellata* Rottb., *Schoenoplectus articulatus* (L.) Palla, *S. corymbosus* (Roth ex Roem. & Schult.) J. Raynal and *S. subulatus* (Vahl) Lye

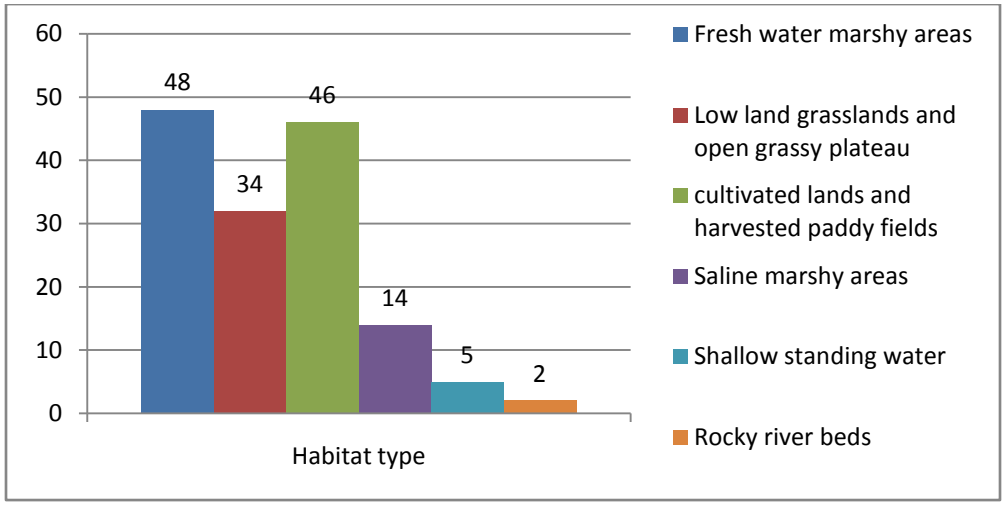
Cyperus cephalotus Vahl is the only species found floating in water bodies. It grow on a substratum of decaying plant material floating on water surface. They have well-developed root system to get anchored on the floating mass of the decaying vegetable matter. Stipe of the achene in this species is developed into a corky ridge which helps in dispersal of the nut through water.

F. Rocky River Beds:

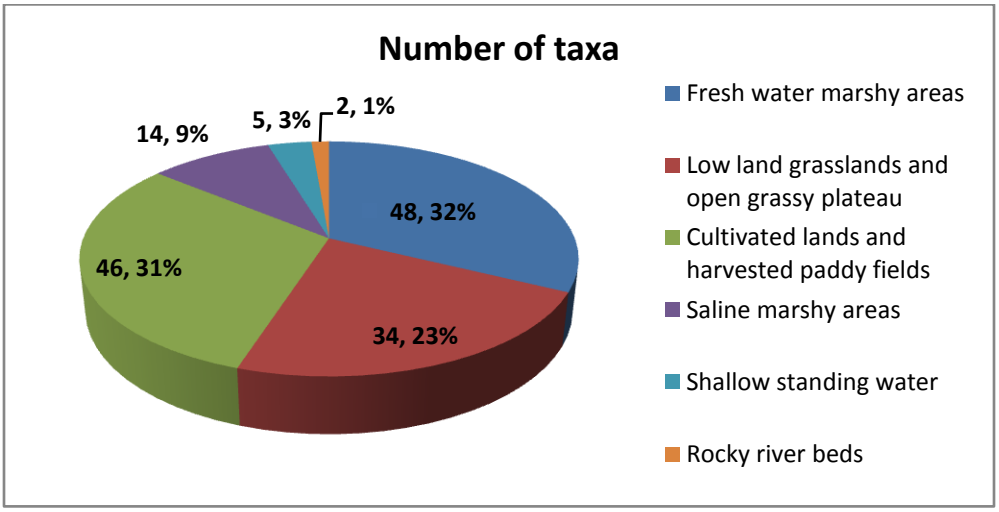
The rocky bottom of shallow rivers is an excellent habitat for a few sedge species. The species growing in such a habitat is always perennial with thick, creeping rhizome and well devolved root system. Two species confined to this habitat are *Cyperus corymbosus* Rottb. and *C. pangorei*Rottb.

Table 1: Distribution of sedges in different wetland habitats

Type	Name of Habitat	Number of taxa observed
A	Fresh water marshy areas	48
B	Low land grasslands and open grassy plateau	34
C	Cultivated lands and harvested paddy fields	46
D	Saline marshy areas	14
E	Shallow standing Water	05
F	Rocky river beds	02



Graph 1: Bar chart showing distribution of sedges in wetlands of Goa



Graph 2: Pie chart showing habitat-wise distribution of sedges in wetlands of Goa

CONCLUSION:

Six important sedge wetland habitats have been identified in the stateand all these habitats are explained along with a list plants found in each habitat. Among these habitats fresh water marshy area comprising swamps, banks of rivers and streams, ponds, lakes, reservoirs and shallow wetlands is the most preferred one. *Cyperuscorymbosus* and *C. pangorei* were found only in Rocky River beds.

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NUTRITIONAL POTENTIAL OF SOME EDIBLE INSECTS FROM DAPOLI REGION

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INTRODUCTION:

As we know, the human population is highly increasing. At the same time it affects the animal population due to the deforestation, industrial development and urbanization [1]. More than 71% of the human population depends on non-vegetarian food, so if there is shortage in animal population then what would be the source of proteins, fats, carbohydrates for non-vegetarians? And vegetarian diet would not fulfill the requirement of non- vegetarians. Taking this into consideration, some of the Indian institutes are working on sources of protein in the form of insects. For instance – Institute of Food Technologist (IFT) working on source with nutritional benefits of insects. SPA CNR Torino working on the evaluation of the nutritional value of edible insects as feed and food. There are many literatures who have investigated on nutritional value of insects [2, 3]. Edible insects are the only source for non-vegetarian as they fulfill the demand of protein.

MATERIALS AND METHOD:

Survey was conducted in 4 different locations from our region. They are as follows: 1) Botanical garden of our college, KKV Horticulture, KKV Forestry and Priya Nursery. Total 15 insect samples were collected and further given for analysis. Insect were firstly cleaned/dried with blotting papers. Edible parts of insect were taken for analysis. The insects were analyzed for protein (Kjeldhal method), carbohydrate (Handel method) and Calcium (flame photometer) content in laboratory.

Insects used for study:

1. Paddy grasshopper (*Hieroglyphusbanianfab*)
2. Hooded grasshopper (*Teratodeasmonticolisgrey*)
3. Caterpillar- silkworm (*BombyxmoriL*); Galleria mellonella Linnaeus
4. Pupae of moths
5. Termites- *Macrotermes* spp. And *Microtermes* spp.
6. Weevils (Sitophilusgranaries)

7. Rhinoceros beetle (*R.ferrugineus*) and white grubs (*R.oryctes*)
8. Wasps (*Vespasp.*)
9. Honey bees (*bees*)
10. Large red ants (*Attasp.*)
11. Crickets (*A.domesticus*)
12. Scorpion bug (*Belostomaindica)*

Table 1: Nutritional status of edible insects found in Dapoli region

Sr.No.	Insects	How To Eat	Parts To Remove	Content (/100g)
1	*H.banian*	Either boiled or fried with oil, spices and salt.	Legs, wings and alimentary canal.	PR (20.6g) CB (3.9mg) CA (5.0mg)
2	*I.monticolis*	Either boiled or fried with oil, spices and salt.	Legs, wings and alimentary canal	PR (14.3g) CB 2.2mg) CA (27.5mg)
3	Caterpillar- *B.mori*; *G.mellonella*	Either boiled with water and cooked or fried with oil, spices and salt.	No necessity of removal of alimentary canal because it vacate within 24hrs	PR (28.2g)
4	Pupaeofmoths	Frying with oil, spices and salt or they are boiled with water and cooked with oil, spices and salt.	No need	PR (55g) CB (25.43mg)
5	Termites- *Macrotermesspp.* And *Microtermesspp.*	Fried with oil, spices and salt	Legs	PR (14.2g)
6	*Sitophilusgranaries*	Boiled and mixed with spices, chili and salt and /or fried in oil.	Legs and wings	PR (6.7g)
7	*R. ferrugineus and R. oryctes*	Boiled and mixed with spices, chili and salt and /or fried in oil.	Legs, elytra hard thorax	PR (19.8g) CB (2.1mg) CA (43.5mg)
8	*Vespa sp.*	Fried with oil, spices and salt.	Legs and wings, sting.	PR (17.8gm) CB (1.9mg) CA (44.5mg)
9	*Bees*	Fried with oil, spices and salt	Legs and wings, sting	PR (0.3g) CB (82.4g)

10	*Atta sp.*	Boiled and mixed with spices, chili and salt and /or fried in oil.	Legs, mouth parts	PR (13.9g) CB (2.9mg) CA (47.8mg)
11	*A. domesticus*	Fried with oil, spices and salt	Legs and wings	PR (12.9g) CB (5.1mg) CA (15.8mg)
12	*B. indica*	Either boiled or fried	Legs and wings	PR (15.83g) CB (2.2mg) CA (45mg)

PR: Protein; CB: Carbohydrate; CA: Calcium

Table 2: Occurrence of Nutritional Insects in Dapoli Region

Sr. No.	Name Of Insects	Botanical Garden of DUBSSC	KKV Forestry Department	KKV Horticulture Department	Priya Nursery
1	*H. banian*	+	+	+	+
2	*I. monticolis*	+	+	+	+
3	*B. mori*	_	-	+	-
4	*G. mellonella*	_	+	+	+
5	*Macrotermes spp.*	+	+	+	+
6	*Microtermes spp.*	+	+	+	+
7	*Sitophilus granaries*	+	+	+	+
8	*R. ferrugineus* and *R. oryctes*	_	+	+	+
9	*Vespa sp.*	+	+	+	+
10	*Bees*	+	+	+	+
11	*Atta sp.*	+	+	+	+
12	*A. domesticus*	+	+	+	-
13	*B. indica*	+	+	+	+

Edible Insects from Dapoli Region:

Hooded Grasshopper

Grub

Silkworm

Pupae of Moth

Macrotermes Spp

Microtermes Spp.

Weevils

Rhinoceros Beetle

White Grubs

Wasps

Honey Bees

Large Red Ant

Scorpion Bug

Paddy Grasshopper

Cricket

RESULT:

Total 15 species have been identified from Dapoli region. Their occurrence and distribution is recorded in table -01 and their features, cooking methods and application are given above.

CONCLUSION:

Edible insects are the only source for non-vegetarians after shortage of animals.

FUTURE PROSPECTUS:

- Insects might not be for everyone, but they could be valuable asset to global food security.
- They are sustainable, green, and nutritious and could help people out of poverty.
- Entomophagy, the consumption of insects is promoted as an alternative sustainable source of protein for humans and animals.
- Edible need to be processed and turned into palatable dishes.

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PRELIMINARY SURVEY OF BUTTERFLIES IN DAPOLI TALUKA OF RATNAGIRI DISTRICT, MAHARASHTRA

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ABSTRACT:

Insects play a vital role in the maintenance of essential life support systems in natural habitat is well known. Among all insects butterflies are ecologically important; the butterflies feed on the nector and are important as pollinators of flowering plants. The larval stages of butterflies feed on the leaves are the primary herbivores in the ecosystem and are important in the transfer of the radiant energy which is fixed by plants and making it available to the other organisms. The present paper incorporates 60 species and sub species distributed over 5 families of butterflies from Dapoli Taluka of Ratnagiri District. Family Nymphalidae represented 20 species followed by families Lycaenidae, Pieridae, Papiionidae and Satyridae with 18, 08, 07 and 07 species respectively

KEYWORDS: Butterfly diversity, Dapoli, Maharashtra.

INTRODUCTION:

The Lepidoptera, butterflies (Rhopalocera) and moths (Heterocera) are a diverse and abundant insect groups in many ecosystems, as herbivores, pollinators and prey.

In India entire Western Ghats is recognized as one of the mega biodiversity centre and 800,000 numbers of insect species are reported from India [1]. There are about 17,280 species of butterflies in the world, out of which, 1641species belonging to 394 genera have been reported from the Indian subcontinent [2].

MATERIALS AND METHODS:

The butterflies were collected with the help of Swip-net method. They were killed in insect killing bottle, brought to the laboratory in the Department of Zoology, Dapoli Urban Senior Science College, Dapoli. They were preserved with dry preservation method. The identification was done with the help of appropriate Literature [3, 4, 5, 6, 7, 8].

Table 1: List of Butterfly Species collected during surveys from Dapoli Taluka, Ratnagiri

Family	Species
A..Papilionidae	
	1. *Graphium sarpedon*
	2. *Graphium agammemnon*
	3. *Papilio demoleus*
	4. *Papilio polymnestor*
	5. *Papilio polytes polytes*
	6. *Princeps helenus helenus*
	7. *Pachliopta aristolochiae*
B. Pieridae	
	1. *Belenois aurota aurota*
	2. *Cepora nerissa phryne*
	3. *Delias eucharis*
	4. *Leptosia nina nina*
	5. Ixias marianne
	6. Hebomoia glaucippe glaucippe
	7. Pareronia valeria hippia
	8. Catopsilia pomona
C. Satyridae	
	1.Melanitis leda ismene
	2.Melanitis phedima
	3.Elymnias hypermnestra undularis
	4.Lethe rohria
	5.Lethe europa europa
	6.Ypthima huebneri
	7.Ypthima baldus satpura
D. Nymphalidae	
	1.*Ariadne merione*
	2.*Phalanta sp.*
	3.*Cynthia cardui*

	4.*Precis iphita iphita*
	5.*Junonia almana almana*
	6.*Jononia hierta hierta*
	7.*Junonia orithya*
	8.*Junonia lemonias lemonias*
	9.*Hypolimnas bolina*
	10.*Neptis hylas*
	11.*Neptis jumbah*
	12.*Pantoporia hordonia hordonia*
	13.*Athyma ranga ranga*
	14.*Athyma perius*
	15.*Euthalia aconthea*
	16.*Euthalia lubentina*
	17. *Polyura athamas*
	18.*Charaxes solon*
	19.*Junonia atlites atlites*
	20.*Kallima horsfieldi*
E. Lycaenidae	
	1. *Curetis acuta/thetis*
	2. *Caleta decidia/Caleta caleta*
	3. *Jamides bochus bochus*
	4. *Jamides celeno aelianus*
	5.*Jamides alecto*
	6. *Catochrysops strabo strabo*
	7.*Leptotes plinius*
	8.*Tarucus nara*
	9.*Tarucus ananda*
	10.*Zizeeria knysna karsandra*
	11.*Zizinia otis sangra*
	12.*Pseudozizeeria maha*
	13.*Pithecops corvus*

	14.*Cilastrina lavendularis puspa*
	15. *Acetolepis puspa*
	16. *Chitades lalus laius*
	17. *Freyeria trochilus putli*
	18. *Amblypodia anita*

RESULTS AND DISCUSSION:

The present paper incorporates 60 species and sub species distributed over 5 families of butterflies from Dapoli Taluka of Ratnagiri District. Family Nymphalidae represented 20 species followed by families Lycaenidae, Pieridae, Papiionidae and Satyridae with 18, 08, 07 and 07 species respectively. In future concentrated efforts will be made to enlist maximum number of butterfly species so as to achieve total biodiversity of butterflies in Mahad Taluka of Raigad District.

Basistha et al. [9] reported 56 species of butterflies from Orang Wildlife Sanctuary, Assam. Ali and Basistha [10] reported 79 species of butterflies from Assam State Zoo-Cum-Botanical garden. Sonia and Pallot [11] recorded 43 species of butterflies from paddy field ecosystem of Palakkad District, Kerala. Whereas in the present study in all 60 species of butterflies were reported. The present study revealed presence of diversity of host plants in the region under study. In future extensive survey will be carried out so as to study holistic profile of butterfly diversity, their host range and role in ecosystem.

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INSECT DIVERSITY IN TALA TAHSIL OF RAIGAD DISTRICT, M.S., INDIA

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ABSTRACT:

The present work was carried out in Tala Tahsil in Raigad district to study insect diversity of region. Surveys were done from December 2015 to December 2017 in all seasons at different study sites. 102 insect species were recorded from three orders namely Odonata, Lepidoptera and Dictyoptera.

KEYWORDS: Insect diversity, Tala, Raigad

INTRODUCTION:

Raigad district is located in Konkan Region of Maharashtra. It is a hot spot for biodiversity, which is located on a west facing spur of Western Ghats or Sahyadri range. The district is bounded by Thana district to the North, Mumbai harbour to the North-west, Pune district to the East. Insects are most diverse and prominent group of animals. Insects have incredibly diverse morphological, physiological, and behavioural adaptations to their surroundings which makes the study of insects a fascinating subject [1].

Many features of insect biology also make them ideal to use as model biological systems [2]. Their abundance, short life cycle, reproductive potential and small size allow scientific experiments to be set up, monitored and duplicated with relative ease in almost any location. Much of our basic understanding of genetics, population ecology, and evolution has resulted from experimentation with insects.Their small size and high reproduction rates make insects ideal model systems in molecular, cellular, organismal, ecological and evolutionary studies [3]. At the same time the beneficial insects help the advancement of human beings either directly or indirectly: by cross pollinating their crops, predating and parasiting their enemies, killing the weeds etc. Useful insects produce silk, honey, lac, medicine, dyes etc.

MATERIALS AND METHODS:

Selection of sites:

Some of the sites for study selected were Ranechiwadi, Bhanang, Bhangkond, Jogwadi, Girne, Padhwan and Borghar**.**

A field survey method was be followed in all season to collect insects by forceps and nets, handpicking etc. and after identification were released in forests. Some other insects were photographed. Identification was done by using various references [2, 4].

RESULTS:

Table1: List of insects recoded in selected study area:

Order: Odonata	
Suborder: Anisoptera	*Euploeamulcibermulciber*Cramer
Family: Aeshnidae	*Paranticaaglea*Stoll
***Aeshna*Fabricius, 1775**	*Paranticasita*Kollar
	*Tirumalaseptentrionis*Butler
Genus: *Aeshna*	***Heliconiinae***
*Aeshnajuncea*Bartenef, 1929	*Acraeaissoria*Hübner
*A. junceamongolica*Bartenef, 1929	*Argynnishyperbius*Linnaeus
*Aeshnamixta*Latreille, 1805	*Cethosiabiblis*Drury
Aeshnapetalura Martin, 1906	*Cethosiacyane*Drury
Genus:*Periaschna* Martin 1908.	*Cirrochroaaoris*Doubleday
*Periaeschnaflinti*Asahina, 1978	*Phalantaphalantha*Drury
*Periaeschnalebasi*Navas, 1930	*Vindulaerotaerota*Fabricius
Family: *Libellulidae* Leach, 1815	***Lycaenidae***
***AcisomaRambur,* 1842**	*Theclinae*
*Acisomapanorpoides*Rambur, 1842	*Arhopalabazalus*Hewitson
Aethriamanta Kirby, 1889	*Arhopalaeumolphuseumolphus*
Aethriamantabrevipennis (Rambur, 1842)	*Catapacilmamajor*Druce
***AgrionopteraBrauer*, 1864**	*Deudorixepijarbas*Moore
Agrionopteradorothea Fraser,1927	*Rapalanissa*Kollar
***Bradinopygageminata* (Rambur, 1842)**	*Ticherraacte*Moore
*Bradinopygageminate*Rambur, 1842	*Zeltusamasa*Hewitson
***Camacinia Kirby*, 1889**	***Lycaeninae***
Camacinia gigantean (Brauer, 1867)	*Acytolepispuspa*Horsfieldii
***Cratilla Kirby*, 1900**	*Heliophorusbrahma* Moore

*Cratillalineata*Foerster, 1903

Cratillametallica (Brauer, 1878)

***CrocothemisBrauer*, 1868**

Crocothemiserythraea (Brullé, 1832)

Crocothemisservilia (Drury, 1770)

***Diplacodes Kirby*, 1889**

Diplacodesnebulosa (Fabricius, 1793) ***Epithemis Laidlaw*, 1955**

Epithemismariae (Laidlaw,1915)

ORDER: *LEPIDOPTERA*

Family *:Nymphalidae*

Libytheiinae

*Libytheamyrrha*Godart

Danaidae

*Danauschrysippuschrysippus*Linnaeus

*Danausgenutia*Cramer

*Euploeaalgea*Godart

MOTHS

Order: *Lepidoptera:*

It includes moths, butterflies and skippes.

Family: *Amorphoscelidae*

Subfamily: *Amorphoscelinae*

Genus: *Amorphoscelis*Stal, 1871

A. annulicornisStal, 1871

Genus: *Acromantis Saussure*, 1870

*A. insularis*Giglio-Tos, 1915

Genus: *EuantissaGiglio*-Tos, 1927

Genus: *Hestiasula Saussure*, 1871

H. brunneriana Saussure,

E. ornata Werner, 1935

Sub-order*: Ditrysia*

Section: *Heterocera/Frenatae*

Family: *Noctuidae*

Achaea sp. Achaea janata.

Bleninadonans.

Bocanamanifestalis

*Heliophorusepiclesindicus*Fruhstorfer

Polyommatinae

*Castaliusrosimonrosimon*Fabricius

Celatoxiamarginatade Nicevelle

*Jamidesalecto*Felder

Jamidesbochus Stoll

Lampidesboeticus Linnaeus

Hesperidae

Pyrginae*.*

*Pseudocoladeniadan*Fabricus

TagiadeslitigiosalitigiosaMoschler

Hesperiinae

*Iambrixsalsalasalsala**Moore*

ORDER: *DICTYOPTERA*

MANTODEA

Family: *Amorphoscelidae*

Subfamily: *Amorphoscelinae*

Genus: *AmorphoscelisS*tal, 1871

A. *annulicornis*Stal, 1871

Family*: Eremiaphilidae*

Genus: *Euantissa*Giglio-Tos, 1927

Genus: *Hestiasula* Saussure, 1871

H. brunneriana Saussure,

Genus: *Ephestiasula*Giglio-Tos, 1915

E. amoena (Bolivar, 1897)

Subfamily Hymenopodinae

Tribe *Hymenopodini*

Genus: *Creobroter*Audinet-Serville, 1839,

*C. elongata*Beier,

C. laevicollis (Saussure, 1870)

Family: *Liturgusidae*

Subfamily: *Liturgusinae*

Tribe *Liturgusini*

Genus: *Humbertiella* Saussure, 1869

*H. affinis*Giglio-Tos, 1917

H. ceylonica Saussure

Callopistria sp.	*H. indica* Saussure, 1869
Callopistriapulcherilinia	*H. nigrospinosa*Sjostedt
S. mauritiaBoisd.	Genus :*Theopompa*Stal, 1877
Dirades sp.	*D. longicollis*Stal, 1877
Eumelearosalia Cram.	*D. lanceolata* (Fabricius, 1798)
Family: G*eometridae*	Subfamily*: Caliridinae*
EuschemapercotaSwinh. Fascellina sp.	Genus: *Parathespis* Saussure, 1869
Hemithea sp.	*P. humbertiana* Saussure, 1869
Anisodes sp.	Subfamily: *Iridopteryginae*
Abraxas sp.	Tribe: *Iridopterygini*
Acropterisciniferaria.	Genus: *Hapalopeza*(Hapalopeza) Stal, 1877
Anisodessp	H. (H.) *nilgirica* Wood-Mason,
Anisodes sp. nr.to apogonaProut	Subfamily: *Nanomantinae*
Heterostegane sp.	Tribe: *Nanomantini*
Family: *Arctiidae*	Genus: *Parananomantis*Mukherjee, 1995
Arginacribaria Clerk	Subfamily :*Tropidomantinae*
A.argus Koll	Tribe: *Tropidomantini*
Asuraarcuata Moore	Genus: *Tropidomantis* (Eomantis) Giglio-Tos, 1915
Characorna sp.	*T. (E.) guttatipennis*Stal, 1877
Family: *Noctuidae*	Genus: *Heterochaetula*Wood-Mason, 1889
Othreisfullonica (Clerck)) O. homaenaHbn.,	*H. fissispinis* Wood-Mason, 1889
Matapasasiarna Moore	*S. bicornis* (Linnaeus, 1758)
Notocryptacurvifascia Felder & Felder	
Potanthuspseudomaesacleo Evans	
Heteropterinae	
Udaspesfolus Cramer	
Pelopidas subochraceaMoore	

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ZOOPLANKTON DIVERSITY OF SIR PIRAJIRAO LAKE OF MURGUD, KOLHAPUR DISTRICT (M. S.)

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ABSTRACT:

A study was carried out to examine the diversity of zooplankton in Sir Pirajirao Lake, Murgud, India. Sir Pirajirao Lake, Murgud is one of the major water reservoirs in Kolhapur district. A total of 36 species of zooplankton were recorded during the study period. The present study aims at providing a preliminary knowledge on the productivity and diversity of zooplanktons. This data will be helpful in management and improvement in the productivity of the lake.

KEYWORDS: Zooplankton Diversity, Sir Pirajirao Lake, Murgud.

INTRODUCTION:

For the existence and continuity of life, water is one of the essential components of the earth. Water occupies about 362 million kilometers (71 %) of the total area of the earth's surface. As compared to marine and terrestrial habitats, fresh water habitats occupy a relatively small portion of the earth's surface but their importance to man is far greater than their area [1].

Water quality assessment generally involves analysis of physicochemical, biological and microbiological parameters and reflects on abiotic and biotic status of the ecosystem. Ecologically, zooplankton are one of the most important biotic components influencing all the functional aspects of an aquatic ecosystem, such as food chains, food webs, energy flow and cycling of matter [2].

Zooplanktons play a vital role in the community nutrition of the fresh water system and hence assume importance in aquaculture activities. The distribution of zooplankton community depends on a complex of factors such as, change of climatic conditions, physical and chemical parameters and vegetation cover. Therefore, the present investigation attempts to study the zooplankton species richness, diversity and evenness in relationship between physicochemical parameters in Sir Pirajirao Lake.

MATERIALS AND METHODS:

Study Site:

The study site of Sir Pirajirao water reservoir, Murgud is situated in Kagal Taluka of Kolhapur district. The area covered by the Lake is about 4.5km.

Collection of Samples:

The lake survey was carried out from January 2017 to December 2017. Water samples were collected fortnightly during the early hours between 7.00 to 10.00 am. The plankton samples were collected by filtering 50 liters of water through standard plankton net (77 mesh bolting silk) and the concentration samples were fixed in 5% of formalin.

Zooplankton Sampling and analysis:

Zooplankton species identification was done with the help of standard references [3]

RESULTS:

Table 1: Qualitative analysis of zooplanktons from water samples of Sir Pirajirao Lake

Sr. No.	Name of the Zooplankton Species
1	*Oikopleura (tunicata)*
2	*Euphausid*
3	*Copepod*
4	*Copepod larva*
5	*Acartia spinicauda*
6	*Paracalanus parvus*
7	*Mysis larva*
8	*Nauplius species*
9	*Daphnia carinata*
10	*Keratella tropica*
11	*Filinia opoliensis*
12	*Asplanchna priodonta*
13.	*Trichocera capucina*
14	*Conochilus hippacrepis*
15	*Rotaria neptunia*
16	*Brachionus caudatus*

17	*Brachionus angularia angularis*
18	*Polyarthra vulgaris*
19	*Diaphanosoma sarsi*
20	*Acarti*
21	*Trichotria tetractis tetractis*
22	*Moina macrocopa*
23	*Lecane hastata*
24	*Brachionus falcatus*
25	*Testudiella patina patina*
26	*Polyarthra*
27	*Brachionus ureceolaris ureceolaris*
28	*Kertella tropica*
29	*Keratella Cutleries f.terta*
30	*Brachionus forficula*
31	*Acrtia*
32	*Hexarth*
33	*Macrotrachel*
34	*Eurytemor*
35	*Anuraeopsi*
36	*Macrotrache*

DISCUSSION:

The average percentage of zooplankton from selected reservoir revealed different forms in their density attributed to water quality. During post monsoon season i.e. from sepetember to December the occurrence of zooplankton were abundant. The density and diversity of zooplankton certainly get influenced by the physicochemical properties of water. Further, it is a fact that the diversity of zooplankton is always less in the flowing fresh water compared to stagnant water like that of reservoirs. There was a variation in zooplankton diversity and percentage during study period. All the physicochemical parameters of pond favors growth of zooplankton as well as aquatic weed in fresh water ponds is well established fact [4, 5].

During the study, total 36 species of zooplanktons were recorded. The diversity of zooplanktons was seen higher in this study. The higher diversity of plankton population in reservoir might be due to availability of suitable food and less predators. In the monsoon, fall of zooplankton density of all the zooplankton components during the study period can be attributed to the dilution effect. The similar results were obtained by Kelly et al. [6] in ephemeral karst lake and Singh [7] in the study of some tropical lakes.

The copepods percentage was higher in the study followed by *Daphnia* and *Keratella*. Larvae and nymphs of several insects were observed at different sites with specific seasonal variation. During post monsoon such stages were abundant. The similar results were noted by Addus and Altaff [8] and Parikh and Mankodi [9].

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PHYTOPLANKTON DIVERSITY STATUS OF NATUWADI DAM

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ABSTRACT:

In any aquatic ecosystem phytoplanktons play key role in its food web. Therefore, conservation and management of aquatic body needs planktonic study. In the present investigation phytoplankton samples were monthly collected during January 2012 to December 2013 and analyzed by Sedgwick - Rafter cell method. Identification and classification of phytoplanktons were done with the standard keys. The study further reported five major planktonic divisions such as Chlorophyta, Chrysophyta, Bacillarophyta, Dinophyta (Pyrrophyta) and Cyanophyta. Among them Chlorophyta was reported to be the largest division containing percent composition of classes in the order of Chlorophyceae (54.24%) > Xanthophyceae (1.75%) > Bacillariophyceae (24.55%) > Dinophyceae (1.57%) > Cyanophyceae (15.56%) > Cryptophyceae (2.31%). The phytoplankton densities started declining from May and reached to their lowest count during June; thereafter slowly increased to reach at their high peaks in the months of December and January.

KEYWORDS: Phytoplankton, Lentic water body, Primary producers, Aquatic resources.

INTRODUCTION:

About one third of freshwater fish feed is plankton at one or the other stage of their life cycle. The measurement of primary and secondary productivity is essential for the study of fishery potential and estimation of fish production. The limnetic zone of lentic water body contains suspended particulate matter due to water movement, known collectively as seston. The components of the bioseston are the plankton and nekton. In most of the large inland waters the bulk of living matter found in water is phytoplanktons that serve as a main source of food directly or indirectly to the fish population and hence their biological importance is very much. Presence of phytoplankton, algae and vascular aquatic plants in an aquatic environment is essential for the proper aeration of water by releasing the oxygen and absorbing the carbon dioxide; which is exhausted by fish and other aquatic organisms. Phytoplankton encompass a surprising range of cell size and cell volume from the largest forms visible to the naked eye, *Volvox* (500 to1500 µm), to micro plankton which vary from 60 to 500 µm. Nanoplankton

are very small, their size varies from 5 to 60 µm. These can only be collected with a special nanoplankton net having mesh size of 30 µm [1]. Zooplanktons serve as a connecting link between primary producers and secondary consumers in food chains of the lentic water bodies. Therefore, studies on long-term fluctuations in the abundance of plankton are important in relation to the conservation of aquatic resources.

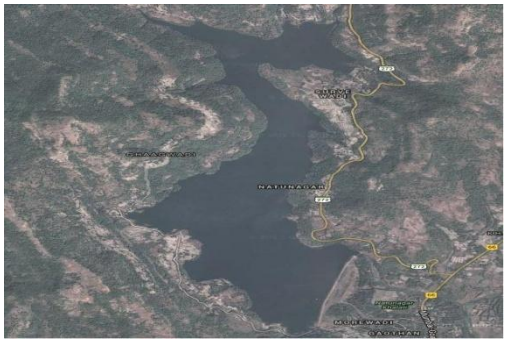
The Diatoms are good indicators of water quality. The benthic algae are an important producer component of the littoral zone of eutrophic lake. The dissolved and suspended nutrients in aquatic body support the growth of algae and other aquatic life, and considered algae as good indicators of water quality. The algae are more sensitive to detergents than Bacteria and Fungi [2].

Generally the significance of planktonic Desmid species and their role in the aquatic food web is important. The composition of phytoplankton is potentially a better indicator of trophic state in an aquatic ecosystem. They also stated that the changes in algal community structure are in accordance with changes in the nutrient status of the system. The conservative species of phytoplankton become the first alarming sign of disturbances in aquatic habitat [3]. According to them the high load of biological oxygen demand and hypoxic situations are unconducive for phytoplankton community. The aquatic algae are sensitive to pollution, and are therefore commonly used for monitoring environmental contamination.

The flagellate algae remain dominant in summer in most of the water bodies. The ecologically highly sensitive Desmids are useful tool in aquatic conservation management especially in those cases where macro organisms fail [4]. The algal growth in tropical inland water constitutes one of the principal causes of deteriorating the potable potentials of water. *Microcystis* is a widely distributed organism, which dominates the phytoplankton community in nutrient rich lakes [5]. In the light of above facts it was decided to assess the status of Natuwadi dam, hence the work was undertaken.

Study area:

Natuwadi dam is a perennial freshwater body situated in the Khed Tehsil of Ratnagiri district in the ranges of Sahyadri of Western Ghats. This dam is basically constructed for irrigation purpose.



Google view of Natuwadi dam

The dam is constructed across the Chorati River near Natuwadi village. This dam comes under the Konkan Irrigation Circle, South Division, Ratnagiri. It is constructed under medium irrigation project in the year 1984 at the Latitude 17^{o} 50' 00" N and Longitude 73^{o} 54' 00" E. Its catchment area of 16.32 sq. km receives an average annual rainfall of about 3632 mm. The dam is of earthen type having length of 846 meters and maximum height of 45.25 meters with spillway of about 41 meters. The spillway of dam is of ogee type with three gates of 12 x 5 meters. The maximum flood discharge of dam is 389.35 M^3/cm. It has two outlets in the form of Right Bank Canal (RBC) and Left Bank Canal (LBC) of 24 km and 12 km length, respectively. The information pertaining to reservoir storage indicates that the maximum water level (MWL) is 93.00 meters. The full reservoir level (FRL) of 92.50 meters stores about 28.08 Mm^3 of water, of which 27.23 Mm^3 is utilizable. The total land area under submergence is about 217 hectares. About 18 villages come under the command area of Natuwadi dam with gross irrigable command area of about 2050 hectares.

MATERIALS AND METHOD:

Phytoplankton samples were monthly collected during January 2012 to December 2013 by using conical net having mesh size of 120µ from three different stations of Natuwadi dam between 8.30 am and 11.30 am. The fixed volume of water (25 liters) was filtered through the plankton net and planktons collected were concentrated to 250 ml. The collected plankter samples were permanently preserved in 4% formalin. The samples were kept for setting for a period of 48 hrs.

The qualitative and quantitative analysis of phytoplankton was carried out in the laboratory with the help of Sedgwick- Rafter cell method and results were expressed in units/l. Preserved and concentrated sample was agitated thoroughly for even distribution of organisms and exactly 1 ml of sample was transferred on to the Sedgwick- Rafter cell counting chamber. The counting of phytoplankton was done under compound microscope (15x eyepiece, 10x and 40x objective lens). The identification and classification of phytoplankton was done with the help of various books [6, 7, 8] .

The phytoplanktons were identified up to generic and species level; and presented in tabular form. Their percent composition and the population dynamics were also determined.

RESULTS:

Phytoplanktons reported from the study dam belong to five major divisions such as Chlorophyta, Chrysophyta, Bacillarophyta, Dinophyta (Pyrrophyta) and Cyanophyta. The Chlorophyta was reported to be the largest division represented by only one class of Chlorophyceae that contained 41 genera/ species belonging to 13 families and 4 orders. Among 13 families, Desmidaceae was dominant. The division Cyanophyta was reported to be second largest group of blue-green algae that contained 12 genera/species which belonged to class Cyanophyceae and Cryptophyceae. Bacillarophyta division of diatoms included 9 genera/species that belonged to 7 families, one order and one class i. e. Bacillariophyceae. Only two species were reported from class Diniphyceae that belonged to division Dinophyta (Pyrrophyta). The division Chrysophyta contained only one genus that belong to one family, one order and one class i.e. Xanthophyceae (Table 1).

Phytoplankton diversity in Natuwadi dam (Plate – I) indicated 6 major classes such as Chlorophyceae, Xanthophyceae, Bacillariophyceae, Dinophyceae and Cyanophyceae (Myxophyceae) and Cryptophyceae. Class Chlorophyceae was reported to be largest included 41 species followed by Cyanophyceae (11) and Bacillariophyceae (09). Only one species was reported each from Xanthophyceae and Cryptophyceae and 2 species from Dinophyceae. The average percentage of Chlorophyceae was 54.24%, that of Xanthophyceae was 1.75%, of Bacillariophyceae 24.55%, Dinophyceae 1.57%, Cyanophyceae 15.56% and that of Cryptophyceae was 2.31% for two years of study in Natuwadi dam (Table 2).

Monthly variations of algal groups in Natuwadi dam during January 2012 to December 2013 are depicted in Table 2. The minimum numerical density of Chlorophyceae (1631 units/l) was reported during June 2013 and maximum (4522 units/l) during December 2013. The Xanthophyceae reported to be minimum (10 units/l) during December 2013 and maximum (190 units/l) during October 2012. The Bacillariophyceae ranged from 1880 unit/l during January 2012 to 6097 units/l during June 2012. The Dinophyceae group showed range from nil during June 2012 to 192 unit/l during July 2012. Myxophyceae showed minimum range of 355 units/l during June 2012 and maximum of 1573 units/l during January 2012. The Cryptophyceae group was not reported in Natuwadi dam during July to September of both the years, but its maximum number of 228 units/l was recorded during April 2013.

In the present investigation the order of dominance of various groups of phytoplankton of Natuwadi dam was represented as:

Chlorophyceae (54.54%) > Bacillariophyceae (24.43%) > Cyanophyceae (Myxophyceae) (15.63%) > Cryptophyceae (2.24%) > Dinophyceae (1.67%) > Xanthophyceae (1.55%). The dominance of Chlorophyceae, Bacillariophyceae and Myxophyceae was reported during summer followed by winter and declined during monsoon. The Xanthophyceae, Dinophyceae and Cryptophyceae showed very low number with more or less steady persistence throughout the study period.

Percent composition of Phytoplankter groups in Natuwadi dam during 2012 and 2013 were more or less similar (Table 3). The phytoplankton densities started declining from May and reached its lowest count during June; and slowly increased to reach at peaks in the months of December and January of both the study years (Fig. 1).

DISCUSSION:

Phytoplanktons are the minute aquatic non motile autotrophs carried by air currents and water currents in aquatic body. Since they are primary produces in aquatic ecosystem, their estimation proves quality of water to sustain heterotrophic communities. Their population in aquatic ecosystem is regulated by various environmental factors. They indirectly participate in the biological treatment of organic waste where they supply oxygen to the bacteria for decomposition process. Many nutrients may potentially be limiting factors for algal growth and tend to accumulate in aquatic ecosystems [9]. Excessive nutrients and organic inputs in water bodies have led to their eutrophication, which is characterized by increase in phytoplankton nuisance algal blooms, loss of water clarity and loss of oxygen in bottom waters. Therefore, phytoplankton and their seasonal succession can be a better predictor of long term environmental changes in the aquatic environment than the more usual descriptors of biomass and productivity indices [10].

The phytoplankton composition of study dam was recorded within the range from 2945 units/l to 8234 units/l. The higher numerical density of phytoplankton was recorded during December 2013 and low density during June 2012. Moreover, higher densities of phytoplankton were also recorded during winter and summer. Maximum density of Chlorophyceae was observed during winter particularly in the months of December and January and minimum during monsoon, particularly in the month of June. The similar trend was exhibited by Bacillariophyceae and Myxophyceae. Garciade Emiliani [11] reported high density of phytoplankton during summer in the flood plain lake of Argentina.

Kalyani *et al.* [12] have recorded two peaks, one in summer and other in winter, of phytoplankton in Bhadrakali lake. In a large community pond minimum numerical density of Chlorophyceae and Myxophyceae were reported in March and July with their maximum record in May and April, respectively by Panda and Dash [13]. Devika *et al*. [14] have reported high population of Chlorophyceae during summer due to high water temperature and transparency. Rajgopal *et al*., [15]

have determined sequence of dominance as Chlorophyceae followed by Cyanophyceae and Bacillariophyceae in Chinnapperkavil pond and Nallanchettipatti pond, Tamil Nadu and further stated that Chlorophyceae and Cyanophyceae are tolerant to organic pollution and resist the stress caused by pollutions. Therefore, they may be used as pollution indicator organisms.

The Chlorophyceae was represented by 37 genera / species among which *Pediastrum* sp., *Chlorella*, *Scenedesmus*, *Spirogyra* and *Treubaria* were dominant in descending manner. The Cyanophyceae was represented by *Microcystis, Synecocystis*, *Oscillatoria, Aphanocapsa*, *Gleocapsa*, *Merismopedia*, etc. and the Bacillariophyceae by *Synedra, Navicula, Nitzschia*, *Cocconeis*, *Suriella* and *Fragillaria*. Among ten genera of Chlorococcales in Natuwadi dam, *Pediastrum* species was observed to be consistent and dominant contributing to the highest density of Chlorophyceae.

Zutshi *et al*., [16] reported 67% *Pediastrum* of the total Chlorophyceae from Srinagar pond. Pailwan [17] have reported 32 species belonging to Chlorophyceae, 20 species from Bacillariophyceae, 13 species from Myxophyceae and two species from Dinophyceae in Kagal, Kahneriwadi and Kandalgaon tanks. Most of their species composition matches with the present work. Karpe [18] have reported minimum density (189 units/l) of *Chlorella* species and maximum density of (405 units/l) in GIP tank, Ambernath. She reported consistent presence of *Chlorella* with *Pediastrum* in Chikhloli reservoir. *Nitzschia* species was reported as a representative of Bacillariophyceae in both the study dams. The water bodies having high levels of nutrients and organic pollution provide favorable conditions to the pollution tolerant species of phytoplankton to thrive well at low oxygen levels. Thus in general the periphytic community also explains the oligotrophic nature of the lake. However, the presence of some pollution tolerance species belonging to Chlorophyceae, Diatoms, Cyanophyta and blue green among periphytic component of alga suggested the necessity of a detailed and long term monitoring of the hydrobiology of water body as a means to protect it from catastrophic degradation due to anthropogenic impacts [19].

Mishra *et al*., [20] reported common occurrence of *Zygnema* species, *Microcystis aeruginosa*, *Oscillatoria*, in J. C. mill pond and Gangasagar pond at Gwalior and also recorded abundance of *Spirogyra* and *Pediastrum simplex* along with high concentration of oxygen in Gangasagar pond. The occurrence of *Microcystis*, *Oscillatoria* represent considerable pollution load [21]. In the present study high density occurrence of *Microcystis*, *Oscillatoria* and *Coleosphaerium* were observed in both the dams. It may be due to extreme evaporation of water in summer that might be the cause for increased organic load in these water bodies [17]. Similar observations were reported in case of *Microcystis* and its dense nature due to extreme evaporation of water at high temperature [22]. The nitrogen hetrotophic *Naviculae* and *Nitzschia* are commonly found in moderately polluted water. Species like *Melosira*, *Fragillaria, Navicula*, *Nitzschia*, *Gomphonema*, *Synedra* and *Chocconales* were consistently reported in

Natuwadi dam. Presence of *Microcystis*, *Oscillatoria*, *Nitzschia*, *Navicula, Scenedesmus* and *Coleospharium* indicated moderate pollution status and meso-eutrophic nature of the study dam.

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Table 1: Checklist of Phytoplankton diversity from Natuwadi dam

Division	Class	Order	Family	Genera
Chlorophyta (Green Algae)	**Chlorophyceae**	Chlorococcales	Dictyosphaeriaceae	*Botryococcus sp*
			Hydroditctyaceae	*Pediastrum sp*
			Coelastraceae	*Coelastrum sp*
			Oocystaceae	*Ankistrodesmus sp*
				Chlorella sp
				Treubaria sp
			Palmellaceae	*Sphaerocystis sp*
			Scenedesmaceae	*Scenedesmus sp*
				Crucigenia sp
				Tetrastrum sp
		Ulotrichales	Ulotrichaceae	*Ulothrix sp*
			Microsporaceae	*Microspora sp*
			Protococcaceae	*Protococcus sp*
		Volvocales	Volvocaceae	*Eudorina sp*
				Volvox sp
		Zygnematales	Zygnemataceae	*Zygnema sp*
				Spirogyra sp
				Zygogonium sp
			Gonatozygonaceae	*Gonatozygon sp*
			Desmidiaceae	*Cosmarium botrytis*
				Cosmarium contractum
				Cosmarium depressum
				Micrasterias sp
				Desmidium sp
				Arthrodesmus sp
				Stauradesmus dejectus
				Staurastrum anatidum
				Staurastrum arctison
				Staurastrum singulum
				Staurastrum contractum
				Staurastrum gracile
				Staurastrum inflexum
				Staurastrum leptocladium
				Staurastrum longispinum
				Staurastrum lunatum
				Staurastrum manfeldtii

				Staurastrum ophiura
				Staurastrum planctonicum
				Staurastrum sexangulare
				Staurodesmus convergens
				Staurodesmus dejectus
Chrysophyta	**Xanthophyceae**	Heterotrichales	Tribonemataceae	*Tribonema sp*
Bacillarophyta (Diatoms)	**Bacillariophyceae**	Bacillariales/ Pennales	Coscinodiscaceae	*Aulacoseira sp*
				Melosira sp
			Fragilariaceae	*Fragillaria sp*
				Synedra sp
			Achnanthaecae	*Cocconeis*
			Naviculaceae	*Navicula sp*
			Gomphonemataceae	*Gomphonema sp*
			Nitzschiaceae	*Nitzschia sp*
			Surirellaceae	*Suriella sp*
Pyrrophyta	**Dinophyceae**	Peridiniales	Gonyaulacaceae	*Gonyaulax sp*
		Gymnodiniales	Gymnodiniaceae	*Gymnodinium sp*
Cyanophyta (Blue-green Algae)	**Cyanophyceae /Myxophyceae**	Chroococcales	Chroococcaceae	*Gloeocaspa sp*
				Synecocystis sp
				Aphanocapsa sp
				Microcystis sp
				Merismopedia sp
				Coelosphaerium sp
			Scytonemataceae	*Microcoleus sp*
		Nostocales	Oscillatoriaceae	*Oscillatoria sp*
				Phormidium sp
			Rivulariaceae	*Rivularia sp*
				Gloeotrichia sp
	Cryptophyceae	Cryptomonadales	Cryptomonadaceae	*Cryptomonas sp*

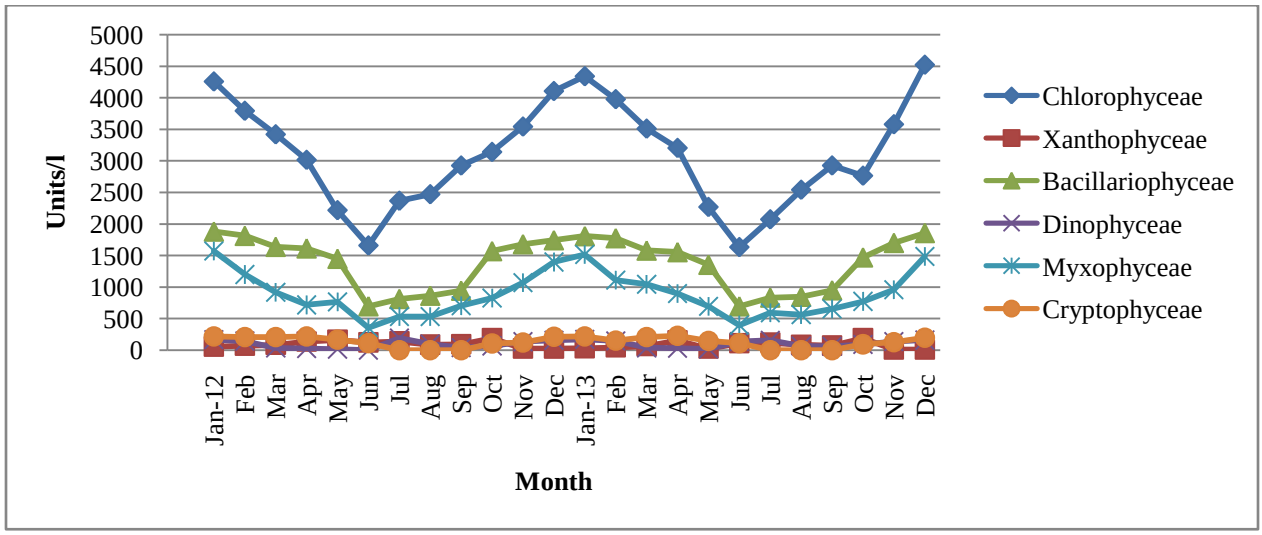
Table 2: Monthly variation of Phytoplankton groups (units/l) in Natuwadi dam during January 2012 to December 2013

Months	Planktonic groups					
	Chlorophyceae	Xanthophyceae	Bacillariophyceae	Dinophyceae	Myxophyceae	Cryptophyceae
Jan-12	4257	56	1880	167	1573	220
Feb	3792	72	1812	144	1200	208
Mar	3419	84	1638	35	917	210
Apr	3014	136	1613	23	718	218
May	2216	163	1449	17	764	167
Jun	1657	123	697	0	355	113
Jul	2365	138	813	192	531	0
Aug	2469	87	865	94	534	0
Sep	2924	94	944	42	704	0
Oct	3140	190	1570	68	825	105
Nov	3542	26	1680	134	1069	120
Dec	4105	23	1743	156	1398	212
Jan-13	4340	32	1807	172	1519	220
Feb	3976	43	1775	148	1112	152
Mar	3509	68	1579	38	1047	210
Apr	3203	155	1554	28	898	228
May	2267	23	1354	22	695	149
Jun	1631	110	696	135	398	110
Jul	2071	120	835	156	592	0
Aug	2540	85	848	67	562	0
Sep	2925	72	950	59	653	0
Oct	2763	190	1471	89	773	94
Nov	3578	12	1700	137	957	126
Dec	4522	10	1857	160	1487	198
Total	74225	2112	33130	2283	21281	3060
%	54.54	1.55	24.43	1.67	15.63	2.24

Table 3: Percent composition of Phytoplankton groups in Natuwadi dam

Year	Phytoplankton groups					
	Chlorophyceae	Xanthophyceae	Bacillariophyceae	Dinophyceae	Myxophyceae	Cryptophyceae
2012	54.24	1.75	24.55	1.57	15.56	2.31
2013	54.83	1.35	24.13	1.77	15.71	2.18
Avg. %	54.54	1.55	24.34	1.67	15.63	2.24

Fig. 1: Monthly variation of Phytoplankton groups (units/l) in Natuwadi dam during January 2012 to December 2013



WATER QUALITY STATUS OF KALLESHWAR TANK, SHIROL FROM KOLHAPUR DISTRICT, MAHARASHTRA

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ABSTRACT:

The present investigation reveals physicochemical characters of water from Shirol reservoir from Shirol tehsil, Kolhapur district, Maharashtra. It lies between 16.7480° N, 74.5909° E with 5.76 hector area. It receives average annual rain fall of 550 mm. Limnological studies of this reservoir were carried out during the period of December 2015 to November 2016 and various physicochemical parameters like temperature, transparency, pH, electric conductivity, free CO_2, total hardness, calcium and magnesium, total alkalinity, chlorides and Dissolved Oxygen were analyzed from surface water of the reservoir. During this analysis it had been found that all the parameters were in the limits prescribed in WHO standards and exhibited monthly variation except free CO_2 which had not shown much fluctuations. The trend of total hardness, calcium and magnesium hardness showed in the month of November which is out of usual trend because of frequency of cloth washing is more in this month. Overall the quality of this pond water is good and triggers the ecosystem development but not potable to human as the water is turbid in most of the months.

KEYWORDS: Water reservoir, physicochemical characteristics, water quality

INTRODUCTION:

India is facing a serious problem of natural resource scarcity, especially that of water in view of population growth and economic development. However, studies related to ecology and environment are often perceived as 'anti-development and detrimental to the overall growth and welfare of human beings and are viewed with suspicion and generally considered as nuisance. The trophic status of a water body depends on the locality and its topography. Of all renewable resources of planet, water has the unique place. It is essential for sustaining all forms of life, food production, economic development and for general wellbeing. Due to tremendous development of industry and agriculture, the water ecosystem has become perceptibly altered in several respects in recent years and as such they are exposed to all local disturbances regardless of where they occur [1]. Wetlands provide subsistence and livelihood for people through irrigation and agriculture, fish culture and fishery, domestic use and water

transport. These water bodies are the major life supporting systems facing ecological degradation today due to irrational human interference and unsustainable developments. The demographic pressure or the anthropogenic disturbances on our water resources and its ecosystems will irrevocably damage and destroy the rich biodiversity supported by it [2].

MATERIALS AND METHODS:

Study Area:

Kalleshwar tank (16.7480° N, 74.5909° E) is manmade, small reservoir having an area (Submergence) of 5.76 ha, situated in Shirol village on Sangli service road. Reservoir bank is covered by civilization. The population of this village is about 25000. The annual rainfall of this area is about 550 mm. Water from this reservoir is used for domestic purposes like cloth washing and bathing. Water is also used for animal washing and animal drinking purpose. Although the limnological studies and water quality status was exclusively studied over the last few decades, this area of Kolhapur district from Maharashtra have been neglected so the present study is carried out to reveal the physico-chemical characteristics and accordingly the suggestions are given to enhance the sustainability of people around the reservoir.

Collection of samples:

The samples of surface water were collected monthly from Shirol reservoir during December 2015 to November 2016. The samples were collected in plastic container in the morning hours and brought to the laboratory for further analysis.

Analysis of physico-chemical properties:

For the analysis, the standard methods were used. Some parameters like Temperature, pH, Transparency was done at the investigation sites. The sample for DO was fixed in the BOD bottle at the sites and then brought to the Laboratory for analysis. Winkler's method was followed for this analysis, while remaining analysis was made by the standard methods [3, 4].

RESULT AND DISCUSSION:

Results for physicochemical parameters at Kalleshwar Tank is depicted in Table 1.

Temperature:

Atmospheric and water temperature both play an important role in the physico-chemical and physiological behavior of the aquatic system. It also exerts profound direct or indirect influence on metabolic and physiological behavior of aquatic ecosystem [5]. Monthly variation in atmospheric and water temperature ranges from 23^{0}C to 33 ^{0}C, with average of 26.083^{0}C and 19 ^{0}C to 29 ^{0}C with average of 23.583^{0}C respectively. The atmospheric temperature was noted minimum in the month of December

while maximum in the month of April whereas water temperature was minimum in the month of December while maximum in the month of March. Similar trend of minimum during winter season and maximum during summer was given by Naik and Purohit [6].

Transparency:

Transparency is a characteristic of water that varies with the combined effect of color and turbidity. It is universally proportional to the turbidity which intern is directly proportional to the amount of suspended organic and inorganic matter. The monthly variation in transparency ranges from 8 cm to 92 cm, with an average of 42 cm. It was recorded maximum in the month of November while it was recorded minimum in the month of June. The lower transparency during rainy season might be due to silt brought into the reservoir and higher transparency during the winter season due to gradual settlement of silt.

pH:

pH is one of the very significant chemical characteristic of all waters, which explains certain significant biotic and abiotic ecological characteristics of aquatic systems in general. pH values ranges from 6 to 8.02, with an average of 6.993. It was minimum in the month of May and maximum in the month of January. Similar trend of pH higher in winter and lower in summer was noted by Mathivanan *et al.* [7]. Increment in pH value in the winter season was resulted due to decomposition of aquatic vegetation.

Electric conductivity:

EC is a basic index to select the suitability of water for agriculture purposes. EC in the water is due to ionization of dissolved inorganic solids and is a measure of total solids [8]. EC values ranges from 0.04 to 0.21 mhos/cm, with an average of 0.122 mhos/cm. Minimum electric conductivity was recorded during June whereas maximum during December. Lower EC during rainy season due to dilution of water by rain. Similar trend of EC lower in rainy was given by Verma [9].

Free CO_2:

Free CO_2 values ranges from 4.4 mg/l to 17.6 mg/l, with an average of 9.533 mg/l. It was minimum in the month of March and April whereas maximum in the month of September. Similar trend was given by Narayan *et al.* [10] and given the justification that higher concentration of Free CO_2 is due to respiration of organisms and absence of photosynthesis.

Hardness:

Hardness is the property of water which prevents lather formation with soap and increases the boiling point of water. Principle cations of hardness are calcium and magnesium. The anions responsible for hardness are bicarbonates, carbonates, sulfate, nitrates and silicates. Monthly variation in hardness ranges from 12 mg/l to 46 mg/l, with an average of 30 mg/l. Minimum hardness was recorded in the

month of June whereas maximum in the month of November. Similar trend of lower hardness in summer and higher during rainy was reported by Shinde *et al.* [11].

Calcium and Magnesium:

Calcium values ranges from 4.01 mg/l to 15.33 mg/l. Minimum value of calcium was recorded in the month of June and maximum in the month of November. Magnesium values ranges from 1.04 mg/l to 7.47 mg/l and shown lower values in June while higher in the month of November. As calcium and magnesium were constituent of hardness, same trend was observed in there parameters as hardness.

Total Alkalinity:

Alkalinity is used as criteria for determining the nutrient status of water. Monthly variation in total alkalinity values ranges between 12 mg/l and 28 mg/l, with an average of 15.66 mg/l. It was observed minimum in the month of August, September and October whereas maximum in the month of December. Similar trend of lower total alkalinity during rainy and higher during winter was also given by Latha and Mohan [12]. Alkalinity increased in the winter season might be due to heavy rain in the months of winter and low photosynthetic activity and decreased in rainy season might be due to delayed rainy season which ultimately increased photosynthesis in these months. Alkalinity is a measure of buffering capacity of water and is important for aquatic life in a fresh water system, because it equilibrates the pH changes that occur naturally as a result of photosynthesis activity of phytoplankton [13]**.**

Chloride:

Chloride values ranges from 14.02 mg/l to 42.06 mg/l, with an average of 24.765 mg/l. Minimum chlorides were observed in the month of September and maximum in the month of December. Sudden increase of chloride concentration in the month of December may be due to increased anthropogenic activities, animal activities, heavy runoff of water and high salts get added from catchment area. Similar trend of chloride highest during winter and lower during rainy was emphasized by Devi *et al.* [2].

Dissolved Oxygen:

DO reflect the water quality status, physical and biological processes in water and show the metabolic balance of lake. DO is an important water quality parameter in accessing water quality. In present investigation DO values ranges between 6.4 mg/l and 12.8 mg/l, with an average of 9.333 mg/l. Highest DO was recorded in the month of January whereas lowest was recorded in the month of September.

CONCLUSIONS:

Total hardness, calcium, magnesium, alkalinity and chlorides were found maximum in the months of winter season, which is an unusual trend because of delayed and prolonged rain pattern in

this area during the year 2015-16. Although the water from this reservoir is suitable for drinking purpose on the basis of physico-chemical parameters and WHO norms, it is recommended that water, not to be used for drinking purpose because of high interference of animal washing throughout the year. On the basis of this preliminary work, it has also been concluded that the water from this reservoir is suitable for the commercial fishing purpose and it is recommended that this water reservoir should be utilized for fishery. As water level decreases in the month of April, May and early June, harvesting of full grown fish is quite easy in the month of February and March. It is also concluded that water from this reservoir is suitable for agricultural purpose but because of River Hiranyakeshi, which is close to the village, people are not using water for irrigation purpose.

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Table 1: Physico-chemical parameters of Kalleshwar Tank, Shirol

Parameter/ Month	A. T	W. T	Transparency	pH	EC	CO_2	Total Hardness	Ca-Hardness	Mg-Hardness	Alkalinity	Chlorides	DO
January	24	23	25.5	8.02	0.11	8.8	36	11.228	6.01	26	22.43	12.8
February	24	25	19.5	6.79	0.09	8.8	28	9.624	4.46	20	22.43	8.4
March	30	29	10	6.78	0.104	4.4	34	9.624	5.7	16	25.23	9.2
April	33	27	9	6.5	0.081	4.4	30	8.822	5.14	16	30.84	8
May	30	26	9	6	0.1	8.8	24	6.416	4.27	18	36.45	10.8
June	25	24	8	6.13	0.04	13.2	12	4.01	1.94	16	16.82	10.8
July	25	23	70	7.13	0.128	8.8	30	4.812	6.12	14	22.43	9.2
August	26	22	70	6.91	0.129	8.8	24	4.812	4.66	12	22.43	8.4
September	24	23	72.5	7.62	0.2	17.6	26	6.416	4.75	12	14.02	6.4
October	23	20	82	7.37	0.15	13.2	32	4.816	6.6	12	16.82	7.6
November	26	22	92	7.36	0.13	8.8	46	15.23	7.47	16	19.62	6.8
December	23	19	36.5	7.31	0.21	8.8	38	10.426	6.7	28	42.06	11.2
minimum	23	19	8	6	0.04	4.4	12	4.01	1.94	12	14.02	6.4
Maximum	33	29	92	8.02	0.21	17.6	46	15.23	7.47	28	42.06	12.8
Average	26.08	23.58	42	6.99	0.123	9.53	30	8.0196	5.3183	17.16	24.298	9.13

All values are in mg/lit. except temperature (^{0}C), transparency (cm), pH and E.C(mhos/cm)

SEASONAL VARIATIONS IN PHYSICOCHEMICAL PROPERTIES OF WATER SAMPLES IN KARAMBAVANE CREEK, WEST COAST OF INDIA

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ABSTRACT:

Major sources contributing to marine pollution are the natural processes and anthropogenic activities. Natural processes include precipitation, erosion, weathering of crystal material; whereas anthropogenic activities areurbanization, industrialization, mining and agricultural activities, etc. Lote-Parshuram industrial area is a chemical industrial zone which releases their treated waste water in the Dabhol creek and is the major source of anthropogenic activity contributing to the pollution. The present study was carried out to find the changes in physicochemical parameters at Karambavane creek. The various parameters like temperature, pH, salinity, DO, BOD, COD, hardness, TDS and chlorides, were measured during February, 2013 to January, 2014. Minimum and maximum values of surface water temperature were (26.1-28.5^{0}C), pH (6.88-7.88), salinity (1.6-11.3 (^{0}/00), DO (5.10-6.87mg/lit), BOD (4.1-4.9mg/lit), COD (18-46mg/lit), hardness (46-560mg/l), TDS (116-815mg/l) and Chlorides (102-6485mg/l).

KEYWORDS: Physicochemical parameters, Karambavane creek, West Coast.

INTRODUCTION:

The marine environment, mainly coastal and estuary, forms an essential component of the global life. In developed and under developed countries human activities can affect the characteristics of the water in their estuaries. The environmental impacts of anthropogenic activities are numerous hence inputs of contaminants can affect the aquatic biota as well as the health of the marine environment [1]. In the marine environment estuary is a complex environment which plays a major role in biodiversity [2, 3]. Highly productive areas which plays crucial role in breeding and as nursery grounds for many important marine species are mangrove zones, salt marshes, mudflats, sea grass, seaward beds etc [4, 5].

Quality of water depends on both natural processes, such as precipitation erosion, weathering of crystal materials and anthropogenic activities are like urbanization, industrialization, mining and agricultural activities [6].These activities play a crucial role in nutrient cycling, eutrophication, biota

abundance and overall food web dynamics in estuarine and near shore ecosystems.Along with these parameters, human activities like industrialization, urbanization, tourism and domestic waste are also affecting to the quality of water to a greater concern now a days [7, 8, 9].

An estuary essentially has salt water, brackish water and fresh water zones with an increasing distance from the mouth of an estuary. Estuary is a high productive area in the coastal zone. It is a partially enclosed, funnel shaped area of coastal water, where seawater mixes with fresh water and nutrients from rivers and runoff from land enriches the area.Estuarine water quality along the west coast of India are highly disturbed and threatened, and deteriorated to the pollution, siltation and erosion, flooding, saltwater intrusion, storm surges and other hazards. Studies of the water quality through the appropriate control measures, and monitoring of diverse quality parameters have become very important and essential to ensure the sustainable development and management of the coastal systems and their resources[10], [11].

The aim of present research is to study the seasonal changes in physicochemical parameter due to the impact of pollution sources and industrial effluents on Karambavane creek environment at Chiplun, Ratnagiri, West coast of Maharashtra, India.

MATERIALS AND METHODS:

Area of Study:

The study area lies at a station in Karambavane creek (Latitude: 17° 34.867'and Longitude: 73° 25.913') Karambavane creek has charming stretch of land on the west coast of India. The region is bordered by Sahyadri hills on the east and Arabian Sea on the west. The unique feature of this area is confluence of two rivers, Jagbudi and Vashishti joining at the Dabhol creek and further flowing in to the Arabian Sea. Water pollution on this coastal front has direct impact on marine ecosystem, human community and therefore it has significant importance to monitor sea water quality.

Climatic Conditions:

It is track of high rain fall with rain fall 3000 mm to 5000 mm year. The place experiences the onset of the monsoon in the month of June and experiences monsoon till the end of September. The average temperature recorded varies from 25^0C to 40^0C.

Physicochemical Study:

Polythene bottles were used to collect water samples. The bottles were thoroughly cleaned with hydrochloric acid, washed with tap water to render free of acid, washed with distilled water twice, again rinsed with the water sample to be collected and then filled the bottle with the sample leaving only a

small air gap at the top. The sample bottles were Stoppard and sealed with paraffin wax. The samples were collected and analyzed for Temperature, pH, Salinity, Dissolved Oxygen (DO), Bio-chemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Hardness, Total Dissolved Solids (TDS) and Chlorides content. The techniques and methods followed for collection, preservation, analysis and interpretation were as per APHA [12].

Water samples were collected from the Karambavane creek at a station during 2013 to 2014. Surface sampling was carried out in three different seasons such as, premonsoon (Feb - May) monsoon (June – Sept.) and post monsoon (Oct – Jan.). Surface water temperature,pH was measured by using Elico Grip pH meter (Mode-2I-120). Salinity, dissolved oxygen (DO) were measured by the standard methods [13]. DO and 5days BOD were estimated by Winkler's method. Chloride estimation was doneby following the standard method described by Strickland and Parsons [14].

RESULTS AND DISCUSSION:

Table 1: Seasonal variations in physicochemical properties of water samples from Karambavane creek during 2013-2014

Parameters / Season	Pre monsoon	Monsoon	Post monsoon
	Mean ± S.D.	Mean ± S.D.	Mean ± S.D.
Temperature	28.22 ± 0.02	26.52 ± 0.65	26.47 ± 0.49
pH	7.20 ± 0.08	7.33 ± 0.41	7.21 ± 0.21
Salinity	5.55 ± 3.38	2.42 ±1.02	8.7 ± 2.14
DO	6.005 ± 0.59	5.72 ± 0.46	6.06 ± 0.29
BOD	4.1 ± 0.34	4.55 ± 0.23	4.47 ± 0.43
COD	35.50 ± 8.54	26.50 ± 13.10	35.00 ± 10.89
Hardness	270.50 ± 89.42	81.50 ± 30.35	378.50 ± 197.29
TDS	238.5 ± 87.59	550.75 ± 210.19	429.50 ± 285.23
Chlorides	993 ± 601.08	312.75 ± 322.48	4365.50 ± 3444.08

Temperature:

Temperature is an important ecological factor has influence in all the living beings and act as an ecological limiting factor. It plays a vital important role in aquatic ecosystems by affecting metabolism and other physiological activities [15].The mean water temperature was found to be ranging from 28.22

to 26.47 ^{o}C and there was no significant difference between their annual pattern. The maximum temperature was noted in pre monsoon season.

pH:

pH tends to increase during day due to photosynthetic activity (consumption of CO_2) and decreases during night due to respiratory activity (consumption of O_2).pH of waste water and polluted natural waters depend largely on the nature of the pollutant.pH is one of the crucial parameters in aquatic ecosystem and affects almost all biochemical activities. Metabolic activities ofaquatic organisms are affected by pH[16].Low pH 6.88 was observed during the post monsoon season which may be due to the influence of fresh water influx, dilution of sea water, low temperature and organic matter decomposition. The mean pH during pre-monsoon, monsoon and post - monsoon seasons were 7.20, 7.33 and 7.21 respectively.Significant change in pH was observed during monsoon season.

Salinity:

In the present study salinity was significantly higherduring post monsoon season(11.30);while it was low (1.6) during monsoon season. This may be due to the high influx of fresh water in the reference site and increased influx of industrial effluents at the sample collection site. The mean of salinity ranged from8.7 -5.55 ^{0}/00.Significant variations in salinity in the monsoon and post monsoon season may be attributed in general to rainfall.

DO:

Dissolved oxygen (DO) is a very important parameter as itindicates the physical, chemical andbiological activities of the aquatic ecosystem.The highest DO content was recorded during pre-monsoon season (6.87) and lowest at the onset of monsoon (5.10).During post-monsoon there was a significant variation in DO. DO is very crucial for the survival of aquaticorganisms and is also used as a parameter to evaluate the degree of freshness of water[17].

BOD:

Biological Oxygen Demand (BOD) is the amount of oxygen required by the living organisms engaged in the utilization and ultimate destruction or stabilization of organic water. It is a very important indicator of the pollution status of water body. There was no significant change in the biochemical oxygen demand (BOD) of the study site during study period. It was 4.1, 4.55, and4.47 during pre-monsoon, monsoon and post-monsoon season.The BOD was lowest during pre-monsoon (3.6 mg/l) and highest during post monsoon (4.9 mg/l).

COD:

Chemical Oxygen Demand (COD) estimates carbonaceous factor of organic matter and it is a measure for pollution in aquatic ecosystems. In present study its range was from26.50mg/l -35.50mg/l. It was lowest in monsoon months (20 mg/l) and highest during post monsoon (46.28 mg/l).

Hardness:

Total hardness is the measurement of the capacity of water to precipitate soap, chiefly due to the presence of calcium and magnesium in the water; therefore, in the present study is defined as the sum of calcium and magnesium concentration and the total hardness was comparatively higher during the summer, and minimum duringpost-monsoon. The mean values were 81.50, 270.50 and 378.5mg/l during pre-monsoon, monsoon and post-monsoon, respectively.

TDS:

Total dissolved solids (TDS) are measure of the combined content of all inorganic and organic substances contained in a liquid as molecular, ionized or suspended form. In present study pre monsoon TDS recorded was238.5mg/l and higher TDS recorded during monsoon season was 550.75 mg/l. There was significant variation recorded during pre- monsoon season± 87.59 mg/l.

Chlorides:

The accumulations of chloride content were high in the post monsoon and recorded as 7750 and also lowduring monsoon season. The average values were 993, 312.75 and 4365.50mg/lduring pre-monsoon, monsoon and post monsoon respectively.

CONCLUSION:

The study indicated significant variations in values of pH, Salinity, Hardness and Chlorides during various seasons, which may affect potential yield of estuarine organisms. Therefore, it is necessary to frequently monitor water samples from Karambavane creek.

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STUDIES ON BIOGEOGRAPHICAL DISTRIBUTION OF AVIFAUNA IN DEVGAD TEHSIL (SINDHUDURG)

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ABSTRACT:

As a well established fact, avifauna is very sensitive for their habitat structure and the overall environment available in that for their natural sustenance. Any minor change in the habitat structure is sensitively reacted by them. Their relationship with the stability of their natural ecosystems is a well-studied fact. Depending on the type of habitats available in a given region, diversity of birds also differs. Devgad tehsil of Sindhudurg district is such a typical geographical region where almost 146 different bird species have been recorded in last decade Most of the species in tehsil are resident of the region while some are migratory. Varied types of habitats and richness of supportive natural resources is responsible for that. This has facilitated survival of a wide diversity of birds in the tehsil area. It is also a fact that though the species richness is there, species abundance in relation to population density is not significant all over and equal in similar types of habitats. It is due to difference in the size of habitat as well as due to certain man made interactions in the places. A study was done to evaluate the overall diversity in relation to these factors.

KEYWORDS: Biogeographical distribution, avifauna, Devgad, habitats

INTRODUCTION:

Sindhudurg district is well known district on the West coast of South Konkan of Maharashtra for its natural richness and tourism. The total geographical area of the district is 5219 sq.km. It is located on $16^{o}4'$ N to 16^{o} 8' N and $73^{o}8'$ E to 74^{o}E.

Devgad is a coastal Town in Sindhudurg district. The types of habitats available in the district can be classifiedas terrestrial habitat, fresh water habitat, marine habitat, estuarine habitat including mangrove covers as well as open arid lands, cultivated lands, scrubby wooded zones as well as forest covers. Hence, substantial and diversified food resources are available to sustain a richavifaunal diversity. Avian diversity distributed all over the tehsil is observed throughout with specific geographical

distributions.Bird life in Sindhudurg district represents almost 255 different species distributed throughout the district among 57 families of the group. As per the observations done in last 8 years, the avian diversity in Devgad Tehsil is comprised of 146 species in total.

Though the species diversity is considerable throughout the tehsil, the species abundance in most of the species is significantly less and varying in different parts. Some common birds like Common domestic crow [*Corvussplendens*], Jungle Crow [*Corvusmacrorhynchos*], Blue rock pigeon [*Columba liva*], Spotted dove [*Streptopeliachinensis*], Black kite [*Milvus migrans*], Brahminy kite [*Heliaster indus*], Red Vented Bulbul [*Pycnonotuscafer*], Red whiskered Bulbul [*P. jacosus*], Egrets and herons of different kinds etc. have been observed to maintain their populations adequately in all parts. It is possibly due to the greater adaptability of such birds in terms of their feeding habits, tolerance to the human vicinity and consequent interference. But the remaining bulk of the avian diversity is facing the ecological strainon their feeding habits and resources due to their own inherited habits and manmade disturbances.

Rapid destruction and fragmentation of the habitats overuse of insecticides and pesticides in fruit cultivations and poaching to some extent has been found to affect the species abundance negatively.

OBJECTIVES:

1. To observe and survey the avian diversity distributed among different eco-geographical parts of Devgad tehsil.
2. To analyze the avian biodiversity according to season and the geographical parameters of the habitats
3. To determine threats of human activities towards the alterations in the habitat structures and consequent decline in avifaunal densities

MATERIAL AND METHOD:

Study area:

The study area selected for the study included a wide range of different types of habitats. But the main representative areas selected were as follows…

1. Agricultural region mostly practiced for Paddy and Barley cultivations only during the rainy season and to some extent during the winters.
2. Mangrove thickets of Wadatar-Malai Creek near Devgad Town.
3. Mango cultivations in Wada and Nadan Villages in North of Devgad town.
4. Open arid land plateau of Talebazar and Lingdal villages in the East of Devgad.

5. Estuarine coastal lines of Kunakeshwar, Mithbav and Tambaldeg villages representing sandy and rocky beaches along with mangrove patches.
6. Open arid land plateau of Girye-Vijaydurg villages in the North-West of Devgad.

METHODOLOGY:

The methodology followed for the avifaunal study can be put in front step wise as follow:

1. The selected sites were visited at a regular interval of time as well as according to the time available.
2. The observations of the birds were done by using capable binoculars of 10 x 35 capacity.
3. Identification of the birds during the study period has been done by using proper identification keys available at hand [1, 2, 3, 4].
4. Photography was done by using a standard digital camera. The observations were made mainly during the early mornings or in the evenings.

The studies were carried out during the period of four years from October 2013 to December 2016. During that, avian species diversity was given prime importance rather than the relevant population density.

OBSERVATIONS:

1. Overall **146** species of birds were observed during the study period. It is belonging to total **55** families out of total **57** families found all over the district. It constitutes 59.60% of the total avian diversity known to be observed throughout the district. Thus it is significantly rich and well distributed all over the tehsil.
2. Population density of all the species was varying according to the season and the type of habitat in different eco-geographical parts of the Devgad tehsil.
3. Avifauna belonging to 02 families out of 57 total families found in the district were not observed in Devgad tehsil but distinctly observed in other parts of the district. Those families are Anatidae and Jacanidae.
4. The rich avian diversity in all the habitat types was detected in all the mangrove ecosystems in the tehsil. They comprised almost **87** species belonging to **38** different families. It is about 59.60% of the total avifaunal diversity in the tehsil.
5. Open and arid lands represented very less biodiversity and that also of typical land birds reaching to a number of 23 species belonging to only 7 families. Some of the specieswere found

in other habitats also. Ex.: Black kite. But birds belonging to family Alaudidae were observed strictly restricted to open lands only. Thus it is just 15.75% of all the avifaunal diversity in selected study area.

6. All other habitat types represent more or less distribution of all the species throughout the tehsil, utilizing even the benefits of human vicinity.
7. Some species were found to be migratory and were seen mostly after the rains till the next rains. But almost 85% of the avifauna is permanent resident of the tehsil.
8. There are certain direct and indirect manmade threats generated to the survival of avifaunal diversity in the tehsil. Those include extensive use of pesticides, rapidly increasing human civilizations, deforestation, poaching, road accidents and destruction of nests, eggs and young ones knowingly or unknowingly. These threats are apart from the regular natural threats that the birds face to survive.

RESULT AND DISCUSSION:

As per the records till date and checklists available, there are total 255 species of birds belonging to 58 families distributed all over the Sindhudurg district which are observed in different periods of the year. Some species of them are migratory while almost 80% species are residents. If the overall scenario of the bird diversity all over Maharashtra state is concerned [540 species], it constitutes 42.33% of the total Indian diversity [1347 species] [3]. If the diversity in Sindhudurg district is concerned in reference to total Indian avian diversity, then it constitutes 19% . If the same is considered in context to the Maharashtra state, then it comes out to be almost 45% of the total [5]. Devgad tehsil comprises a significant bulk of the avifauna with 146 varieties from 55 different families. It does not mean that it is the number of all species observed in the tehsil. Some species may have been missed during the study period due to limitations in the observation methods and limitations of the area itself.

Of the 55 families, family Ardeidae represents the maximum species diversity with 10 species under it. It was also found to have the most rich species abundance and population density of all. It is followed by the family Muscicapidae with 8 species and family Columbidae with 7 species. Family Cuculidae includes 5 species and stands third in the rank. Nine families as Alaudidae, Alcenididae, Charadridae, Hirundinidae, Motacillidae, Phasinidae, Picidae, Sturnidae and Timallidae have 4 representatives of each. The remaining 41 families have either 3, 2, or just 1 representative of them. Thus it could be noted easily that there is significant species richness but poor species abundance.

If population density is concerned, again the family Ardeidae dominates here. The Variety of egrets and herons are found distributed all over the tehsil, occupying almost every type of habitat and feeding source. But most of their abundance is concentrated among the mangrove thickets throughout [6]. Large heronaries have been detected among the mangroves of Wadatar-Malai creek and Mithbav creek indicating main dependence of the family members on marine food resources.

Thus the studies made on ecological interactions of birds in any habitat can cover wide range of ecological factors in the habitat and almost every animal group present in that ecosystem as the birds interact almost with every species in their surrounding directly or indirectly. Hence briefly, avifaunal diversity of Devgad Tehsil is certainly rich and needs to pay attention for its conservation by all means. Environmental education of common local man in terms of biodiversity conservation and sustainable development is also a need of time.

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COMPARATIVE STUDY OF DIFFERENT METHODS FOR BIOMASS ESTIMATION OF TEAK

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ABSTRACT:

The level of CO2 in the atmosphere is constantly rising from the advent of the industrial revolution. Today it has reached to the 390ppm i.e. about 004% in atmosphere. The plantations are seen as one of the measures to mitigate these rising levels of CO2. Teak plantations are now utilised as carbon storage projects in many tropical countries. Present study screens the methods of measuring the biomass of the bole of teak plant. The bole of the tree harvested having diameter of 4.3 cm at the breast height of the tree. The biomass of the bole was calculated by directly oven drying and by using allometric equations specific for the bole. The carbon content was measured based on the conventions of IPCC. By comparing both the values it was found that both differ by slight variations.

INTRODUCTION:

From time immemorial the Carbon formed one of the principle backbones of the living systems. But in present scenario its combination with the oxygen is ringing alarming bells for the existence of the living beings. The concentration of the CO2 in the atmosphere is constantly rising from the 280ppm of preindustrial era to the 390ppm of today [1]. This is not only the result of industrialization but other anthropogenic activities like burning of fossil fuels, deforestation; increasing population also has contributed significantly to this. This rising CO2 level has given rise to the new phenomenon called global warming. This demon of global warming has alarmed the world scientific community which is thriving hard to find out the solution for this. But the nature has its own mechanisms to rectify the wrongs done by the human being. The plants are acting as the main CO2 sinks as they absorb it and store it in the long run [2]. The tropical forests are playing major role in sequestering the major portion

of the CO2 in the biomass [3]. In the Asian countries like India, Indonesia, Malaysia, Myanmar, Nepal etc; the vast stretches of the tropical forests are the major sinks of the world.

The major plantations of the Asia and Africa are dominated by the teak. The durability and workability of the teak makes it most preferred tree for plantation. Also the sequestration of carbon can be seen as one of the incentives of such plantations. The young plantations can relatively sequester carbon rapidly and the old plantations act as reservoir of it. The utilization of teak in furniture and as building material rather than fuel can also give the advantage of extending the storage period.

Several methods and procedures are suggested for arriving at the amount of carbon fixed in the plants. Most of the methods provide approximate estimations. There is a need to further investigate on the same and to check out the reliability and feasibility of these methods. Present study aims at investigating the biomass estimation of teak plant by two different methods - direct harvesting (destructive method) and use of allometric equation (non destructive method). Further these biomass values from two different methods are used to calculate the carbon sequestered in the same plant. To check out this only the bole biomass of the tree was considered to ignore any discrepancies that may arise out of the errors in measurements.

MATERIALS AND METHODS:

The teak plant was located from the outskirts of the Gargoti town (NL 16 18 54 and EL 74 08 26 altitude 573m). This region falls on the eastern slopes of the Sahyadri Mountain, having annual precipitation around 1800 mm. The climate here is classified as Aw on the Koppen-Geiger system.

There are two methods of field measurement – destructive and non destructive. In destructive method the plant is directly harvested from the site and weight of the different components of the tree like trunk, branches, leaves etc. is measured [4]. Again the weight of the oven dried materials is estimated. This method is feasible only for the plants with small biomass. For the present study, the bole of the tree was harvested from the site. It is then cut into pieces and then oven dried to a constant weight. Prior to this the procedure for second method was followed involving the measurements like tree height (H), diameter at the breast height (DBH) and specific gravity of the wood. In this method there is no need of felling the tree. The dry biomass of the tree was calculated by using the method of Colgan et al [5]. The horizontal cross section i.e. disc at the base of the tree was taken. The weight of the disc was recorded (field weight FW), then dried in oven to a constant weight (DW) and water content (WC) of the disc was calculated by using the equation

$$WC = \frac{FW - DW}{FW}$$

Then the dried weight of the disc is determined and volume of the disc is measured by water displacement method. These values were used to calculate the density of the wood. By using the same method the volume of the dried pieces of the bole was calculated and its biomass is estimated by multiplying its wet mass with (1- WC).

For the second method the biomass of the bole of tree was calculated by using the different parameters like bole height (H), density of the wood (ρ) and diameter at the breast height (DBH). These parameters are utilized in the allometric equation developed by Chaturvedi and Raghuvanshi for the bole biomass estimation of teak in tropical forests [6].

$$InY = 5.153 + 0.448\ InX \qquad R2=0.934$$

where $X = \rho D^2 H$

RESULT AND DISCUSSION:

The diameter (DBH) of the bole at breast height was found to be 4.2 cm, density was 0.57 g/cm3 and tree height was 4.07 m. The dry biomass of the tree was 23.48 kg by the allometric equation method. By the destructive method the dry weight of the bole was found to be 26.07 kg. The difference between these two types of estimates is around 2.59 kg which is not very insignificant. The difference in the weights can be attributed to the errors in the measure of parameters for non destructive method. Although the allometric method counts the various parameters like diameter, density and tree height the accurate dry weight estimation may need the consideration of any other parameter. While applying the allometric equations to the biomass estimation the location of the area from where the tree is harvested is also important. So, we recommend to derive the location specific and species specific allometric equations for biomass estimation of any tree.

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USES AND CONSERVATION OF SOME ETHNOMEDICINAL PLANTS BY BHILS AND BARELAS FROM EAST NIMAR, MADHYA PRADESH, INDIA

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ABSTRACT

According to present study 45 plants are naturalized in all parts of East Nimar belonging to 12 families and 34 genera. A family - wise analysis of all the 45 plants is carried out. Fabaceae emerges as the largest family followed by Cucurbitaceae and Liliaceae. The other families, such as Asclepiadaceae shares (4 species), followed by families, Aristolochiaceae and Capparaceae (2 species), Pssifloraceae, Polygonaceae, Basellaceae, Sapindaceae, Celastraceae and Combretaceae (1 species each).

The common diseases of the tribals from this area are respiratory disorders, stomach and abdominal disorders, flatulence, diarrhoea and dysentery, malaria fever tuberculosis, skin diseases, venereal diseases, conjunctivitis. Besides, there are some diseases reported as specific to men, women or children in tribal communities. Men occasionally suffer from liver problems, possibly due to consumption of country liquor, typhoid, headache, eczema and venereal diseases. Constipation and appendicitis are not common among them because of consumption of large amount of leafy vegetable.The common female diseases are intestinal worms, anaemia, leucorrhoea, hysteria, dysmenorrhoea (painful menstruation) etc. The abortion practice is not uncommon. The traditional knowledge and resource management practices of the indigenous people should be applied in modern development strategies.Traditional knowledge of indigenous people with modern tools of genetic engineering to get the desired results.

KEYWORDS: Ethnomedicine; Bhils; Barela; East Nimar

STUDY AREA:

East Nimar comprises of two districts viz. Khandwa and Burhanpur. The Khandwa district lies between 21^0 05' to 22^0 20' N and 76^0 01' to 76^0 40' E. The total geographical area of the district is 6206 km^2 . Khandwa town is headquarter of the district. The district has 3 Tehsils viz Khandwa, Harsud, and Pandhana. There are 7 development blocks, 7 Janpad Panchayats and 332 Gram Panchayats. Each Panchayat consits of few villages; most of the towns of the district are connected by motorable roads. Burhanpur district lies between 21^0 05' to 22^0 37' N and 75^0 57' to 76^0 48' E. It has an area of 4573 km^2.

Headquarter of this district is Burhanpur, which is the lone main town. It is situated on the bank of river Tapti. This district also has 3 Tehsils viz. Burhanpur, Nepanagar and Khaknar. It includes 2 development blocks, 3 Janpad Panchayats and 220 Gram Panchayats. Itarsi-Bhusawal line of Central Railway cuts across the central region of East Nimar and connects both Khandwa and Burhanpur.

METHODOLOGY:

It has been conducted through extensive field visits and observation among the tribal people. It is the outcome of careful and planned fieldwork with selected tribes: Bhils and Barelas during the last 4 years. The areas selected for study were those where the concentration of these ethnic groups is believed to be intense. During investigation, frequent field trips were made to the remote villages. The field trips were so planned as to cover maximum sites of the study area. After establishing good rapport with local practitioners, the ethnomedicinal information was collected. The plants of significance were collected in vegetative as well as in blooming conditions. The data was crosschecked to confirm the authenticity of recorded information. The collected plant specimens were identified using flora of Madhya Pradesh Vol. I, II and III. Field observation on plants, the Tribal Names (T.N.) and information, their uses were recorded in the field book. Voucher Specimens were brought to laboratory and prepared according to the conventional herbarium technique (Jain and Rao, 1976). During investigation, the tribal areas at the foot hills of Satpuda were covered which include the 39 villages and their surroundings.

ENUMERETION OF ETHNOMEDICINAL PLANTS OF EAST NIMAR:

***Abrus precatorious* L. Fabaceae (SM-101)**

T.N. - Ratti/Gunja (Bh and Br).

Uses:

- Powder of 1 or 2 seeds with beetal leaf is given to woman in the morning after 4 days of menstruation for 21 days as a contraceptive.
- 4 or 5 fresh leaves are chewed in the morning in diabetes.

***Aeschynomene indica* L. Fabaceae (SM-138)**

T.N.-Mothi Rajali (Bh and Br).

Uses:

- 2 handful of leaves are crushed and 1 cup of the extract is given for 3 days twice a day to women after childbirth as galactagogue.
- Paste of root is applied on swellings of body parts caused by rheumatism.

***Aloe vera* (L.) Burm.f. Liliaceae (SM-152)**

T.N. - Gwarpatha/Godphad ghas (Bh and Br)

Uses:

- 4 teaspoon leaf pulp is given early in the morning once to cure piles, stomachache and rectal fissures and for relief in pains.

***Alysicarpus monilifer* (L.) DC. Fabaceae (SM-154)**

T.N. –Chatya Pala (Bh and Br).

Uses:

- 10 gm root paste is given orally twice a day with water for 3 days to cure dysentery.
- The paste of entire plant is used on piles.

***Alysicarpus vaginalis* (L.) DC. Fabaceae (SM-155)**

T.N.- Dhakta Dhampta (Bh and Br).

Uses:

- Plant paste is used in burn injury for quick relief.
- 20 ml decoction of entire plant is used in bone fracture twice a day for 1 month.

***Anogeissus latifolia* (Roxb. ex DC.) Wall. Combretaceae (SM-176)**

T.N.-Dharoa/ Dhaunda (Bh and Br).

Uses:

- Extract prepared from 10 gm powdered bark is given twice a day for 3 to 7 days in fever.
- 1-2 teaspoon powdered bark is given twice aday for 3 days to control cough, cold and also in diabetes.

***Antigonon leptopus* Hook. and Arnott. Polygonaceae (SM-178)**

T.N. – Jhumki (Bh and Br).

Uses:

- Boiled dried root is powdered finely and mixed with (ratio in 3:1) *Myristica fragrans* (Jaiphal). 20 gm powder is taken with cow's milk once on empty stomach to check undesirable discharge of semen with urine and to increase sperm count and potency in men.

***Aristolochia bracteolata* Lam. Aristolochiaceae (SM-190)**

T.N.-Kidamar/Gidhan (Bh and Br).

Uses:

- 1 teaspoon leaf extract is given twice daily to removing intestinal worms.
- Decoction of entire plant is applied on body to relieve itching in eczema and skin diseases twice a day.

***Aristolochia indica* L. Aristolochiaceae (SM-191)**

T.N.-Kidamari/Gidhan (Bh and Br).

Uses:

- Root powder is given with honey in leucoderma.
- 10 gm root and 5 gm root of *Justicia procumbens* are crushed together and extract is made. 1 teaspoon extract is given twice a day in cancer. It is long term treatment.

***Asparagus gracilis* Royle, Illustr. Liliaceae (SM-201)**

T.N.-Saslyamusli (Bh and Br).

Uses:

- 20 gm dry root powder is taken with cow's milk twice a day to cure urinary problems, mental disorders and malaria.
- Root paste is used against sexual and general debility.

***Asparagus racemosus* Willd.,Sp. Liliaceae (SM-202)**

T.N.-Sarasarmusli (Bh and Br).

Uses:

- 2 teaspoon root powder is taken twice a day as remedy for rabid dog bite.
- Dry root powder is taken thrice a day for a week to cure urinary problems.
- Root paste is used internally in sexual debility in men.

***Asphodelus tenuifolius* Cav. in Ann. Liliaceae (SM-203)**

T.N. - Piazi (Bh and Br).

Uses:

- 5 gm seed powder is given twice a day for 7 to 21 days to treat skin infection, inflammation and as a diuretic.
- Seed paste is applied on ulcers and inflammed parts.

***Atylosia scarabaeoides* (L.) Benth. in Miq. Fabaceae(SM-204)**

T.N. - Rantur (Bh and Br).

Uses:

- ½ cup plant decoction is given twice a day in cholera and dysentery.
- 1 teaspoon leaf extract is given twice or thrice a day in small pox and venereal sores.
- 2 tablets made from plant is used twice a day in dropsy (Nalguj).

***Basella alba* L. Basellaceae (SM-317)**

T.N. - Poi/Pasalei (Bh and Br);

Uses:

- 5 fruits are given once a day during waxing period of moon (fortnight) after fifth day of menstruation on empty stomach for 21 days to promote female fertility.
- Leaf juice is used in urticaria (pitti) for immediate relief.

***Benincasa hispida* (Thunb.) Cong. Cucurbitaceae (SM-322)**

T.N.- Bhura Kaddu (Bh and Br).

Uses:

- The seeds are pounded with little water and to make paste. 2 teaspoon paste is given orally thrice a day with cow's milk at the onset of epilepsy.

***Butea monosperma* (Lam.) Taub. Fabaceae (SM-371)**

T.N.- Khakhari (Bh and Br).

Uses:

- Young leaves are used as a tonic after childbirth.
- 11 flowers are soaked in 200 ml water in a copper pot overnight and mashed next day in the morning and filtered. Filtrate is given as a single dose each day, on empty stomach, for 30 days to cure diabetes and also used to cure urinary complaints.

***Butea superba* Roxb. Fabaceae (SM-372)**

T.N.- Khakhari(Bh and Br).

Uses:

- Leaf juice is given with curd, twice a day in prickly heat eruptions of children.
- Fresh leaf extract is applied on eczema twice a day.

- Lukewarm root decoction is massaged on body to remove general debility. Also 10 ml decoction is given twice a day for fast recovery.

***Cajanus cajan* (L.) Huth in Helios Fabaceae (SM-375)**

T.N.- Tudi Zara (Bh and Br).

Uses:

- Leaves are chewed to a fine paste. It is applied on cuts, wounds and burns thrice a day to immediately check bleeding and fast healing.
- 12 leaves are chewed early in the morning on empty stomach, once a day, for seven times to cure jaundice.

***Calotropis gigantea* (L.) R. Br. Asclepiadaceae (SM-410)**

T.N.- Akra (Bh and Br).

Uses:

- 10 gm root powder is given twice a day, for 15 days, to promote gastric secretion and is useful in asthma, bronchitis and dyspepsia.
- Latex mixed with jaggery and made into tablets, is given thrice a day, to cure chikangunia.

***Calotropis procera* (Ait.) R. Br. Asclepiadaceae (SM-411)**

T.N.- Ankada (Bh and Br).

Uses:

- Latex diluted with water in ratio of 1:5 is applied over gums in toothache, once a day.

***Cardiospermum halicacabum* L. Sapindaceae (SM-415)**

T.N.-Phatphatej (Bh and Br).

Uses:

- Fresh seeds are collected in the morning and tied on the ear or hand or around the head with a thread. As the seeds dry slowly, simultaneously the pain of hemicrania (adhasisi) also subsides.
- 1 drop leaf juice is put in the ear with alternate fomentation, twice a day, for 3 days, to cure otalgia.

***Celastrus paniculatus* Willd., Sp. Celastraceae (SM-429)**

T.N.- Pinguel (Bh and Br).

Uses:

- The paste of root mixed with one pinch powder of *Curcuma longa* is applied twice a day on boils and wounds for fast relief.

***Ceropegia bulbosa* Roxb. Asclepiadaceae (SM-433)**

T.N. - Gakaryakand (Bh and Br).

Uses:

- 20 gm powder of tuberous root is given with 1 glass of cow's milk to cure digestion disorders.

***Chlorophytum arundinaceum* Baker Liliaceae (SM-436)**

T.N.- Dhouli Musli (Bh and Br).

Uses:

- Scape is eaten as vegetable, as a tonic.
- 20 gm root powder is mixed with ghee and given in blisters of mouth and throat infection.

***Chlorophytum tuberosum* (Roxb.) Baker in J. Liliaceae (SM-437)**

T.N.-Dhouli Musli (Bh and Br).

Uses:

- 2 teaspoon powder of root is given twice a day with milk to cure fever and as an aphrodisiac.
- ½ cup juice of leaves is given twice a day to cure anaemia.

***Citrullus colocynthis* L. Cucurbitaceae (SM-441)**

T.N. - Ghorkakde (Bh and Br).

Uses:

- ¼ fruit is eaten with salt and seeds of *Trachyspermum ammi* once a day (during rainy season) for 7 days to cure stomach pains and sciatica.

***Cleome gynandra* L. Capparaceae (SM-442)**

T.N.- Karalia (Bh and Br).

Uses:

- 2 drops filtered leaf juice is put twice a day for 3 days as an eardrop in earache.
- 2½ gm seed powder is given in bed time to removing intestinal worms.

***Cleome viscosa* L. Capparaceae(SM-443)**

T.N.- Pivili Tilwari (Bh and Br).

Uses:

- 2 drops leaf juice is put as a eardrop for removing puss twice a day for 3 days.
- 2 drops infusion of leaves is used as nasal drops to cure headache for 3 days.

***Clitoria ternatea* L. Fabaceae (SM-446)**

T.N.- Gokarni (Bh and Br).

Uses:

- 50 ml root extract is given orally to hasten delivery during labour pains.
- 5 gm powder of root is given with cow's milk twice a day for 30 days to cure goitre.

***Coccinia grandis* (L.) Voigt, Hort. Cucurbitaceae (SM-447)**

T.N.- Dhorkakri (Bh and Br).

Uses:

- 1 cup leaf juice is given once a day on empty stomach for 3 months to control diabetes.
- 10 gm root paste with seeds of *Trachyspermum ammi* in ratio 2:1 once a day on empty stomach for 3 days to cure menstrual problems.
- 10 gm root paste is given in empty stomcach to cure weakness and impotency in male for 1 month.

***Combretum albidum* G.Don in Trams. Combretaecae (SM-453)**

T.N.- Rhetbel/Retel (Bh and Br).

Uses:

- 5-6 leaves are chewed followed by a cup of water for immediate relief from gastric troubles and diarrhoea.
- 10 gm stem paste is given with cow's milk twice a day after meals to cure mental disorder, mania and insomnia.

***Corallocarpus epigaeus* (Rottl. & Willd.) Hook. Cucurbitaceae (SM-456)**

T.N.- Mirichkand (Bh and Br).

Uses:

- Paste of root tuber is mixed with pinch of *Curcuma longa* powder and made into poultice. It is applied on swelling caused after snakebite.

Crotalaria albida **Heyne ex Roth, Nov. Fabaceae (SM-476)**

T.N. - Ban Methi (Bh and Br).

Uses:

- 5 gm paste of leaves is given twice a day for 3 days to relieve constipation and stomach disorders.
- Extract of leaves is used in scabies.

Crotalaria linifolia L. **Fabaceae (SM-482)**

T.N.- Jhunjhunia (Bh and Br).

Uses:

- Root of plant is rubbed with water on a stone to get a fine paste. For children the dose is 0.2 gm(the quantity equal to grain of *Sorghum vulgare*) and 2 gm for adults. It is given twice a day for 3 days to treat diarrhoea and vomiting.

Crotalaria nana **Burm. Fabaceae (SM-483)**

T.N.- Aadmya San (Bh and Br).

Uses:

- 10 gm root powder is given with leaf of *Piper betle* (beetal leaf) twice a day for 7 days in jaundice.
- Plant paste is used against burning sensation and rheumatism.

Crotalaria retusa **L. Fabaceae (SM-484)**

T.N.- Ghagri (Bh and Br).

Uses:

- 5 gm seed powder boiled with cow's milk is used for increasing body strength.
- Fine paste of seeds is applied on scabies.
- 2-10 ml extract of leaves is used twice a day for 5 days for curing diarrhoea.

Cryptolepis buchanani **Roem & Schult. Asclepiadaceae (SM-485)**

T.N.-Kawavel (Bh and Br).

Uses:

- Root paste is mildly heated and gently massaged over the body once a day for 7 days after bathing to cure rheumatoid arthritis.
- On snakebite site, paste of root is applied to control swelling. 5 ml juice is given to patient to relieve poisoning symptoms. Similarly it is also useful in insect bites and scorpion sting.

***Dalbergia sissoo* Roxb. Fabaceae (SM-498)**

T.N.- Bothiola (Bh and Br).

Uses:

- Bark of nodal part of plant mixed with tender leaves of *Papaver somniferum* (Aphim) and rind of *Punica granatum* are pounded in 1:1:1 ratio to get paste. 20 gm paste is consumed at bed time for 7 days with cow's milk to cure undesired discharge of semen, gonorrhoea and white discharge.

***Desmodium gangeticum* (L.) DC. Fabaceae (SM-403)**

T.N.- Shalapani (Bh and Br).

Uses:

- Leaf extract is applied on scorpion sitng site. Same extract is given orally at one hour interval to relieve poisoning symptoms. Similarly it is useful in snakebites.
- 10 ml leaf juice is given twice a day in chronic fever.

***Desmodium triflorum* (L.) DC. Fabaceae (SM-504)**

T.N.- Kudalya (Bh and Br).

Uses:

- Paste of fresh leaves is applied on wounds twice a day for fast healing.
- Paste of tender leaves is applied all over the body during convulsion in children.

***Diplocyclos palmatus* (L.) Jeffrey in Kew Bull. Cucurbitaceae (SM-530)**

T.N.- Chatargoti/Chirchirgoti (Bh and Br).

Uses:

- 1 seed and 1 gm of entire plant of *Selaginella bryopteris* is given from fifth day of menses on empty stomach for 21 days to a woman desirous of having a child. The medication is to be swallowed, not chewing.
- 2½ seeds are roasted in ghee, powdered and divided into three equal doses. It is given at an interval of 6 hours for 3 days (9 doses in all) to cure double pneumonia and convulsions in children.

***Erythrina variegata* L. Fabaceae (SM-544)**

T.N.- Pangra (Bh and Br).

Uses:

- 2 gm bark powder is given with water every hour to relieve poisoing symptoms caused by snake bite.
- Edible oil is smeared on leaves and mildly heated. It is applied on joints for arthritis.

***Flemingia nana* Roxb. Fabaceae (SM-560)**

T.N.- Bhui Khakara/Jameen Palas (Bh and Br).

Uses:

- 10 ml decoction of root is given twice a day for 3 months rubbed on nails during attack of hysteria and epilepsy.
- Root of plant with root of *Ougeinia oogeinsis* and root of *Curculigo orchioides* are powdered. 1 teaspoon is given twice a day with cow's milk to cure sexual and general debility.

***Gloriosa superba* L. Liliaceae (SM-567)**

T.N.- Karihari/Singmudya(Bh and Br).

Uses by Korku:

- Root paste is applied on site of scorpion sting externally to remove effects of poison from the body.
- Paste of tuberous root is applied in joint pains, specially knee joint pains and rheumatism.
- Root paste is applied on site of thorn externally to expel it from any part of the body.

***Passiflora foetida* L. Passifloraceae (SM-1004)**

T.N. - Rakhi phulya (Bh and Br).

Uses:

- Leaf paste is smeared on head, forehead and nails in headache and giddness, for quick relief.
- 20 ml plant extract is given twice a day in insomnia and hypertension.

ABBREVIATIONS:

TN: Tribal Name; Bh:Bhils; Br:Barelas and SM:Shakun Mishra (Specimen voucher Number).

RESULTS AND DISCUSSION:

The author recorded 45 taxa belonging to 34 genera and 12 families are used specially for ailments by the tribals of this area. However this area is still shaded and needs more investigation with latest techniques for validation for all types of fever and malaria (Atra).

CONSERVATIONAL ASPECT:

Conservation of nature is an ancient tradition in India where the biodiversity is mostly preserved on religious grounds. The tribals have their own ways of protecting medicinally, economically and culturally important plants. They impose taboos, totems and the social and religious restrictions on cutting or harming plant species. In case of mistake or violation, punishment is given. Not only individual species but entire forest tracts are conserved. Such pockets are known as 'sacred groves' which show optimum growth of vegetation. This phenomenon can be considered a good example of conservation as well as judicious use of natural resources.

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APPLICATION OF NANOMATERIALS IN ENVIRONMENT: A REVIEW

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ABSTRACT:

Nanotechnology is the field of producing nanomaterial's for the betterment of human life and environment both directly and indirectly. This article gives a review on the ongoing research and development on the scope of nanotechnology in environmental cleaning. Various types of nanomaterials are discussed which are used for remediations of air, contaminated wastewater, groundwater, surface water and soil. The categories of nanoparticles studied include those which are based on titanium dioxide, iron, bimetallics, catalytic particles, clays, carbon nanotube, dendrimers and magnetic nanoparticles.

KEYWORDS: Applications, Environment, Nanotechnology, Nanomaterials

INTRODUCTION:

Today pollution is one of the major issues of concern and there is a need of technology for cleaning and sensing pollution. Nanotechnology focused on the design, synthesis, characterization and application of materials and devices on the nanoscale. A nanometer is one billionth of a meter (10^{-9} m) about one hundred thousand times smaller than the diameter of a human hair, a thousand times smaller than a red blood cell, or about half the size of diameter of DNA. As the nanotechnology is successful in consumer products and other sectors, nanomaterials can be used for the improvement of the environment, both direct applications as to detect, prevent and remove pollutants as well as indirectly by designing cleaner industrial processes and create environmentally products. To identified the role of nanotechnology to solved various environmental issues research on nanoscale science should be done, However many uncertainty regarding the nonmaterial impact on human and ecological health is also been kept in mind. Nanotechnology has an important application in water sector. As the amount of freshwaters is less, sea water can be considered for human consumption after desalination process. Carbon nanotube membranes can be used as a cheaper option. The nanofilters can be used to clean the ground water.

Nanosensors can be developed to detect the waterborne contaminants. Air pollution is another area where nanotechnology has promising role to play. Nanofilters can be applied to automobile and factory to prevent discharge of contaminants into the atmosphere. Nanosensors can be developed and deployed to detect toxic gasses at low concentration. Nanotechnology also plays important role in environmental remediation which includes degradation of hazardous contaminants in cost effective method. The nanomaterials used for environmental applications are mentioned below.

Titanium Dioxide (TiO_2) Based Nanoparticles:

These nanoparticles are easily available at low cost and they are less toxic. TiO_2 nanoparticles are used in water treatment as a photocatalyst.

Iron Based Nanoparticles:

These Nanoparticles are used in the treatment of contaminated soils, sediments, and solid wastes.

Bimetallic Nanoparticles:

Zero-valent iron can be used for the removal of halogenated organic compound (HOCs) one of the latest innovative technologies for environmental remediation. Nanoparticle of Paladium and Gold reduced the chlorinated compounds from water and ground water. Nutt *et al*. [1] synthesized Pd supported on gold nanoparticles (Au NPs). They found that these catalysts were considerably more active than Pd NPs. Joo and Zhao [2] prepared Fe-Pd bimetallic with 0.2% w/w of sodium carboxy methyl cellulose (CMC) as stabilizer and used them for the degradation of lindane and atrazine, the chlorinated herbicides.

Nanoparticulate photocatalysts and catalysts:

The metal complex porphyrins and other biological porphyrin-type molecules like vitamin B12, which are referred to as metalloporphyrinogens, have several characteristics that make them very applicable for the treatment of persistent organic pollutants [3].

Nanoclays:

Most of the clays can swell and thus increase the space in between their layers to accommodate the adsorbed water and ionic species. These clays were employed in the pillaring process.

Nanotubes:

Carbon nanotubes hold tremendous potential for applications because of their unique properties, such as high thermal and electrical conductivities, high strength, high stiffness, and special adsorption properties [4]. Carbon nanotubes have cylindrical pores and adsorbent molecules interact with their carbon atoms on the surrounding walls. However, for cylindrical and spherical pores, the potentials are greater because more surface atoms interact with the adsorbed molecule [4, 5]. Purified commercial single-walled carbon nanotubes (SWCNTs) and multi-walled carbon nanotubes (MWCNTs) by sodium hypochlorite solutions and used them as adsorbent for the removal of zinc from water. Likewise, fluoride is one of the pollutants in the drinking water and it has been adsorbed from water by amorphous $Al_2 O_3$ supported on carbon nanotubes ($Al_2 O_3$ /CNTs) [6]. Also, Aligned carbon nanotubes (ACNTs), a new kind of carbon material, were prepared by catalytic degradation of xylene via ferrocene as catalyst and used for the adsorption of fluoride from drinking water [6]. Stafiej and Pyrzynska [7] prepared purified carbon nanotubes via soaking them in HNO_3 for 12 h at room temperature and then washed them with deionized water until natural pH.

Dendrimer and nanosponges:

The environmental applications of dendrimers were first explored by Diallo *et al*. [8]. They have reported the effective removal of copper from water via different generations of PAMAM dendrimers.

Micelles (Self-assembled surfactants):

Micelles are self-assembled surfactant materials in a bulk solution. Surfactant-enhanced remediation techniques have shown significant potential in their application for the removal of polycyclic aromatic hydrocarbon (PAHs) pollutants in the soil.

Magnetic Nanoparticles:

Hu *et al*. [9] developed an innovative process combining nanoparticle adsorption and magnetic separation for the removal and recovery of Cr (VI) from wastewater. Different kinds of magnetic nanoparticles were also employed for the removal of organic pollutants, such as sorption of methylene blue on polycyclic acid-bound iron oxide from an aqueous solution [10].

Nanomembrane and Nanosieve:

A membrane is a semi-permeable and selective barrier between two phases (retentive and permeate) through which only selected chemical species may diffuse. Membrane filtration is frequently employed for the separation of dissolved solutes in a fluid or the separation of a gas mixture [11]. Historically, membrane technology has had wide application in wastewater treatment and desalination via reverse osmosis. In this method, a pressure difference across a membrane is employed to overcome the osmotic pressure gradient. The smaller water molecules are literally pushed through the membrane while the large solute species are retained behind [12].

CONCLUSION:

The nanotechnology is immerging field and has a great scope in large number of fields, the applications of nonmaterial in environmental science should also be considered. Such considerations include both direct and indirect benefits and include designing of models for decreasing and removal of pollutants. This review has tried to explain some evidence to this issue. Some of the nanomaterials are explained with regard of their role in environmental protection.

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CONSERVATION OF BIODIVERSITY IN INDIA:

POLICY INITIATIVES AND LEGAL ASPECTS

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ABSTRACT:

India is rich in biological diversity and associated traditional as well as contemporary knowledge system relating thereto. Till today India has taken a number of policy initiatives and legal measures towards conservation of nature, natural resources, and biodiversity. India is one of the 12 mega biodiversity countries of the world and one among the 194 signatories to the Convention on Biological Diversity (CBD) in Earth Summit at Rio de Janeiro in 1992. It is considered necessary to provide for conservation, sustainable utilization and equitable sharing of the benefits arising out of utilization of genetic resources and also to give effect to the said convention. Among the several acts prevailing in the country, the Biological Diversity Act, 2002 (BD Act) is crucial one. It was born out of India's attempt to realize the objectives enshrined in the United Nations Convention on Biological Diversity (CBD) 1992. The BD Act provides provisions for regulated access to biological resources by bonafide end-users for various purposes including scientific research, commercial activities and sustainable use of non-timber forest produce. The Act is implemented through the mechanism of three functional bodies viz., National Biodiversity Authority (NBA) at the national level, State Biodiversity Boards (SBBs) in different states, and Biodiversity Management Committees (BMCs) at the level of local community (Panchayat). The BD Act mainly insists upon appropriate benefit sharing under mutually agreed terms related to access and transfer of biological resources or knowledge occurring in or obtained from India for various purposes.

This conceptual research paper/article highlights India's rich biodiversity, focuses on the Indian initiatives for conservation of biodiversity, and summarizes the legal aspects with respect to BD Act.

KEYWORDS: Biodiversity of India, Biological Diversity Act, Convention on Biological Diversity, Conservation of Biodiversity

INTRODUCTION TO THE BIODIVERSITY OF INDIA:

India is one of the richest countries in the world in terms of biodiversity. There are four out of 34 global biodiversity hotspots, which is an indicator of high degree of endemism of species in India. About 5150 plant and 1837 animal species are endemic. India is one of the eight primary centers of origin of cultivated plants and also a centre of crop diversity with about 375 wild relatives in rice, pulses, millets etc. It has 16 major types and 251 subtypes of forests [1]. In fact, India embraces three major biological realms, viz. Indo-Malayan, Eurasian and Afro-tropical and is adorned with 10 bio-geographic zones and 26 biotic provinces [2].

Moreover, India, is a mega-diverse country with only 2.5% of the land area, 4% of water, and accounts for about 8% of the recorded species of the world, which includes millions of races, subspecies and local variants of species and the ecological processes and cycles that link organisms into population, communities, and all different ecosystems [3]. In India 45,968 species of plants and 91,364 species of animals have been documented so far. The faunal wealth is also equally or more diverse. India's 10 bio-geographic zones possess an exemplary diversity of ecological habitats like alpine forests, grasslands, wetlands, coastal and marine ecosystems, and desert ecosystems.

Unfortunately, ever mounting human population, rapid expansion of agriculture, industrialization, urbanization and large scale developmental projects such as dams, highways, mining have led to habitat destruction, fragmentation, degradation and over exploitation of biological resources. Coupled with these factors unsustainable use of resources and illegal trade of high value wildlife products have severely threatened many species of flora and fauna. The agro-biodiversity has also suffered seriously due to introduction and promotion of few high yielding varieties. Yet, very little has been done to harness the traditional knowledge on biodiversity inherited by a large number of local communities, given that India has had rich tradition of conserving nature and natural resources. Worship of trees, forests, rivers, ponds, mountains and association of animals and birds with gods and goddesses had contributed immensely to their conservation during historic past. This calls for concerted efforts towards scientific research, education and policy back up so as to conserve biodiversity while ensuring economic and ecological security.

POLICY INITIATIVES FOR CONSERVATION OF BIODIVERSITY:

India is a party to the United Nations Convention on Biological Diversity (CBD) signed at Rio de Janeiro on the 5th day of June, 1992. The said convention came into force on the 29th December, 1993. The convention reaffirms the sovereign rights of the States over their biological resources. It has the

main objective of conservation of biological diversity, sustainable use of its components and fair and equitable sharing of the benefits arising out of utilization of genetic resources. The Biological Diversity Act 2002 (BD Act) was born out of India's attempt to realize the objectives enshrined in the United Nations CBD 1992. The BD Act introduced in India in the year 2002. At the national level, National Biodiversity Authority (NBA) is responsible for decisions pertaining to Access and Benefit Sharing (ABS); approval for access to and transfers of biological resources, results or technology of scientific research to foreign citizens, companies or non-resident Indians; and several other matters related to conservation of India's biodiversity. In order to implement the BD Act, in accordance with its Section 8, a NBA was established in the year 2003, which is assisted by State Biodiversity Boards (SBBs) and Biodiversity Management Committees (BMCs) at the state and local levels respectively.

India has taken a number of policy initiatives towards conservation of nature, natural resources and biodiversity at international, national and regional levels. Some of the significant initiatives include the World Heritage Convention, 1972; Convention on International Trade in Endangered Species of Flora and Fauna (CITES), 1975; Ramsar Convention on Wetlands, 1975; FAO's International Undertaking on Plant Genetic Resources, 1983; Convention on Biological Diversity, 1992; UN Convention to Combat Desertification, 1994; Trade Related Intellectual Property Rights (WTO-1994), 1994; Cartagena Protocol for Bio-safety to CBD, 2000; International Treaty on Plant Genetic Resources for Food and Agriculture (FAO), 2001; Global Strategy for Plant Conservation, 2002; the Bonn Guidelines on Access to Genetic Resources and Fair and Equitable Sharing of the Benefits arising out of their utilization, 2002 among others. Consequent upon the ratification of CBD by India on 18th February, 1994 and in pursuance of the Conference of Parties the Government of India, predominantly the Ministry of Environment and Forests, has taken steps to implement the CBD provisions by promulgating the BD Act, 2002 in the Parliament of India, recognizing the urgent need to develop human resources, capabilities and public policy in order to take an active part in the new economy associated with the use of Biological Diversity and Biotechnology.

With the initiative of the Government of India about 17 biodiversity-rich countries have formed a group known as 'Like Minded Mega-diverse Countries (LMMC)'. This group has adopted the New Delhi Ministerial Declaration of LMMCs on Access and Benefit Sharing, which is a new beginning towards international regime on access and benefit sharing as a legally binding instrument [4].

Besides it, environment protection is enshrined in the Constitution of India [Article 48A and Article 51A (g)], and also in Forest (Conservation) Act, Wildlife (Protection) Act, Biological Diversity Act, National Green Tribunal Act, National Biodiversity Action Plan, National Forest Policy, National Wildlife

Action Plan, National Forestry Action Programme, National Environment Policy and National Action Plan on Climate Change, The Scheduled Tribes & other Traditional Forest dwellers (Recognition of Forest Rights) Act, 2006.

LEGAL ASPECTS WITH RESPECT TO CONSERVATION OF BIODIVERSITY:

Apart from the various policies, action plans, and acts as mentioned above BD Act, 2002 followed by BD Rules, 2004 are playing a significant role in conservation of biodiversity in India.

Introduction to the Biological Diversity Act:

The Biological Diversity Act (BD Act) introduced in the year 2002 followed by Biological Diversity Rules, 2004 (BD Rules). The BD Act was passed in the Lok Sabha on 2nd December 2002 and in the Rajya Sabha on 11th December 2002. It has received an assent of the President on 5th February, 2003. This act extends to the whole of India. The Act on the lines of CBD mainly provides for conservation of biological diversity; sustainable use of its components; and fair and equitable sharing of the benefits arising out of the use of biological resources, knowledge and for matters connected therewith or incidental thereto. It primarily addresses an access to genetic resources and associated knowledge by foreign individuals, institutions or companies, to ensure equitable sharing of benefits arising out of the use of these resources and knowledge to the country and the people.

In order to implement the provisions of the BD Act, National Biodiversity Authority (NBA) was established in October, 2003 at Chennai. The machinery available for implementation of the act consists of National Biodiversity Authority (NBA) at the national level, State Biodiversity Board (SBBs) at the state level, and Biodiversity Management Committees (BMCs) at the local level. The Act is quite comprehensive enough and consisting of about 12 Chapters covering regulation of access of biological diversity, composition and functioning of NBA, SBBs, BMCs, and other miscellaneous provisions; and 65 Sections in all covering provisions relating to conservation of biological diversity, sustainable use of its components and fair and equitable sharing of the benefits arising out of the use of biological resources, knowledge and for matters connected therewith or incidental thereto [5].

Mechanism for Access and Benefit sharing:

The BD Act primarily addresses the issues concerning access to genetic resources and associated knowledge by foreign nationals, institutions or companies, and equitable sharing of benefits arising out of the use of these resources and associated knowledge by the country and its people. The Act governs

access and benefit sharing (ABS) through a three tier system, where NBA and SBAs are consulting BMCs on matters related to use of biological resources and associated knowledge within their jurisdiction. In order to safeguard the interests of the local people and to allow research by Indian citizens within the country, free access to biological resources for use within India for any purpose other than commercial use for Indian people has been given to the traditional physicians i.e. Vaids and Haqims and other citizens [6].

Benefit sharing out of usage of biological resources can be done in the manner such as i) joint ownership of intellectual property rights, ii) transfer of technology, iii) location of production, iv) research and development units in the area of source, v) payment of monetary and non-monetary compensation, and vi) setting up of venture capital fund for aiding the cause of benefit claimers. The legislation provides for exemptions to local people and community for free access to use biological resources within India; to growers and cultivators of biodiversity, and Vaids and Haqims to use biological resources; to collaborative research through government sponsored or government approved institutions subject to overall guidelines and approval of the Central Government; and to value added products.

Access to Biological Resources and Associated Traditional Knowledge:

The BD Act stipulates norms for access to biological resources and traditional knowledge in the ways like i) Access to biological resources and traditional knowledge to foreign citizens, companies and non-resident Indians (NRIs) based on prior approval of NBA (Sections 3, 4, 6 and Rules 14-20), ii) Access permits to Indian citizens, companies, associations and other organizations registered in India on the basis of prior intimation to the State Biodiversity Board concerned (Section 7), and iii) Exemption of prior approval or intimation for local people and communities, including growers and cultivators of biodiversity, and Vaids and Haqims, practicing indigenous medicines (Section 7).

The key procedures to be followed for access to biological resources and traditional knowledge are dealt with under Rule 14. The provisions are duly laid down to ensure effective, efficient and transparent access procedures through written agreements and applications in prescribed formats to the authority i.e. NBA for grant of approval [7].

Revocation of Access or Approval:

Revocation of access or approval granted to an applicant is done only on the basis of any complaint or suo moto under the conditions such as i) violation of the provisions of the Act or conditions

on which the approval was granted, ii) non-compliance of the terms of the agreement, iii) failure to comply with any of the condition of access granted, and iv) on account of overriding public interest or for protection of environment and conservation of biodiversity (Rule 15, Sub-rule 1).

Restrictions for Access to Biological Resources:

The Act imposes certain restrictions on request related to access to biological resources and traditional knowledge if the request is on i) endangered taxa, ii) endemic and rare taxa, iii) likely adverse effects on the livelihood of the local people, iv) adverse and irrecoverable environmental impact, and v) cause genetic erosion or affect ecosystem function, vi) purpose contrary to national interests and other related international agreements to which India is party (Rule 16, Sub-rule 1) [8].

Procedure for Prior Approval of Transfer of Research Results:

Guidelines on collaborative research projects (Section 5) involving transfer or exchange of biological resources or information relating thereto between institutions, including government sponsored institutions of India and such institutions in other countries are offered in the BD Act, 2002. Establishment of Designated National Repository (DNR) (Section 39) is an essential part of the infrastructure for biodiversity conservation. There are certain guidelines in relation to access to bio-resources or associated knowledge for research or for commercial purpose by foreigners (Section 3) and determination of equitable benefit sharing arising out of the use of accessed biological resources, their by-products, innovations and practices associated with their use and applications, and knowledge (Section 21), transfer of results of any research relating to any biological resources occurring in or obtained from India for further research or for commercialization (Section 4), intellectual property rights of invention based on any research or information on a biological resources obtained from India (Section 6), biological resources normally traded as commodities (Section 40), and areas of importance as Biodiversity Heritage Sites (Section 37) are notified under the Act. The BD Act does not permit any person to transfer the results of any research relating to biological resources obtained from India for monetary consideration to foreign nationals, companies or NRIs without the prior approval of the authority (Section 4).

Criteria for Benefit Sharing:

The BD Act, according to Section 21 and Rule 20 of the BD Rules provides for appropriate benefit sharing provisions in the access agreement and mutually agreed terms related to access and transfer of

biological resources or knowledge occurring in or obtained from India for commercial use, bio-survey, bio-utilization or any other monetary purposes. The Act also provides for setting up of biodiversity funds at national, state and local levels. Benefits will be given directly to individuals or group of individuals only in cases, where biological resources or associated knowledge are accessed directly through them. In all other cases, monetary benefits will be deposited in the Biodiversity Fund, which in turn is used for the conservation and development of biological resources and socio-economic development of areas from where resources have been accessed.

Peoples' Biodiversity Registers (PBRs):

The rules promulgated under BD Act include the provision to constitute the BMCs, which are entrusted with preparation of Peoples' Biodiversity Registers (PBRs) in consultation with the local people. The register shall contain comprehensive information on availability and knowledge of local biological resources or any other traditional knowledge associated with them [9]. Establishment of comprehensive PBRs not only helps to inventorize and document the local biological and genetic resources, but also to conserve and sustainably use the bio-cultural diversity for rewarding income generation [10]. With the globalization and increasing influence of (Intellectual Property Rights (IPRs), there is an urgent need to develop appropriate national and international guidelines for implementing the provisions of ABS and thereby preventing misappropriation of traditional knowledge as well as conserving of bio-resources for the future.

CONCLUDING REMARKS:

Biological diversity is the hallmark of life on earth. It is very crucial and can be considered as back bone of sustainable development. Biodiversity makes up the structure of ecosystems and habitats that support essential living resources, including wildlife, fisheries, and forests. It provides for basic human needs such as food, shelter, and medicine. It composes ecosystems that maintain oxygen in the air, enrich the soil, purify the water, protect against the flood and storm damage, and thus regulate the climate. Biodiversity also has good recreational, cultural, spiritual and aesthetic values. Hence, there is a great need of its conservation and protection. It is be suggested that apart from policy measures and initiatives taken by the Government of India; and various legal measures introduced in the form of various acts from time to time; strong commitment, active participation and involvement of the Indian nationals is a need of hour.

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FISH DIVERSITY AND FISHERIES POTENTIAL FROM WARANA RIVER IN HATKANAGALE TAHSIL OF KOLHAPUR DISTRICT (M.S.)

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ABSTRACT:

The present investigation was carried out to study the present status of fish fauna from Warana river in Hatkanangale tahsil of Kolhapur district. It was also aimed to study the fishing methods used by the fisherman community, fish fecundity and threats to fish fauna in the present study area. Total 40 fish species were recorded from 24 genera belonging to 14 families of 7 orders. The introduced exotic fish species are good breeders and plays significant role on naturally occurring fish fauna in this area. The threats like discharge of untreated sewage and effluents, sand mining, irregularity in water discharge from dam and dynamite fishing were affecting the local natural fish species.

KEYWORDS: Fish diversity, Fecundity, Warana river, Threats.

INTRODUCTION:

India is endowed with vast freshwater consisting 45,000 Km. of rivers, 26,334 Km. of canals, ponds and tanks 2.36 million hectares and 2.05 million hectares of reservoirs, which present like harbor a rich and diversified fish fauna characterized by many rare and endemic fish species. The Western Ghats range extends along the western coast of India and is crisscrossed with several rivers providing water to the plains of Peninsular India [1].

About 21,730 species of fishes have been recorded in the world; of which, about 11.7% are found in Indian waters. Out of the 2546 species so far listed, 73 (3.32%) belong to the cold freshwater regime, 544 (24.73%) to the warm freshwater domain, 143 (6.50%) to the brackish water and 1440 (65.45%) to the marine ecosystem. Freshwater fish diversity is very high with around 288 species and high rate of endemism (> 50%) [2, 3].

Approximately 20% of the world's freshwater fish is currently either endangered or extinct. It is thought to be losing freshwater species at a rate comparable to the rates observed for species loss in

tropical forests. Throughout the world, freshwater life is disproportionately more at risk, compared with land based or terrestrial life, and this can be generally attributed to the degradation and destruction of habitat [4].

Hence the present investigation was carried out to analyze the present status of the fish fauna and the threats to the fisheries potential of lower Warana River of Hatkanangale Tahsil.

MATERIAL AND METHODS:

Study Area: Warana River:

The Warana River originates in Sahyadri, near Patherpunj in Patan block of Satara district of Maharashtra at an altitude of 914 m from MSL and drains the tehsil of Shirala, Shahuwadi, Panhala parts of Walwa and Hatkanangale. It runs southeastwards and joins Krishna near Haripur village in Sangli district at an altitude of 548m. It has the four main tributaries like Morna, Meni, Kadavi and Kansa.Total length of the river is around 150 Km. The part of this river in Hatkanangale tahsil was selected for the present investigation.

Collection and Preservation:

The fish surveys and collection were carried out through commercial catches of fisherman folk community. Visual surveys of various fishing gears were used to sample fish species. Collected fish species were preserved and identified with the help of taxonomic keys and field guides [5].

Fish Fecundity:

The matured female fishes of *Cyprinus carpio* were collected and weighed. They were dissected to remove out intact gonads. The weight of matured ovaries was recorded. Three samples of each ovary were taken from the anterior, middle and posterior regions. All the ovaries were preserved in 5% formalin solution. After some hours eggs were become large and separate from each other. The total number of eggs was counted in 1gm subsamples were computed.

$F = n \times G / g$

Where “F” is fecundity, “n” is the average number of eggs, “G” is weight of the gonads and “g” is the weight of sub sample. The GSI value was calculated from the ratio of total body weight and gonad weight.

GSI=Gonad weight / body weight ×100

The attempt was made to recognize the threats to ichthyo-fauna in the study area. The local fish markets were also visited to document the fishes from same locality.

RESULTS AND DISCUSSION:

A checklist of freshwater fish species for the study area was prepared by using information available in literature and collected from sampling (Table 1).

Table 1: Checklist of Fish fauna of Warana River from Hatkanagale tahsil region

Order	Family	Subfamily	Genus	Species	Local Name
Anguilliformes	Anguilidae		*Anguila*	*anguila*	Vam,
Cypriniformes	Cyprinidae	Rasborinae	*Rasbora*	*daniconius*	Dandvan
		Cyprininae	*Puntius*	*sarana*	Khavali
				(Tor) khudree	Mahasheer
				Jerdone	Parag
				kolus	Kolshi
				ticto	Khavali
			Cyprinus	*carpio communis*	Sypris
			Labeo	*rohita*	Rohu
				calbasu	Kanas
				fimbriatus	Tamber
				boggut	Sandasi
				porcellus	Tambudki
				boga	Khavlya
			Catla	*catla*	Catla
			Cirrhinus	*mrigala*	Mirgal
				reba	Mirgal
			Hypopthalmichthys	*molitrix*	Silver
			Osteobrama	*cotio cotio*	--
		Garrinae	*Garra*	*mullya*	Mullya
	Cobitidae	Cobitinae	*Lepidocephachthys*	*thermalic*	Mori
	Botinae		*Botia*	*striata Var. kolhapurensis*	Waghmasa
Siluriformes	Siluroidae	Siluridae	*Ompak*	*bimaculatus*	Wanz
				pabo	Kali Wanz
			Wallago	*attu*	Valshivda
	Bagridae		*Mystus*	*cavasius*	Katarna
				seenghala	Singalu
				malabaricus	Shingati

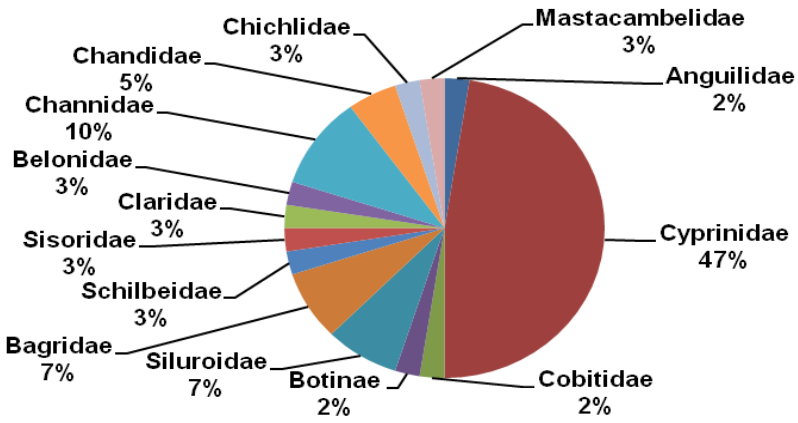
	Schilbeidae	Schilbeinae	*Neotropius*	*khavalchor*	Khavalchor
	Sisoridae	--	*Gagata*	*itchkeea*	Itchka
	Claridae	--	*Clarius*	*batrachus*	Mangur
Antherinoformes	Belonidae	--	*Xenentodon*	*cancila*	Takli
Channiformes	Channidae	--	*Channa*	*gachua*	Dokarya
				punctatus	Kala Masa
				marulius	Maral
				striatus	Mangasha
Perciformes	Chandidae	--	*Ambassis(Chanda)*	*ranga*	Kachaki
				nama	Kachaki
	Chichlidae	--	*Sarotherodon*	*mossambicus*	Tilap
Mastacambeliformes	Mastacambelidae	--	*Mastacambelus*	*armatus*	Vambhat

The total number of species recorded from the present study area was 40 belonging to 23 genera and 14 families. Maximum species were recorded from family Cyprinidae (47%) followed by Channidae (10%); Bagridae and Siluroidae (7% each); Channidae (5%); Chichlidae, Belonidae, Claridae, Schilbedae and Mastacambelidae (3% each) and minimum in family Botinae, Cobitidae and anguilidae (2% each) (Fig.1).

The life history traits like fecundity and body size are useful predictors of life history strategies of organisms. The fecundity of introduced fish *Cyprinus carpio* was studied and it was 114920 for a fish weighing about 913 gm. Its GSI was 9.52. The other exotic fish species like *Sarotherodon mossabimcus* and *Hypopthalmichthys molitrix* are also natural breeding introduced fish species in the study area with high fecundity rates. They may be competing with natural fish species for food and habitat.

The part of Warana River in Hatkanangale Tahsil is rich in fish diversity. It has a great fisheries potential. It has certain threats like sand mining, excessive fishing, Dynamite fishing, discharge of excessive load of sewage and effluent which may adversely affect the fisheries potential of the river. The sand mining and Dynamite fishing are the notable most destructive threats in the study area as it causes habitat destruction.

Fig. 1. Familywise distribution of fish species from Warana River



We recommend that, there is need for the analysis of water quality parameters to check the suitability of water for commercial fisheries. The riverine pollution of this area should be minimized for better fishing practices. Further, it is suggested that the nutritional status and market value of the fishes of this area should be thoroughly assessed.

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JOANNESIA PRINCEPS VELL. (EUPHORBIACEAE): AN EXOTIC PLANT REPORTED FROM MAHARASHTRA STATE

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ABSTRACT

Euphorbiaceae is seventh largest family which comprised 43 genera and 111 species for Maharashtra state [1]. *Joannesia princeps* Vell., commonly known a 'arara nut-tree' a Brazilian tree belongs to this family was introduced by European traders in India. *Joannesia princeps* is endemic to Minas Gerais, North Espirito Santo, and South Bahia, Brazil. This species is threatened due to habitat loss. Kolhapur district is also rich in plant diversity. Yadav and Sardesai [2] reported 2227 species and 1023 genera of Angiosperms from Kolhapur district. In Kolhapur city there are about 54 gardens which give shelter to many exotic and indigenous tree species. While studying exotic tree species of Kolhapur city, *J. princeps* is observed in Town Hall garden which is one of the oldest garden of Kolhapur city. *J. princeps* was not included by previous workers in floral diversity of Maharashtra state. This is new report for Maharashtra state. The taxonomic description, illustration and photo plates are given in present paper.

KEYWORDS: *Joannesia princeps*, Euphorbiaceae, New record, Maharashtra.

TAXONOMIC DESCRIPTION:

Joannesia princeps *Vell. in Alogr. Alkalis 199. 1798*. *Joannesia insolita* Pittier in Bol. Soc. Venez. Ci. Nat. 6: 8. 1940. *Andicus pentaphyllus* Vell. in Fl. Flumin. 80.1829. [3].

Fig. 1 and 2. A large tree, bark grayish shiny. Leaves palmately compound, alternate or whorled, ex-stipulate, glabrous, petiole 20-25 cm long, two raised glands present at the junction of leaflets or top of petiole, leaflets 5, 11.5-17 x 6.5-9.5 cm, elliptic ovate or lanceolate, subcordate to truncate at base and mucronate at apex, apex clockwise spirally twisted, and entire margin, petiolule 2-3.5 cm long. Inflorescence diachasial cyme, peduncle pubescent to glabrous, 20-30 cm long, flowers unisexual, creamy white, bracteates, bract 3-6 x1-2 mm, elliptic ovate, pubescent, glandular at base laterally, pedicel3-4 mm long. ***Male flower:*** Sepals 5, gamosepalous, 3-3.5mm long, minutely pubescent outside,

petals 5, 1-1.25 x 0.3-0.5 cm, elliptic obovate, glabrous, fragrant, creamy white, stamens 8 in two whorls of 4, dimorphic, filaments glabrous, unitd at its half, filaments of outer whorl 5 mm long and inner 5.5 mm long, anther bilobed, sagitate or heart shaped, basifixed. ***Female flower:*** Sepals 5, gamosepalous, 3-3.5mm long, minutely pubescent outside, petals 5, 1-1.25 x 0.3-0.5 cm, elliptic obovate, glabrous, fragrant, creamy white, ovary 5 x 3.5 mm, elliptic, bicarpellary two locular, greenish white, pubescent, stigma papillate, papillae 8. ***Fruit:*** Drupe or combined nut,12-16 x 10-12 cm, pericarp fleshy outside and stony inside, 2 seeded, Seeds 3-3.2 x 2-2.3 cm, brown, glabrous, broader than long.

Fig. 1: *Jonnesia princeps* **A) Single twig, B) Single leaf, C) Inflorescense, D) Part of Inflorescense E) Single female flower, F) Dissected male flower, G) Gynoecium, H & I) Fruits.**

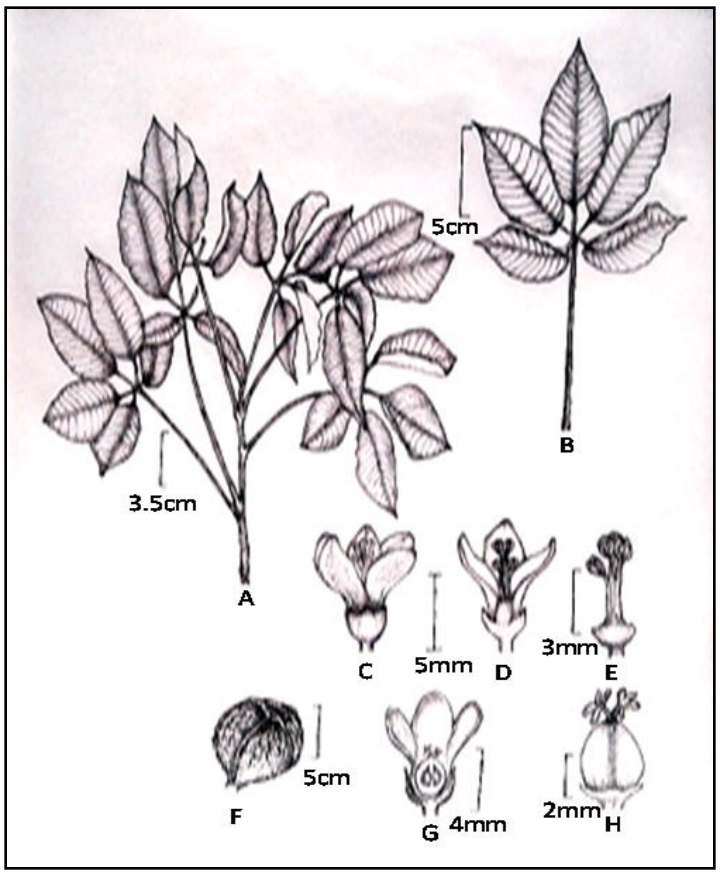

Fig. 2. *Joannesia princeps* Vell. A) A portion of twig, B) Single leaf, C) Male flower, D) L.S Of male flower, E) Stamens, F) Fruit, G) L.S of female flower, H) Ovary

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Short Communications

QUALITY ASSESSMENT OF DRINKING WATER SUPPLIED TO ISLAMPUR (MAHARASHTRA)

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ABSTRACT

Maharashtra JeevanPradhikaran is supplying water from Krishna river to Islampur city through the distribution network after proper treatment for potability. The quality water is at risk to detoriate during its flow through the distributing system. For assessment of quality of water supplied to user through this distribution system, physicochemical parameters and microbial contamination was studied in this present investigation. 102 sample stations were selected for the investigation. About 15% water samples indicated the presence of nitrite more than permissible limit. About 10% samples showed contamination with faecal coliforms. At certain sampling stations frequently leakages were observed. 50% of contaminated stations suffered from water-borne diseases.

KEY WORDS: Drinking water, Physicochemical and microbial parameter

STUDY OF DIVERSITY OF DECAPOD FAUNA FROM MANGROVE ECOSYSTEM OF NHAVA CREEK (RAIGAD), NAVI MUMBAI, MAHARASHTRA

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ABSTRACT:

Healthy mangrove forests provide a critical habitat, suitable feeding, breeding and nursing grounds for many species of decapods in intertidal and estuarine areas and are key to a healthy marine ecology. With continuing degradation and destruction of mangroves, there is a critical need to understand the biodiversity of the mangrove ecosystems. Data on species diversity of decapods in mangrove ecosystem of Nhava creek revealed presence of mainly 09 species recorded, from that 63.00 % belonged to crabs, 35 % to Prawns and shrimps and 2 % each to lobsters and squilla. Fiddler crab (*Ucaannulipes*) and hermit crab (*Pagurusprideaux*) are abundant at both sites. Species like *Scylla serrata*and *Leptodiusexaratus*were common whereas occasional distribution of *Portunus sanguinolentus*, *P. Pelagicus* were noted. *Penaeusmonodon, P. semisculatus, Metapenaeus affinis* and *Acetesindicus* were common whereas *Panuliruspolyphagus* and *Squilla mantis* were rare at observation sites. At present, mangroves of Nhava creek supports moderate density of decapods.

KEYWORDS: Diversity, Decapods, Mangrooves, Nhava creek

MOLECULAR IDENTIFICATION AND DISTRIBUTION OF AN EXOTIC SLUG *SARASINULA PLEBEIA* (FISCHER, 1868) FROM THE NORTHERN WESTERN GHATS, INDIA

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ABSTRACT:

Sarasinula plebeia (Fischer, 1868) is veronicellidae slug originally described from New Caledonia. It is nocturnal, hide during the day and a polyphagous herbivore. It is serious pest of agriculture and was introduced in the Central America, Madagascar, Australasia and some Pacific island groups. In India, veronicellidae slugs are a most important pest of agriculture like *Laevicaulis alte*, *Semperula maculata*, *Semperula birmanica* and *Semperula parva* etc. In the present study, *S. plebeia* was collected from the campus grounds of Shivaji University, Kolhapur. Two samples were analyzed for mitochondrial COI partial regions sequence. These results were compared with the online database available on National Centre for Biotechnology Information (NCBI). There is 99% sequence similarity to earlier deposited sequences of *S. plebeia*. So the DNA barcode helps for the identification of the species at molecular level. Considering the previous and present distribution of *S. plebeia*, it is broadly distributed in northern Western Ghats of India, which is serious agriculture issue.

KEYWORDS: *Sarasinula plebeia*, veronicellidae, mitochondrial COI, Western Ghats.

EFFECT OF CARBON NANOMATERIALS ON THE CHLOROPHYLL CONTENT IN THE LEAVES OF *IN-VITRO* GROWN SHOOTS OF *EHRETIA LAEVIS* ROXB.

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ABSTRACT:

The present work deals with effect of carbon nanomaterials on the chlorophyll content in the leaves of *in-vitro* grown shoots of *Ehretia laevis* Roxb. The nodal sector explants were cultured on Murashige and Skoog (MS) medium supplemented with different concentrations 0.5-5.0 mg/l of Benzyl Amino Purine (BAP). The obtimum result of BAP (2.5mg/l) induced mean of 5.1±0.31 shoots, 2.34±0.14 cm shoot length and 10.6±0.64 leaves/explants. Murashige and Skoog (MS) medium 2.5mg/l BAP was supplemented with increasing concentrations 20, 40, 60, 80, 100 and 120 µg/ ml of water soluble carbon nanomaterials. MS medium without carbon nanomaterials served as control. *In vitro* grown shoots were inoculated on the MS medium for the study of chlorophyll content in the leaves. Inoculation of culture tubes was carried out under aseptic conditions in the laminar airflow cabinet and incubated at 25±2^{0}C temperature and 3000 lux light intensity in the culture room. After 4 weeks the chlorophyll content in the leaves of *in-vitro* grown shoots were studied. Results showed that chlorophyll-a, chlorophyll-b and total chlorophylls content in the leaves of *in vitro* grown shoots of *Ehretia laevis* Roxb., increased with increasing concentrations of carbon nanomaterials and recorded highest (1.73±0.14 mg/g) at 60 µg/ml. At higher levels of carbon nanomaterials,chlorophyll content was declined.

KEYWORDS: Carbon nanomaterials, chlorophyll, explants, shoots, *Ehretia laevis.*

MERCURY INDUCED FLUCTUATIONS IN FOLLICLE STIMULATING HORMONE OF FISH

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ABSTRACT:

Water pollution by industrial effluents containing organics and heavy metals pose a serious hazard to the aquatic biota and public health. Highly polluted water apparently causes death of fish, but low levels of pollution may have no visible impact on fish but it may decrease the fecundity and eventually the extinction of this important natural resource. Mercury (Hg) is a highly toxic, non essential, persistent, immutable and non biodegradable metal. Mercury is known to bioaccumulate in human through food chain causing serious hazards. Mercury released in the environment is transformed in methyl mercury causing bioaccumulation and interfere the pitutitary gonadal axis resulting in alterations in reproductive hormones of fish. Pituitary gonadotropins both follicle stimulating hormone (FSH) and leutinizing hormone (LH) control the annual cycle of gonadal growth, ovulation in females, sperm release in males and production of sex steroids in both sexes thereby impairing the reproductive behavior. In females FSH stimulates growth of ovarian follicles and secretion of estradiol while in males FSH stimulates spermatogenesis.

Present study was undertaken to explore and confirm the endocrine disruptive effects of mercury on a fresh water teleost *Cirrhinus mrigala.* Radioimmunoassay is an immunological assay technique to measure concentration of antigen (hormone). It is a sensitive, specific method which involves competitive binding of radio labeled antigen and unlabeled antigen with a high affinity antibody. The result of quantitative alterations in follicle stimulating hormone may be either due to blocking of gonadotropin releasing hormone (GnRH) or quatitative and qualitative deterioration of gonadotropes (cells secreting gonadotropins). The dose dependent alterations in FSH suggest that the long term sub lethal exposure to mercury is detrimental to fish.

KEYWORDS: Mercury, Radioimmunoassay, follicle stimulating hormone, *Cirrhinus mrigala.*

INSECT PEST CONTROL POTENTIAL OF COMMON INDIAN TOAD BUFO (*DATTAPHRYNUS MELANOSTICTUS*)

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ABSTRACT:

The Common Indian Toad *Duttaphrynus melanostictus* is found is Anura amphibian animal. As like all amphibians belonging to order Anura (Batrachomorphus), Bufo is also truly carnivorous animal which majorly feeds on insects belonging to order Coleoptera, Lepidoptera, Arthoptera and Hemiptera cause major damage and are a major reason for yield depression. The toad absolutely feeds on insects belonging to order Coleoptera, Lepidoptera and Arthoptera, so they can be used to control these loss causing insects pests. In this study from month of June to October, we studied percent infestation by insects and average consumption of insect by toad.

KEYWORDS: Toad, insect pests, biological control.

REARING PERFORMANCE OF ERI SILKWORMS *PHILOSAMIA RACINI*

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ABSTRACT:

The Eri silkworm, *P. ricini* is a non–mulberry domesticated, multi-voltine insect, producing Eri silk. It is mostly found in Assam and Meghalaya. The present study has been done by tray rearing method and spreading castor leaves over the worms in rearing tray for one month. The present study is focused on sustainability of Eri Silkworm in Chiplun in Konkan area, and study reviled that larval development of Eri silkworm was normal with survival rate of 90%.

KEYWORDS: Rearing performance, Eri Silkworms.

FIRST KARYOLOGICAL ANALYSIS OF AN ENDEMIC INDIAN MAHARAJA BARB *(PUNTIUS SAHYADRIENSIS,* SILAS - 1953*)* FROM NORTHERN WESTERN GHATS OF INDIA

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ABSTRACT:

The family Cyprinidae, one of the largest families of freshwater fish and genus *Puntius* is one of the group of barb fishes. Cytogenetic data of Puntius shows extensive variability in karyotypic formula. The present study was undertaken for the karyological analysis of endemic fish species, Indian Maharaja Barb (*Puntius sahyadriensis*) from Northern Western Ghats of India. Gill cells of four male and four female fishes were used for the karyological analysis. Conventional staining of both the cells showed diploid chromosome 2n=50 and fundamental number (NF) was 66, Karyologically it showed 4 metacentric, 4 sub-metacentric, 8 Acrocentric and 34 Telocentric chromosomes. The Karyotype formula for the *Puntius sahyadriensis* is (2n (diploid) 50 = $L^{m}_{4} + L^{sb}_{4} + M^{a}_{8} + L^{t}_{8} + M^{t}_{10} + S^{t}_{16}$)

KEYWORDS: Karyotype, *Puntius sahyadriensis,* Diploid Chromosome,Western Ghats of India.

ISOLATION OF ENTOMOPHAGUS FUNGI (WHITE MUSCARDINE) AND STANDARDIZATION OF MEDIA

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ABSTRACT:

Entomophagus fungi is a natuarally occurring fungi in lepidopteran larvae. The main objective of our research was to isolate the fungus from infected lepidopteran larvae. The isolated fungal pathogen initially shown white coloured and then gradually changed to yellow colour after 48 hrs. The pure culture of the fungus was spread on Sabouraud's Dextrose Agar plate and incubated at room temperature. Isolation of conidiophores was carried out in D/w by easy mechanism as compared to standard technique. Morphological characteristics (margin edge, texture, size, colour, elevation) were studied by gram staining.

KEYWORDS: Entomophagus fungi, isolation standardization of media, characterization.

DIVERSITY OF BIVALVE AND GASTROPODA FROM RATNAGIRI, WEST COAST OF INDIA

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ABSTRACT:

Ratnagiri coast one is the rich in diversity of marine molluscs, the study were undertaken of marine bivalve and gastropods from mangrove habitat, rocky substrata, sandy beach, and muddy habitat, during October, 2014 to September, 2015 from selected study sites Bhatye estuary, Shirgaon creek, Mirya, Bhawati-bander and local markets, of Ratnagiri district coast, The calculation done according to Shannon Wiener Diversity Index, The productive molluscan fauna in prevalence of different habitats, so a wide chance of research to further explore on the possibility of ecological value and there urgent need to conservation to the species.

KEYWORDS: Marine bivalve, gastropoda, diversity, Ratnagiri, West Coast of India.

STUDY OF ANTIBACTERIAL PROPERTIES OF SPIDER SILK

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ABSTRACT:

The natural world is good source of therapeutic products that are able to inhibit the growth of bacteria. However, due to increased incidence of new infections and the increasing incidence of bacterial resistance to antibiotics, severe and ongoing needs be felt to discovery of diverse chemical structure and new mechanism of antimicrobial compound. Spiders for their biological activity need to produce cobweb from silk. The purpose of this study was to determine if spider silk exhibit antibacterial properties. In order to determine antibacterial properties the spider silk, web were extracted using different solvent such as methanol, ethanol, acetone and water. These extracts were screened for antibacterial activity using disc diffusion assay. Two bacteria's were used in the antibacterial assay namely Escherichiacoli and bacillussubtilis. In screening acetone solvent was shown the best for antibacterial activity compare to another solvent.

KEYWORDS: Antibacterial properties, Spider silk, Escherichiacoli, Bacillussubtilis.

IMPACT OF AERATED DRINKS AND PACKED FRUIT JUICES ON THE METABOLIC ACTIVITIES OF MAN

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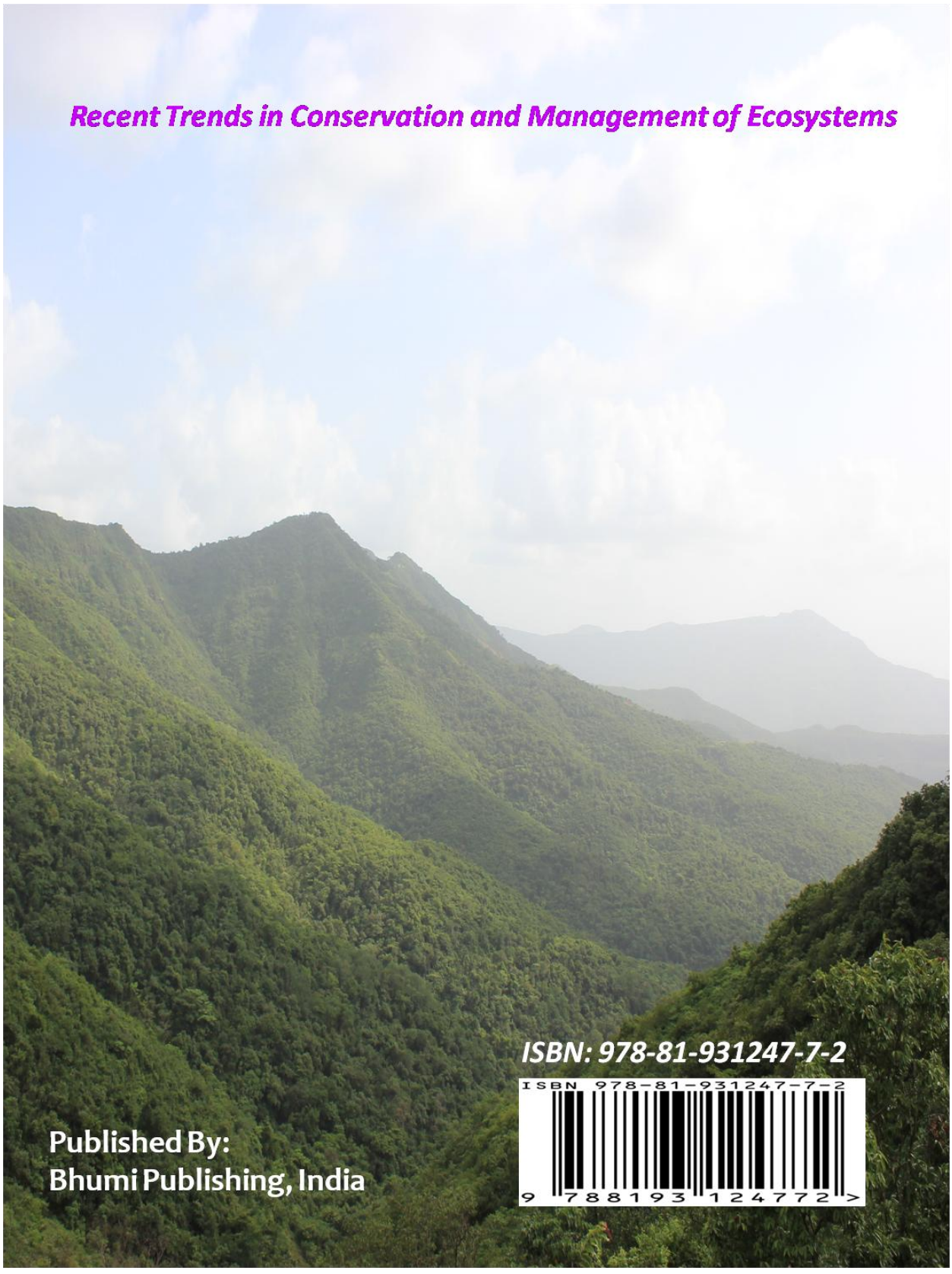
ABSTRACT:

pH is the negative logarithm of the hydrogen ion concentration, [H^+], a measure of the degree to which a solution is acidic or alkaline. The pH is used as a measure of whether the body is maintaining a normal acid-base balance. A favorable pH is essential to the functioning of enzymes and other biochemical systems. The body's fluids are normally somewhat alkaline, the pH being between 7.35 and 7.45. A pH above 7.8 or below 6.8 is generally fatal. Digestion is the process of breaking down the food we eat into components that are small enough for our body to absorb. The process starts with our teeth and saliva and then digestion and absorption of nutrients continue in the intestine, using enzymes made in the liver, gall bladder and pancreas. Different enzymes are more effective at different pH levels. If the pH levels are too high or too low for a particular enzyme, it might get denatured and will no longer perform its function. The enzymes that help digest food in the stomach such as pepsin, work best at a pH around 2, while those that function in the intestine including peptidases and maltase work best at pH around 7.5. The human body works best when it remains close to neutral 7. Soft drink can cause people to gain weight, weakening of teeth, and high number of cavities, malnutrition and insomnia. The present study investigates the pH of soft drink before and after mixing with chapati extract. An Increase in pH values was observed which suggest that soft drink increases acidity.

KEYWORDS: pH, acid-base balance, neutral, acidity.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