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**State Level Seminar
EMERGING TRENDS IN BIODIVERSITY CONSERVATION
(ETBC-2019)**

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Study of Water Quality Status of Godavari River at Kopergaon Taluka Dist. Ahmednagar (M.S.)

Rohan Kumar Yadav and B.S. Yadav

K.J. Somaiya College, Kopergaon, Dist. Ahmednagar,
Maharashtra, India.

ABSTRACT: *In the present investigation, physico chemical analysis of Godavari river have been done. The results obtained in the present probe reveals that the parameter are within the range prescribed by WHO and ISO standards for drinking purpose. Physical qualities like temperature PH, and chemical qualities like dissolved oxygen was considerably reduced. The values of TDS, Iron, Flourides Chlorides and Sulphate were fluctuating significantly.*

Introduction

During the past few decades the country has experienced heavy industrialization. As a result number of contamination in water bodies has risen. It has become vitually impossible for the laboratories situated mostly in the urban areas to regularly monitor the quality of water bodies. Through the river drinking and irrigation water supplied to the several taluka of Nashik, Ahmednagar and Aurangabad District, but since several years it has been noticed that river is facing a growing environmental deterioration. Soil erosion, flooding discharge of industrial effluents and organic domestic sewage is affecting water resources adversely. Therefore present work has been undertaken to study the physico-chemical nature of water of the Godavari river.

Material and method

In the present investigation, for studying the over all physic-chemical nature of water, water samples were collected from the selected station during first week of every months at fort night during the study period (Jan.- Dec. 15-16). The sample collection sites were designated as site A1, A2 and A3. The samples were collected in wide mouthed screw capped air tight and opaque polythene containers. Each samples were collected from 15 cm below the surface of water and physico-chemical parameters like temp, pH] dissolved oxygen, total dissolved solids iron, fouride, sulphate, hardness and total alkalinity were analysed by the procedurediscribed in standard method of APHA (1989).

Results and Discussion

Monthly variations of physic-chemical charecteristics are shown in Table-1. The concentrations of parameters at various sampling station are represented in Table- 1.

Temperature

Temperature is one of the most important physical parameters rise in temperature speed up the biochemical reaction and reduce the solubility of the gases. In the present investigations the highest temperature 24⁰C was, noticed in the month of Dec.2015 at the A2 and A3 sites however lowest temperature recorded in month of January 2015 at A1 site. Similor observations were made by Garde and Yadav (2010) at Chanakapur Dam. Nashik (MS) Salve and Hivare (2008) observed similar fluctuation in temperature of Wanaparakalpa reservoir near Parli-Vaijanath dist. Beed (MS).

P^H.

P^H is considered as important chemical parameter in water body since most of the aquatic organisms are adopted to average P^H and do not stand with abrupt changes. However the range of tolerance varies between species to species. The P^H values varies from 7.2 to 8.7 are suitable for aquatic organism. In the present experiment the maximum P^H was observed 8.53 in month of Jan at A3 and minimum P^H was observed 7.4 in month of December 2015 (fig.) Similar observation were made buy Prapurna and Shashikant (2017) Samal et.al(2005) observed similar result at Hirakund reservoir and Shastri (2005) of Malegaon Dist. Nashik (MS)

Dissolved Oxygen

The dissolved oxygen is sometime referred as the measure of the pulse of an aquatic ecosystem. Higher level of DO observed in month of Dec. 2015 while DO were recorded lower in month of January 2015. Shashikant and Raina (1990) reported that concentration of DO is directly related to the concentration of the phytoplankton. Similar observation were made by Kadam *et al.* (2008). Jindal and Thakar (2009) also observed the same result at Rewaiser wetland Dist. Mandi (H.P.)

Total Alkalinity

Total alkalinity shows marked seasonal variations. The alkalinity was high in month of Dec., 2015. Similar observations were by Garde and Yadav (2010) in the Chankapur reservoir.

Hardness

The total hardness range from 90 to 164 mg/L. The total hardness was highest at A3 in month of Dec., 2015 and lowest at A1 in month of Jan. 2015. Similar observations were made by Salve and Hivare (2008), Ugale and Hivare (2005) observed similar results during the limnological study of an ancient reservoir Jagtunga Samudia located at Khandar, Dist. Nanded.

Chloride

The concentration of chloride was recorded minimum 4.60 to 0.86 mg/L in month of Dec., 2015 and maximum 4.0.9.0 in month of Jan. 2015 at site A1 (Table-1). Similar observation were made by Sharma *et al.* (2008).

Fluoride

In the present study the fluoride concentration was found minimum 0.035 mg/L at A1, in month of Dec. 2015 and maximum 0.144 mg/L at A3 in month of Jan. 2015. The present result supported by Naseem and Gauhar (2009).

Sulphate

The minimum concentration 1.28 mg / L of sulphate was observed at A2 site in month of Dec. 2015. Similar observations were made by Aher *et al.* (2008), while studying the physico-chemical analysis of Kagdipura Swamp near Aurangabad.

From the present investigation it can be concluded that the water quality of Godavari river near Kopargaon is in permissible limits for surface water irrigation and suitable for exploitation of fishes and aquaculture.

Acknowledgement

One of the Author (RKY) thankful to the Principal, K.J.Somaiya College, Kopargaon for encouragement throughout the completion of this work.

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Impact of Fenevalerate Pesticide on the Total Protein Content of Fresh-Water Fish *Nimechilus botia*

Rohan Kumar Yadav, Goswami D.B.

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Maharashtra, India.

ABSTRACT: In the present experiment fresh water fish *Nimechilus botia* were exposed to the lethal concentrations of 3.92, 3.40, 3.10 and 2.60 ppm of fenevalerate (LC50 values of 24,48,72 and 96 hrs. respectively). After exposure periods total protein were estimated by using the lowery method. The results of the present investigation reveals a significant decrease in protein content. After 72 hrs. of exposure a significant decrease in protein content was observed.

Keywords:xyz, word.

Introduction

The pesticides are toxic substances which are used for pest control in agriculture. The application of pesticides has become one of the modern tools in the agriculture. But indiscriminate use of these has resulted in the contamination of aquatic bodies and affecting sincerely to the non-target organisms. These pesticides accumulated in the body of non-target organisms and damages the organs and other systems of the body and disturb the physiological and biological processes of the organisms.

The freshwater fish s

Material and Materials

The fresh-water fish *Nimechilus botia* was collected from Girna Dam near Malegaon. Fishes were cleaned in the laboratory and maintained in the plastic troughs for 4-5 days for acclimatization. The fishes were fed alternate days and water was changed. Fishes were not fed during the experiment. The physico-chemical parameters like temperature, P^H, dissolved oxygen dissolved solids and alkalinity were determined by the standard methods of APHA.

The fishes were grouped into five batches. The first batch was maintained as a control and second, third, fourth and fifth batches of fishes were exposed to 3.92, 3.40, 3.10 and 2.60 ppm LC50 values of 24, 48, 72 and 96 hrs. respectively). After exposure periods the fishes were dissected and hepatopancrease were taken out for biochemical assay of proteins by lowery method.

Results

The Physico-chemical parameters of water was used and maintained constant (Table-1). The results of the present investigation when fishes were exposed to fenevalerate pesticide for 24, 48, 72 and 96 hrs. reveals a significant decrease in protein content. In the control group the total protein content was 212.24±08.14. The protein contents in experimental fishes was noticed 206.00±8.36, 180 ±7.86, 140 ± 7.28 and 186 ± 6.80 after exposure to the Lc50 values of 24, 28, 72 and 96 hrs. Slight rise in protein content was observed after 96 hrs. of exposure (Table-2)

Table 1:Values of water parameters

Sr.No.	Parameters	Values (Ml/L)
1	Temperature	29.5
2	P ^H	7.2
3	Dossolved Oxygen	4.8
4	Dissolved solids	4.58
5	Alkalinity	60

Table 2: Effect of fanevalerate pesticides on protein content of fresh-water fish *Nimechilus botia*.

Group of fish	24 hrs.	48 hrs.	72 hrs.	96 hrs.
Control	212.24±8.14	212.24 ± 8.14	212.24 ± 8.14	212.24 ± 8.14
Experimental	206.06 ± 8.36	180.00 ± 7.46	140.68 ± 7.28	186.00 ± 6.80

Discussion

Being an important organic constituent proteins play an important role in cellular metabolism. Proteins regulate the process of interactions between intra and extra cellular media.

In the present experiment when fish *Nimechilus botia* exposed to the fenevalerate pesticide a significant decrease in protein content of hepatopancreas was observed. The decrease in protein content may be due to possible utilization of protein for metabolic purposes and enhanced proteolysis to meet the higher energy demand under toxicant stress. Similar observations were made by Kulkarni *et al.* (2005). Parate and Kulkarni (2003) suggested that depletion of protein may be due to utilization of protein for the production of energy to mitigate the pesticide stress and to prevent from fatigue due to the effect of pesticide. Keshvan *et al.* (2010) reported the depletion of protein content in fresh water crab *Barytelphusa guerini* exposed to hidden pesticides. Muley (2012) noticed the decrease in protein content in a Bivalve *Lamellidens marginalis* exposed to mercuric chloride.

In the present study, rise in the protein content were observed after 96 hrs. exposure. This rise in protein content may be due to anaerobic metabolism which can be increased under stressful conditions being able to cause change in protein content. Similar results were observed by Yadav *et al.* (2010) Bhagya Lakshami *et al.* (1981) reported an increase in protein content in the tissues of the crab *Oziotelphusa senex* after scemithion exposure. Humaira (2015) showed decline in protein content in crab *Barytelphusa guerinii* after exposure to folicure, pesticide. Borane and Zambare (2006) reported that cadmium chloride induced alterations in the protein contents of fresh-water fish *Channa orientalis*. eharjan and Raja (2008) suggested that changes in total proteins exposed to fanevalerate pesticide. Dhapate *et al.* (2007) reported that endosulfan pesticide influence the protein content of fresh-water fish *Nimechilus botia*.

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One of the author (R.K. Yadav) is thankful to the principal, V.N. Naik College Nashik for encouragement throughout the work.

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Pseudoheteroinverta betwensis Fresh Water Fish, *Heteropneustes fossilis*

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ABSTRACT: The present investigation deals with the incidence of infection of cestode, *Pseudoheteroinverta betwensis*¹⁵ parasitizing *Heteropneustes fossilis* from Bundelkhand Region (U.P.) India. The study were recorded during Aug. 2014 to July 2018 from different sampling station of Bundelkhand region of Uttar Pradesh. For this study 480 fresh water fish, *Heteropneustes fossilis* examined. The incidence of infection, winter season (27.08%) followed by monsoon season (22.91%) whereas low in summer season (19.58%).

Keywords: Incidence of infection, *Heteropneustes fossilis*, Bundelkhand region (U.P.)

Introduction

The infection of cestode parasites are found plenty of fishes, which reduces the food value of these hosts and decrease in their production and result in mortality, so the study of cestode parasites is necessity today. Very scanty work on the cestode parasite of catfish of Bundelkhand region of Uttar Pradesh were carried out. Notable contributions were made in population dynamics of helminth parasites by earlier researchers^{1,2,3,5,7,9,10,14,18}. The present study was designed to evaluate the prevalence of cestodes, *Pseudoheteroinverta betwensis*¹⁵ parasitizing fresh water fish, *Heteropneustes fossilis*.

Materials and Methods

In this study, intestines of *Heteropneustes fossilis* were examined for cestode infection during the period of Aug. 2014 to July 2018 from different localities of Bundelkhand Region of (U.P.) India. Cestodes were collected, preserved in 5% formalin, dehydrated in various alcoholic grades, stained in Mayer's Hemalum, cleared in xylol and mounted in Canada balsum. These cestodes were prepared for identification by standard methods^{13,23}. On taxonomic observations identified cestode was *Pseudoheteroinverta betwensis*¹⁵ Obtained data were recorded, processed for study of incidence of infection.

Discussion

Infection of cestode, *Pseudoheteroinverta betwensis*¹⁵ from *Heteropneustes fossilis* are presented (Table 1, Fig. 1). The incidence of infection of *Pseudoheteroinverta betwensis*¹⁵ were recorded in winter (27.08%) followed by monsoon season (22.91%) whereas infection was low in summer (19.58%). It was reported that temperature, humidity, rainfall, feeding habits of host, availability of infective host and parasite maturation were responsible for influencing the parasitic infections¹¹. Feeding activity of the host is reason for seasonal fluctuation of infections²⁰. Workers⁸ reported high prevalence of parasites in the Indian Major Carp *Labeo rohita* (Ham.) in Rajshahi, Bangladesh and highest prevalence (75%) and mean density (10.44) of parasites were found in the month of December and lowest (20%) in the month of February. There was high incidence of infection of *Senga* sp., *Gangesia* sp., *Proteocephalus* sp. Infected to *Channa* sp. In summer season (76.66%), 73.33% & 70.00%) followed by winter (65.21%, 52.17% & 56.52%) whereas infection was low in monsoon (36.84%, 26.31%, 31.57%)⁴. The incidence of infection of *Senga microrostellata*⁶ their²¹ incidence of infection were recorded (80.00%) in summer season followed in winter (52.50%) where as low (37.50%) in monsoon season. Srivastav²² reported that incidence of infection of *Mastacembelus armatus*¹² highest prevalence during summer season and lowest in rainy season. Narayan¹⁷ reported that high incidence of infection were recorded in winter season (78.33%) followed by monsoon season (63.33%) whereas low in summer season (46.66%) and Narayan¹⁶ reported high incidence of infection were recorded in summer season (73.75%) followed by winter season (51.25%) whereas low in monsoon season (48.75%). Narayan¹⁴ reported high incidence of infection were recorded in summer season (21.66%) followed by winter season (28.33%) whereas low in monsoon season (26.66%).

Pathan¹⁹ recorded infection of *Gangesia* sp. in *Wallago attu* during 2011-2012 maximum prevalence (50.0) in male was recorded in the months of January, whereas minimum (0) in August, September, October in rest of months between (42.86) to (37.50). The maximum prevalence (42.86) in female was recorded in the months

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of, November and January. Whereas minimum (0) in August and September, in rest of months between (37.50) to (28.50) and in 2012-2013 maximum prevalence (57.14) in male was recorded in the months of March, whereas minimum (0) in July, August and September. In rest of months between (12.50) to (37.50). The maximum prevalence (42.86) in female was recorded in the months of, February, May, November, and January. Whereas minimum (0) in July. In rest of months between (12.50) to (37.50).

On the basis of above discussion it can be concluded that the incidence of infection of cestode, *Pseudoheteroinverta betwensis*¹⁵ from *Heteropneustes fossilis* in Bundelkhand region of (U.P.) India high incidence of infection were recorded in winter season (27.08%) followed by monsoon season (22.91%) whereas low in summer season (19.58%).

Table 1: Incidence of infection of *Pseudoheteroinverta betwensis*¹⁵ from *Heteropneustes fossilis* during Aug. 2014 to July 2018.

Sr. no.	Season	Number of host examined	Number of host infected & their (incidence of infection) prevalence	Number of parasites collected
1	Summer	480	94 (19.58%)	99
2	Monsoon	480	110 (22.91%)	120
3	Winter	480	130 (27.08%)	141

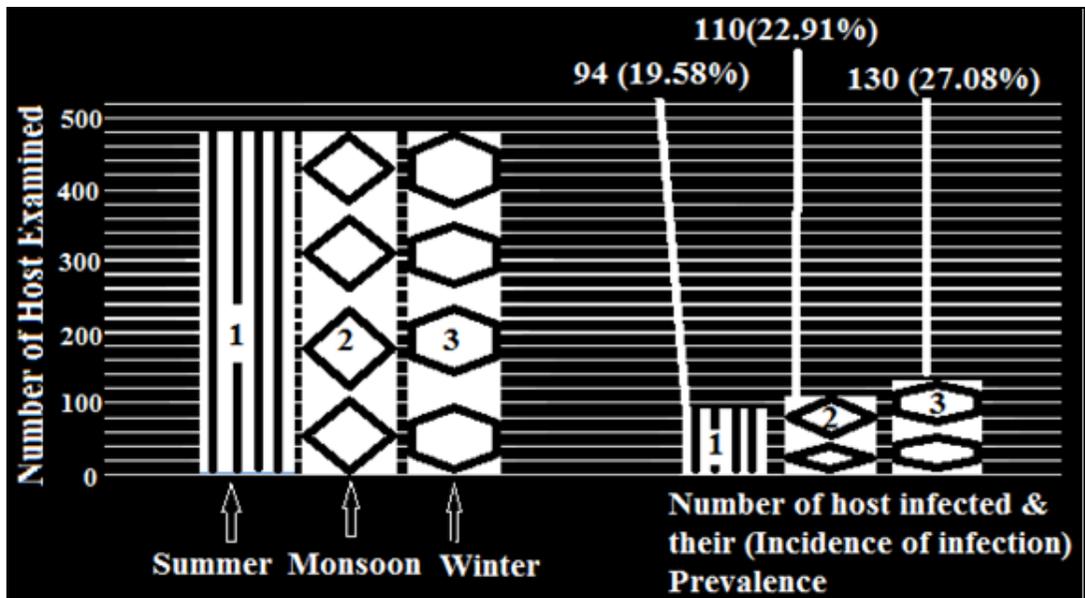


Fig 1: Incidence of infection of *Heteropneustes fossilis* during Aug.2014 to July 2018.

Conclusion and Result

Recorded data of present study show highest incidence of infection of cestodes in winter season followed by monsoon season whereas low in summer season due to environmental factors, breeding factor and feeding habitat influence of the seasonality of parasitic infection either directly or indirectly. Result of present study therefore is expected to be helpful for future research on helminth parasites of fresh water fish in this area.

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***Daphnia* Biodiversity of Mula Dam District- Ahmednagar, Maharashtra**

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ABSTRACT: *Mula Dam is an earthfill and gravity dam on Mula river near Rahuri in Ahmednagar district of the state of Maharashtra in India. In order to assess the biodiversity of Daphnia studies were undertaken for a year span on monthly basis and both qualitative and quantitative analysis of daphnia was done. During the study period Daphnia were identified and recorded during year span. The seasonal Daphnia biodiversity showed the peak during summer season while lower values were observed in rainy season.*

Introduction

Daphnia are one of the several small aquatic crustaceans commonly called water fleas because of their saltatory swimming style resembles the movements of fleas. *Daphnia* live in various aquatic environments ranging from acidic swamps to freshwater lakes and ponds.

The zooplankton play an important role in energy transfer in an aquatic ecosystem. They provide food for fishes in fish production. The body of *Daphnia* is usually 1–5 millimetres (0.04–0.20 in) long, and is divided into segments, The head is fused, and is generally bent down towards the body with a visible notch separating the two. In most species, the rest of the body is covered by a carapace, with a ventral gap in which the five or six pairs of legs lie. The most prominent features are the compound eyes, the second antennae and a pair of abdominal setae. In many species, the outer carapace of a *Daphnia* is transparent so all the internal organs, even the beating heart, can be seen. The knowledge of their abundance, diversity and distribution is important in understanding trophodynamics and trophic progression of water bodies.

In the present investigation an qualitative as well as quantitative assessment of *Daphnia* has been undertaken from Mula dam of Ahmednagar District.

Materials and methods

Water sample from 3 different spots of Mula dam were collected on monthly basis for period of one year i.e. from January 2017 to December 2017 for qualitative and quantitative estimation of *Daphnia* from each sampling spot 50 litre of water was filtered through plankton net having mesh size of 30µm, filtered water sample was preserved with lugols solution. The sample was then observed under binocular microscope for qualitative and quantitative estimation by using Sedgewick rafter cell method (APHA,1998). *Daphnia* were identified by using keys and monographs given by Edmonson (1959) and other regional publications. The physicochemical parameters of dam water were estimated (APHA,1998) to show its relation with density and diversity of *Daphnia*.

Results and Discussion

In the present investigation total 10 species of *Daphnia* were recorded. The two most readily available species of *Daphnia* were *D. pulex* (small and most common) and *D. magna* (large). The species with single genera were *D. dentifera*, *D. carinata*, *D. magna*, *D. longispina*, *D. pulex*. Monthly population density of *Daphnia* showed its peak during may 2017 while least density was recorded in july 2017.

Sameer and Kotov(2016) have also reported abundance of *Daphnia* in various water bodies of India. They have also reported that study on daphnia distribution in indian continent is less.

Lower values of *Daphnia* population density and diversity were observed during monsoon which could be due to dilution of water resulting in less nutrients or due to factors such as transparency, dissolved oxygen or pH.

Table 1: Distribution of *Daphnia* at various station of Mula Dam.

Sr.No.	Zooplankton	Summer	Rainy	Stations
1	<i>D. pulex</i>	9-21	8-16	A1, A2, A3
2	<i>D. magna</i>	5-20	3-6	A1, A2, A3
3	<i>D. dentifera</i>	4-14	2-4	A1, A2, A3
4	<i>D. carinata</i>	6-21	3-5	A1, A2, A3
5	<i>D. longispina</i>	9-15	4-6	A1, A2, A3

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Sevin (carbaryl, 50%) and Endotaf (endosulfan, 35%) Pesticides Impact on Nitrogen Fixation Potential of Soil Cyanobacteria *Nostoc muscorum*

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ABSTRACT: In the present study, nitrogen fixation efficiency of Cyanobacteria (blue-green alga) *Nostoc muscorum* was tested at increasing concentration of commercial grade pesticides Sevin (carbaryl, 50%) and Endotaf (endosulfan, 35%). Estimation of total nitrogen (%) fixed by the tested alga at each concentration (ppm) of pesticides was carried out by using conventional Micro- kjeldahl method. The pragmatic results revealed that, in the presence of 20 ppm of Sevin and even 5 ppm dose level of Endotaf pesticides, total nitrogen content was consistently decreased with the further increase concentrations of pesticides. At the higher dose level i.e. 250 ppm of Sevin and 100 ppm of endotaf, *Nostoc muscorum* showed 86.9% and 95.0% decrease in total nitrogen content over the untreated control respectively. On the other hand, at 500 ppm concentration of Sevin and 250 ppm of Endotaf pesticide, growth and nitrogen fixation was ceased in the tested blue-green alga. In general, it was seen that higher levels of pesticides application i.e. more than 20 ppm of Sevin and even 10 ppm of Endotaf adversely affected the occurrence and survivability of *Nostoc muscorum* in the laboratory cultures which is responsible for nitrogen fixation. It was concluded that indiscriminate use of studied pesticides had deleterious effect on nitrogen fixation of cyanobacteria *Nostoc muscorum* while the recommended doses of field application, the studied pesticides had no adverse effect under various crop fields.

Keywords: *Nostoc muscorum*, Sevin and Endotaf pesticides, Nitrogen fixation, Micro- kjeldahl method.

Introduction

Cyanobacteria are unique prokaryotic organisms with the ability to perform mutually compatible functions like biological nitrogen fixation and photosynthesis. The cyanobacteria contain nitrogenase and fix atmospheric nitrogen for which these attained remarkable practical importance since last 2- 3 decades as biofertilizer (Ahmed, 2001). They have tremendous potential in environmental management as soil conditioner, biofertilizer, biomonitors of soil fertility, water quality, feed for animals and protein supplements (Whitton and Potts, 2000).

In Maharashtra state, the agro- ecological conditions are favourable for the growth of blue-green algae and has great scope for its adoption to marginal farmers. *Nostoc*, *Hapalosiphon*, *Aulosira*, *Anabaena* and *Calothrix* were dominant nitrogen fixing cyanobacteria encountered in various agro-practices areas of Kopergaon tahsil, Maharashtra state. Such forms hold promise for crops such as maize, rice, mungbean, tomato and sugarcane (Meelu, 1992) and wheat (Genter *et al.*, 1995) by fixing nitrogen. However, the agronomic potential of blue-green algae is currently little exploited. An indepth agro-ecological research is an essential requisite for the sustainable improvement of blue-green algal technology (Roger, 1991).

One of the problem that has been noticed under field conditions is the destruction of blue-green algal populations by pesticide application intended to control the insects and pests of the various agricultural crops (Venkataraman, 1972; Kannaiyan, 1978). Variety of pesticides like organochlorines, organophosphates, carbamates and synthetic pyrethroids are now in use. These agrochemicals also damage wide variety of beneficial microorganisms because of their long persistence in the environment (Padhy, 1985). Therefore, pesticides used in routine applications in crop fields have important environmental effects in addition to those usually intended.

Such investigations are useful in awakening the farmers to adopt better farm management practices that in turn will reduce the chemical fertilizer input and problem of environmental degradation due to excessive use of pesticides. By considering all these issues along with societal responsibilities the present study was done on tolerance of commonly used pesticides carbamate, Sevin and organochlorine, Endotaf pesticides and their effect on nitrogen fixation of cyanobacteria *Nostoc muscorum* isolated from agro-practices areas of Kopergaon tahsil, Maharashtra state.

Material and Method

In the present work, effect of commonly used pesticides Sevin (carbaryl, 50%) and Endotaf (endosulfan, 35%) belonging to carbamate and organochlorine group, was studied on the tolerance and nitrogen fixation of soil blue-green alga *Nostoc muscorum*. These pesticides are generally used to control sucking, lepidopterous and nematode pests and mites that occurred in maize, wheat, sugarcane, cotton, onion, vegetable and oil yielding crops of the study area. The pesticide application rates recommended to control various crop pests of this region are 0.75 kg/ha for carbaryl Sevin and 0.7 liter/ha for endosulfan (Endotaf) and dimethoate (Rogor) which will provide a range of 5- 10 ppm in the agricultural crop field.

During the experiment, two commercial grade pesticides as carbamate, Sevin (Union Carbide Ltd.) and organochlorine, Endotaf (Rallis India Ltd.) were used. Stock solutions of these pesticides were prepared freshly for experiments in the sterilized media and added to the 50 ml of nitrogen free BG-11 culture media to obtain the desired concentrations (2.5, 5, 10, 20, 50, 100, 250 and 500 ppm) of each pesticide. The pH of all the media was adjusted to 7.5. Total nitrogen fixed by the cyanobacteria *Nostoc muscorum* at each concentration of two pesticides was estimated by conventional Micro- kjeldahl method (Jackson, 1958) after 28 days of harvesting in the laboratory cultures. Experiments were conducted in triplicate sets by inoculating equal amounts of actively growing tested unialgal isolate into cotton stoppered conical flasks.

Results and Discussion

The practical results as depicted in Table- 1 regarding nitrogen fixation potential of Cyanobacteria, *Nostoc muscorum* at 2.5, 5, 10, 20, 50, 100, 250 and 500 ppm concentrations of each studied pesticides in laboratory cultures were proved statistically significant. The tested blue-green alga *Nostoc muscorum* showed increased total nitrogen content upto 10 ppm concentration of Sevin over the control. While in the presence of 20 ppm dose level of Sevin pesticide, total nitrogen content was consistently decreased with the further increase concentrations of pesticides. At the higher dose level i.e. 250 ppm of Sevin, *N. muscorum* showed 86.9% decrease in total nitrogen content over the untreated control. On the other hand, at 500 ppm concentration of Sevin pesticide, growth and nitrogen fixation was ceased in the tested blue-green alga *Nostoc muscorum* (Fig. 1).

Table 1: Total nitrogen (%) fixed by *Nostoc muscorum* at different concentrations of Sevin (carbaryl, 50%) and Endotaf (endosulfan, 35%) pesticides. (Harvested after 28 days of incubation)

Conc. of pesticides (ppm)	0.00 (Control)	2.5	5	10	20	50	100	250	500
Sevin	4.89	4.96 (+1.4)	5.14 (+5.1)	4.96 (+1.4)	3.41 (-30.2)	2.00 (-59.1)	1.17 (-76.0)	0.64 (-86.9)	--
Endotaf	4.89	5.10 (+4.2)	4.27 (-12.6)	3.10 (-36.6)	2.00 (-59.1)	1.05 (-78.5)	0.24 (-95.0)	--	--

Values represents total nitrogen (%) mean of three replicates; figures in parenthesis () show percent increase (+) or decrease (-) relative to the total nitrogen in the control.

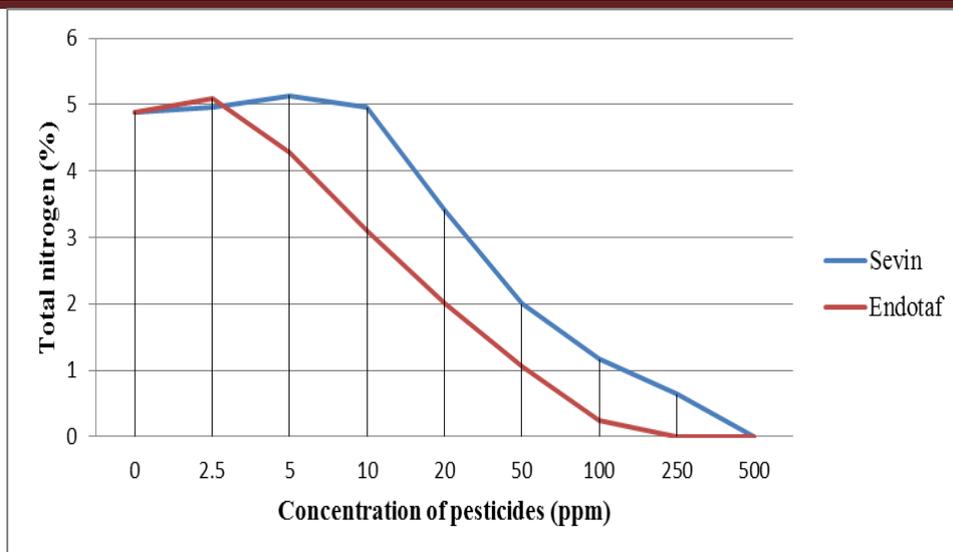


Fig. 1: Tolerance of Sevin (carbaryl, 50%) and Endotaf (endosulfan, 35%) pesticides on total nitrogen (%) fixed by *Nostoc muscorum*.

Concurrently, with Endotaf at 5 ppm concentration, progressive decline in nitrogen fixation occurred upto 100 ppm concentration where decrease in total nitrogen content was observed by 95.0% than the control in *Nostoc muscorum*. Further increase in dose level (i.e. above 100 ppm) of Endotaf pesticide, resulted into ending of growth and nitrogen fixation of *Nostoc muscorum* (Fig. 1).

The results obtained during the present investigation revealed that in laboratory cultures, the carbamate pesticide Sevin was less toxic than organochlorine, Endotaf to the tested cyanobacteria *Nostoc muscorum*. Further, a progressive decline in the nitrogen fixation of tested blue-green alga occurs with increasing concentrations of each pesticides. Among the different pesticides treatments, Endotaf was found to be highly toxic to *Nostoc muscorum* than the Sevin pesticide treatments. The reduction in total nitrogen content of the pesticide-adapted cyanobacteria *Nostoc muscorum* strain may occurred due to the inhibition of some stage(s) during the process of nitrogen fixation in the presence of higher concentrations of pesticides. Further stimulatory effect of Furadan, Sevin at lower concentrations on nitrogen fixation by blue-green algae under culture conditions may be due to the presence of nutrients in media that minimizes the toxicity of carbofuran (Kar and Singh, 1978; Sharama and Gaur, 1981). These views are coincides with the reports of earlier workers; Furadan (Kar and Singh, 1978); Sevin (Adhikary *et al.*, 1984); organo- chlorine (Pattnaik and Prakash Rao, 1982); Monocrotophos and Butachlor (Kiran Sharma and Singh, 2006) and Rogor (Das, 2008).

Conclusion

In general, it was seen that higher levels of pesticides application i.e. more than 20 ppm of Sevin and even 10 ppm of Endotaf adversely affected the occurrence and survivability of *Nostoc muscorum* in the laboratory culture which is responsible for nitrogen fixation. It was concluded that at the recommended doses of field application, the studied pesticides had no deleterious effect on nitrogen fixation of tested cyanobacteria *Nostoc muscorum*. Caution should be taken to determine the appropriate application dosage of these agrochemicals before applying them into the crop fields. Further it was also suggested that field studies on the blue-green algal population in pesticide burdened soils is required to be supplemented the data generated in the laboratory for proper analysis.

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Influence of Algal Extracts and Other Constrains on Protein Content of Cabbage Vegetable Crop (*Brassica oleracea* L.) Var. Kranti- 18

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ABSTRACT: A field experiments were conducted during the period of March- June of 2010-2011 in the black loamy soil. The experiment was laid out in RBD consisting eight treatments in which each experimental unit was repeated three times. The results revealed that the impact of algal extracts on cabbage vegetable crop protein content was found to be better in term of protein content over all other treatments. Among various input resources constraints treatment, the lowest and minimum protein content of 5.04 mg/ gm was occurred in the treatment T₀ (Control). The foliar application of algal extracts treatments, *Lyngbya martensiana* (T₂) shows (7.29 mg/ gm), *Hydrodictyon reticulatum* (T₄) shows (7.2 mg/ gm), *Chara zeylanica* (T₁) recorded (7.02 mg/ gm) and *Rhizoclonium crassipellitum* extract (T₃) recorded (6.48 mg/ gm) most augmentation in protein content. While the Recommended dose of NPK (T₇) treatment recoded (6.12 mg/ gm) protein content in the test plants resulting into encouraging increase and stands next to the algal extracts. While the Plantsol and Power plant recorded less protein content as compare to algal extract i.e (5.94 mg/ gm) and (5.8 mg/ gm) respectively.

Keywords: Extract, *Chara zeylanica*, *Hydrodictyon reticulatum*, *Lyngbya martensiana*, NPK, Plantsol, power plant.

Introduction

Fresh water algae contain high percentage of macro and micronutrients bounded in their major biochemical constituents and metabolites such as carbohydrates and proteins (Wake *et al.*, 1992). In this respect, Adam (1999) found that algal filtrate of the Cyanobacteria *Nostoc muscorum* significantly increased germination of wheat seeds as well as their growth parameters and nitrogen compounds, compared to controls. Also, Lozano *et al.* (1999) stated that, the application of an extract from algae to soil or foliage increased ash, protein and carbohydrate contents of potatoes (*Solanum tuberosum*).

Blue-green algal extract excretes a great number of substances that influence plant growth and development (Ordog, 1999). These microorganisms have been reported to benefit plants by producing growth promoting regulators (the nature of which is said to resemble gibberellins and auxins) polypeptides, antibacterial and antifungal substances that exert phytopathogen biocontrol and polymers; especially polysaccharides, that improve plant growth and productivity (Zaccaro *et al.*, 1999). Moreover, Zaccaro *et al* (2001) reported that, foliar application of biochemical organic substances, which supply macro and micronutrients, of increased demand.

In the light of the abovementioned reviews, it was of particular interest to investigate the effect of the four algal extracts; *Chara zeylanica* extract, *Lyngbya martensiana* extract, *Rhizoclonium crassipellitum* extract, *Hydrodictyon reticulatum* extract as T₁, T₂, T₃ and T₄ respectively on protein content of Cabbage grown in black soil.

Materials and Methods

• Preparation of Algal liquid extract:

The algal extract was prepared by using the method of Bhosale *et al.* (1975). 10 gram of fine powder of selected fresh water algae, *Chara zeylanica*, *Lyngbya martensiana*, *Rhizoclonium crassipellitum* and *Hydrodictyon reticulatum* were mixed separately in 100 ml of sterile distilled water, boiled it up to final volume of 10ml extract was allowed to cool at room temperature. Then extract was filtered through double- layered muslin cloth. The extract was used as stock solution of concentration 100%. Then the extracts were diluted with sterile distilled water separately for the preparation of 1%, 5%, 10%, 15%, 20% and 25% concentrations and were stored in airtight stopper bottles separately. Thus, these prepared algal extracts of aforesaid concentrations were applied as liquid fertilizer for testing the seed germination and assessing the seedling growth of cabbage vegetable crops.

• **Selection of algae and determination of algal extract concentration:**

The potential of algal species as liquid fertilizer was considered on the basis of pragmatic results obtained. The extracts of collected algal species with different graded concentrations were tested on the seeds of Cabbage. During the investigation, algal extracts of 15% *Chara zeylanica* and *Hydrodictyon reticulatum*; 20% *Lyngbya martensiana* and *Rhizoclonium crassipellitum* were showed observant and noteworthy increase in percent seed germination, root length, shoot length and total height of seedling over the control. Moreover, the higher algal extract concentrations above 25% where there was decreased seed germination and seedling growth over the control. Therefore only using extracts of *Chara zeylanica* and *Hydrodictyon reticulatum* at 15% and *Lyngbya martensiana* and *Rhizoclonium crassipellitum* at 20% concentration level used on the test vegetables Cabbage owing to assess their effect on growth and protein content.

The Cabbage seeds were soaked in 15% concentration of *Chara zeylanica*, *Hydrodictyon reticulatum* and 20% concentration of *Lyngbya martensiana*, *Rhizoclonium crassipellitum* extracts and other different constraints for about 14 hours. There after the presoaked seeds were placed in the raised bed at 10- 12 cm distance and 1- 1.5 cm deep. After completion of the sowing, light irrigation was given. After four weeks, seedlings were ready for transplantation.

• **Experimental layout plan and specifications**

The experimental plot was laid out in a Randomized Block Design (RBD) with seven treatments and one absolute (water sprayed) control, which were replicated in thrice.

• **Experimental Plot Specifications**

Specification	Cabbage
Crop variety:	Kranti-18
Season;	March- June
Gross plot size:	3.6 X 3.0 m
Net plot size:	3.0 X 2.5 m
Spacing:	40X40cm
Treatments used:	8
Replications:	3
No. of plants:	24
Source of irrigation:	Well Pravara left canal

Spraying of algal liquid extracts, Power plant, Plantsol and Recommended dose on cabbage vegetable crop pre flowering, flowering and Post flowering.

• **Estimation of proteins (mg/ gm)**

Proteins in the samples were extracted and estimated by Lowry's method (Lowry *et. al.*, 1951) using Folin-Ciocalteu reagent. 1 gm of leaf peel (Cabbage) was extracted with 10 ml of 0.1M phosphate buffer (pH 7.0) by grinding in pestle and mortar. The extract was centrifuged at 5000 rpm for 15 minutes. To the 1 ml of the supernatant; 5 ml of alkaline copper solution was added and mixed well. After 10 minutes, 0.5ml of diluted Folin- Ciocalteu reagent was rapidly added with immediate mixing and incubated at room temperature in dark for 30 minutes. Blue coloured product was measured at 660 nm on spectrophotometer by taking in one tube reaction mixture without sample (blank). Proteins content of the samples were calculated by drawing the standard curve using Bovine Serum Albumin (BSA) as working standard at a concentration of 1 mg/ ml.

Results and Discussion

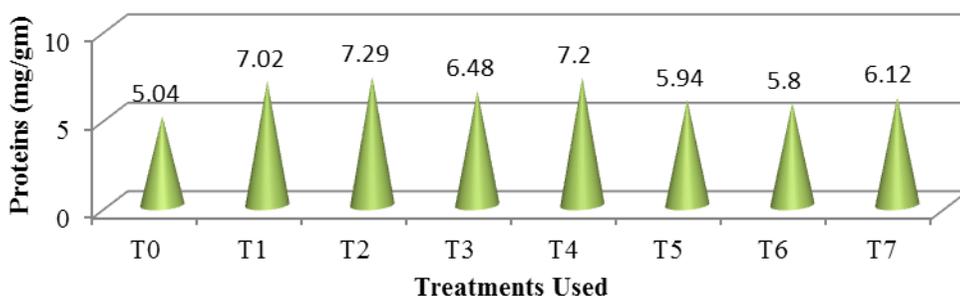
Fresh water algae distributed worldwide and improve the growth and development of the plants, with which they share the habitat, because they: 1- contribute to soil fertility in many ecosystems, 2- produce various biologically active substances and 3- have higher efficiency in bio-absorption of heavy metals i.e. bioremediation (Zaccaro *et al.*, 2001). Moreover, Hedge *et al.* (1999) documented that, application of algal biofertilizers is useful for the reclamation of marginal soils such as saline-alkali and calcareous soils.

In this context, pretreatment of Cabbage vegetable crop in the four algal filtrates, led to increase the protein content (T₁, T₂, T₃ and T₄ respectively) as compare to the control, Plantsol, Power plant, and recommended dose (T₀, T₅, T₆ and T₇ respectively).

Table-1: Effect of Algal Extracts, Plantsol, Power plant and Recommended dose of NPK as foliar application on Protein Content (Biochemical Content) of Cabbage (*Brassica oleracea* L.) var. Kranti- 18.

Treatments	Symbol	Proteins (mg/ gm)
Control	T ₀	5.04
<i>Chara zeylanica</i> extract	T ₁	7.02
<i>Lyngbya martensiana</i> extract	T ₂	7.29
<i>Rhizoclonium crassipellitum</i> extract	T ₃	6.48
<i>Hydrodictyon reticulatum</i> extract	T ₄	7.2
Plantsol	T ₅	5.94
Power plant	T ₆	5.8
Recommended dose of NPK	T ₇	6.12

Fig-1: Effect of algal extracts (T₁, T₂, T₃, T₄) Plantsol (T₅), Power plant (T₆) and Recommended dose of NPK (T₇) as foliar application on Protein content of Cabbage (*Brassica oleracea* L.) var. Kranti- 18.



The results pertaining to the protein content (mg/ gm) of Cabbage head for different treatments was presented in the Table- 1 and graphically illustrated in Fig. 1. The protein content in test Cabbage heads ranged between minimum 5.04 mg/ gm to maximum 7.29 mg/ gm. From this it was evident that, the treatment T₂ (*Lyngbya martensiana* extract) recorded significantly higher amount of 7.29 mg/ gm protein which was on par to the T₄ treatment. This was followed by the treatment T₄ (*Hydrodictyon reticulatum* extract), T₁ (*Chara zeylanica* extract), T₃ (*Rhizoclonium crassipellitum* extract) and correspondingly readings noted were 7.20 mg/ gm, 7.02 mg/ gm and 6.48 mg/ gm. Of these treatments, the treatment T₄ was on par to the T₂ treatment whereas T₃ was on par to the treatment T₇. The moderate amount of protein i.e. 5.94 mg/ gm and 5.80 mg/ gm was appeared in the treatment T₅ (Plantsol) and T₆ (Power plant) respectively which was on par to each other. Noteworthy, the T₇ (Recommended dose of NPK) treatment showed 6.12 mg/ gm of protein content which positioned next to the algal extracts treatments and also on par to the T₃ treatment. However, the lowest and minimum protein content of 5.04 mg/ gm was occurred in the treatment T₀ (Control).

The treatment of algal extracts have more pronounced and crucial influence on the protein content was in consonance with the reports of several workers, Featom by-Smith *et al.* (1987) recorded 13% increase in protein content over the untreated control plants in Groundnut seeds treated with foliar applications of commercial seaweed concentrate. Kolhe and Ruikar (1987) reported significantly increased protein content in graded levels of nitrogen and biofertilizers in Cabbage. Mostafa *et al.* (1999) obtained highest amount of proteins from shoot system of fabe beans treated with *Enteromorpha intestinalis* and *Jania rubens* extracts. Venkataraman Kumar and Mohan (2000) observed recovery and accumulation in biochemical constituents like proteins in ragi plants when their seeds were presoaked in 1% SLF prepared from *Padina pavonica* and *Sargassum plagiophyllum*. Anantharaj and Venkatesalu (2001, 2002) obtained a significant increase in protein content than the unspread control due to seaweed application in *Vigna catajung* and *Dolichos biflorus*. Likewise, the foliar application of SLE of *H.valentiae* exhibited greatest influence on the protein synthesis leading to 60.94% increase over the control in Fenugreek was studied by Khemnar (2001).

Zaccaro *et al.* (2001) who documented that, the biofertilizers are likely to assume greater significance as complement and/or supplement to chemical fertilizers in improving the nutrient supplies to cereal crops because of high nutrient turn-over in the cereal production system, exorbitant cost of fertilizers and greater consciousness on environmental protection.

Conclusions

The use of bio-organic fertilizers in agriculture has been recognized of late, as a better substitute to chemical fertilizer, in regard to the environment friendly attribute of the former and the harmful effect of the latter on human health. While, being environment friendly, bio-organic fertilizers, also improve the physical properties of the soil, water retention capacity, prevent nutrient depletion and add value to the crop grown.

To conclude, the fresh water filamentous algae as liquid fertilizer may prove efficient tool for boosting green revolution, to overcome food shortage all over the world and will be appeared highly beneficial to mankind. In regard, to this, as revealed in the present study, the effect of algal extract has showed best results in terms protein content of the crop, as against the use of chemical fertilizer and recommended use of NPK alone.

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Effect of Mutagen on Mineral Content of the Morphological Mutant of Cowpea [*Vigna unguiculata* (L.) Walp.]

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ABSTRACT: Cowpea [*Vigna unguiculata* (L.) Walp.] belongs to family Fabaceae. Cowpea is an important grain legume throughout the tropics and subtropics. Cowpea seeds are important source of protein, vitamins and minerals. It is one of the most important pulse crops in India. Cowpea variety- Phule Pandhari (PCP-9708) was used for present research work. The seeds were treated with chemical mutagen like EMS and physical mutagen gamma rays and combination of EMS and gamma rays. In the present studies mineral content were estimated in the morphological viable mutant like Robust mutant, Branched mutant, Dark green mutant, Early flowering mutant, Late flowering mutant, Tall mutant, Dwarf mutant, Bold seeded mutant, Luxuriant mutant and Divergently branched mutant in Cowpea. The estimated value of mineral elements in viable mutant was observed for N, P, K, Ca, Mg, S, Fe, Mn, Zn, Cu and Na. Induced mutagenesis may bring about changes in the overall morphology of plants and also increase in biochemical nature like carbohydrates, proteins, fats, vitamins and minerals.

Keywords: Cowpea, Gamma rays, EMS, Mineral, Mutagens.

Introduction

Cowpea [*Vigna unguiculata* (L.) Walp.] belongs to family Fabaceae. It is also known as 'Labia' and in Marathi known as *Chavali*. It contains carbohydrates, proteins, fats, vitamins and minerals. Cowpea is one of the most important pulse crop in India. The seeds are major source of dietary protein in most developing countries. There are twenty two varieties of Cowpea have been recommended for different states and union territory. Cowpea provides a dietary protein for the human consumption and plays an important role in Indian subcontinents. It is one of nitrogen fixing

Materials and Methods

Selection of experimental seed material

The experimental seed material of Cowpea (*Vigna unguiculata* [L.] Walp.) Variety- **Phule Pandhari** (PCP-9708) was collected from Pulse and oil seed research station, Pandharpur, Dist- Solapur released by Mahatma Phule Krishi Vidhyapeeth, Rahuri, Dist-Ahmednagar.

Mutagens used

Physical mutagen Gamma rays, Chemical mutagen Ethyl methane sulphonate (EMS) were used for treatment.

Gamma rays treatment

The experimental seed material was irradiated at Nuclear Chemistry Division, Department of Chemistry, Savitribai Phule Pune University, Pune, Ganesh khind, Pune- 411007. For Gamma rays treatment the dry and healthy seeds were packed and irradiated with 200 kR, 300 kR, 400 kR and 500 kR obtained from source Co⁶⁰.

EMS treatment

Chemical mutagen Ethyl methane sulphonate (EMS) was obtained from Spectrochem Pvt. Ltd. Mumbai with a molecular weight 124.16 and density 1.20. Dry and healthy seeds were treated with EMS at the concentration of 0.050%, 0.075 %, 0.10% and 0.125 % for 6 hours.

Experimental Setup

The seeds of each treatment along with control were sown in research field by Complete Randomize block Design (RBD) with three replication and result is recorded.

Result and Discussion

Minerals Content

Macro and micronutrients was estimated from the seed samples of Cowpea mutant. The different minerals like N, P, K, Ca, Mg, S, Fe, Mn, Zn, Cu and Na was estimated from the given seeds samples of ten different viable mutants. The average of mineral contents in seeds of control from 0.10% to 4.26% and in other minerals shows 16 ppm to 118 ppm. The highest 5.22% nitrogen content was observed in dwarf mutant. The highest 0.60% phosphorus mineral content was observed in branched and late flowering mutant.

Effect of mutagen on Mineral content of the morphological mutant of *Vigna unguiculata* (L.) Walp.

Morphological Mutants	N %	P %	K %	Ca %	Mg %	S %	Fe ppm	Mn ppm	Zn ppm	Cu ppm	Na %
Control	4.26	0.45	1.50	0.39	0.19	0.10	118	16	50.6	Nil	0.55
Robust Mutant	1.26	0.59	1.70	0.35	0.42	0.15	106	7.90	57.2	Nil	0.40
Branched Mutant	4.09	0.60	1.50	0.30	0.44	0.20	254	12.0	50.2	Nil	0.60
Dark Green Mutant	4.41	0.56	1.31	0.40	0.41	0.19	143	16.13	50.94	Nil	0.40
Early flowering Mutant	4.20	0.54	1.50	0.56	0.38	0.24	130	14	45.0	Nil	0.50
Late flowering Mutant	4.59	0.60	1.49	0.43	0.33	0.15	130	18	51.6	Nil	0.40
Tall Mutant	3.86	0.50	1.40	0.47	0.32	0.17	256	18	46.8	Nil	0.40
Dwarf Mutant	5.22	0.61	1.68	0.70	0.55	0.09	356	10	68.66	Nil	0.55
Bold seeded Mutant	4.14	0.50	1.35	0.57	0.38	0.16	384	19.8	150	Nil	0.96
Luxuriant Mutant	4.48	0.37	1.40	0.43	0.30	0.06	178	10	46.4	Nil	0.40
Divergently Branched Mutant	4.87	0.53	1.40	0.63	0.40	0.21	208	15.4	55	Nil	0.50

The highest 0.50% potassium mineral content was observed in branched and early flowering mutant. The highest 0.70% calcium mineral content was found in dwarf mutant. The other Mg, S and Na mineral content was 0.9 % to 0.50 % observed in varied content of minerals in seed samples. In case of Fe, Mn, Zn and Cu the mineral content was 7.90 ppm to 256 ppm was observed in seed sample. In Fe the highest 356 ppm mineral content was observed in dwarf mutant.

Mineral content were estimated in the morphological viable mutant like Robust mutant, Branched mutant, Dark green mutant, Early flowering mutant, Late flowering mutant, Tall mutant, Dwarf mutant, Bold seeded mutant, Luxuriant mutant and Divergently branched mutant in Cowpea. The estimated value of mineral elements in viable mutant was observed for N, P, K, Ca, Mg, S, Fe, Mn, Zn, Cu and Na. The estimated values of mineral content has been significantly increased in the majority of viable mutants and in few mutants showed linear decreased values. The higher values of mineral elements correlated to high yielding mutants was observed in majority of morphological viable mutants in the present work.

Conclusions

All viable mutants were estimated from the seed samples of Cowpea like N, P, K, Ca, Mg, S, Na, Fe, Mn, Zn, Cu were estimated. Dwarf mutant content highest mineral percentage in N (5.22 %), P (0.61%), Mg (0.55%) and Zn (68.66%) and Robust mutant content K (1.70%) and bold seeded mutant content Fe (384 ppm) and Mn (19.8ppm.) than control. The nutritional improvement of legumes through breeding program has very immense important in world of food crisis. For this quantitative improvement of plants in yield is very important.

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Effect of Anticancer Drug, Cisplatin on the Nucleolar Changes in the Developing Oocytes of Fresh Water Bivalve, *Parreysia corrugata* (M)

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ABSTRACT: Cisplatin is the potent and valuable anticancer drug widely used for chemotherapy against solid tumors. This drug exhibits effective chemoprevention in cancer therapy and also lead to several manipulations and cytotoxicity. In present toxicity studies, sub-lethal dose of cisplatin ($LC_{50}/10$ for 96 hours) was given to an experimental model, the fresh water bivalve *Parreysia corrugata* for 30 days. The nucleolar changes of developing oocytes from female gonads ovary were observed from control and treated bivalves by using Methyl green and Pyronin-Y stains. It was found that the chronic exposure of anticancer drug, Cisplatin (1.007 ppm) induced alterations in the structure of nucleolus and hence the nucleolus of developing oocytes showed condensation of the chromatin, aggregation of the RNA at certain locations, overgrowth of the nucleolus and induction of increased number of nucleoli. Extra nucleoli were more prominent in cisplatin treated bivalves after 30 days of exposure.

Keywords: Cisplatin, Anticancer drug, Developing Oocytes, Nucleolus, Bivalves.

Abbreviations: DNA- Deoxyribonucleic acid, RNA- Ribonucleic acid, MSL. Mean sea level, LC_{50} - Lethal concentration for 50% mortality, NOR- Nucleolar Organizer region.

Introduction

The main process and strategy to control the cancers is to develop the anticancer drugs that could inhibit the DNA replication. Since the expression of all the genes is through the process of transcription, several transcription inhibitors are also developed as the anticancer drugs. However there is no satisfactory drug known to control the cancer. Many Scientists have used various markers and methods to screen the antitumor /anticancer drugs with mode of action at DNA replication and transcription level. In cell nucleus, nucleolus is the site of the fast replication of DNA to form tandem repeats of DNA and the site for the transcription of the rRNA. The nucleolar activities are multiplied many fold in the developing oocytes. And hence this can act as the best suitable marker to screen the anticancer drugs.

Lodish *et al.* (2000) reported that approximately 80 % of the total RNA in rapidly growing mammalian cells is rRNA and 15 % is tRNA; protein encoding mRNA is thus constitutes very small quantity of the total RNA (Lodish *et al.*, 2000).

During embryonic development i. e. cleavage, large quantity and number of proteins are needed. Since the DNA contents are actively involved in the process of replication for its rapid multiplication, most of the rRNA, mRNA and ribosomes required during the cleavage are synthesized during oogenesis and are stored in the ooplasm. Thus nucleoli of developing oocytes are actively involved in ribosome synthesis. The increased activities make nucleolus as a target to the anticancer drugs, as these drugs first attack and affect the cells of high metabolic rate or activities.

When the developing oocytes are exposed to replication inhibitors and the transcription inhibitors, they will show varied effects on the nucleolus. Thus, by applying single anticancer drug test, one can determine whether the drug is replication inhibitor or transcription inhibitor. The nucleolus is the most important and definitely differentiated nuclear sub component. It is very important nuclear structure, where the biosynthesis of ribosome takes place. It is also clear that the nucleolus also performs non ribosomal functions (Raska *et al.*, 2006).

The antitumor activities of cisplatin involves induction of inter and intra crosslinks that severely leads to distortion of the DNA helix and blocks its duplication. Repair of cisplatin-DNA adducts by mammalian excision nuclease (Zambale *et al.*, 1996).

Cisplatin, cis-diammine dichloroplatinum II (cis-DDP), the platinum containing coordination complex. It is an effective antitumor agent used in the treatment of wide variety of human cancers (Rozeneweig M. *et al.* 1977; Prestayko A.W. *et al.*, 1979, Review, Br., 1993). Cisplatin is very effective anticancer drug widely used in the treatment of the bladder, testis, ovary and other solid tumors (Borch R.F., 1987). The present study will be

useful to develop the simple model for the screening of the anticancer drugs and their effects at the primary level. This study can also help us to compare effectiveness and side effects of various anticancer drugs.

Material and methods

The fresh water bivalves, *Parreysia corrugata* (M) were collected from Girna lake area near Jamda (Latitude 20° 33'N, Longitude 75°10'E, 352 m MSL) which is 14 km away from Chalisgaon, District Jalgaon of Maharashtra State. Bivalves were collected and brought to laboratory in aerated container. They were maintained in a glass aquarium containing dechlorinated water for 3- 4 days at 21°C- 26°C temperature. The PH of water was in the range of 7.0- 7.5 and well acclimatized at laboratory conditions. The water in aquarium was changed regularly after every 24 hours. After acclimatization, healthy full size bivalves of 2.8-3.00 cm height X 4.6- 5.3 cm length were selected from the aquarium and used for the experiments.

The well acclimatized bivalves, *Parreysia corrugata* were divided into two groups with equal number of animals. They were kept in separate aquarium for 30 days. Bivalves from one group were maintained as a control and one group was treated by chronic concentration (LC₅₀/10 value of 96 hours) of Cisplatin (1.007 ppm).

On 10th, 20th and 30th day of exposure, bivalves from control group and experimental group were sacrificed and their gonads were removed and fixed in Carnoy's fluid for 25 to 30 minutes only, as it is a rapid nuclear fixative. Then gonads were dehydrated in alcohol grades, cleared in xylene and embedded in paraffin wax (56-58°C).

Then, prepared blocks of the gonads, trimmed and attached to microtome pegs and were then cut with the thickness of 06 µ (micron), arranged ribbons of the section on the glass slides smeared with thin film of egg albumen and affixed for 24 hours, and stained with Methyl Green Pyronin-Y stain. So as to observe the DNA and RNA specific areas in the nucleolus, the sections were also stained by Methyl Green and Pyronin-Y stains. Among sections some oocytes were without nucleus or nucleolus on the basis of path through which the sections of oocytes were taken. The oocytes in section with prominent nucleus and nucleolus were selected for the study. The characteristic features of the nucleolus and their number were counted, measured and photographed. The photographs are presented in the plates.

Observations and Results

Fresh water bivalve, *Parreysia corrugata* is hermaphrodite animal. The gonads are composed of different follicles such as male and female, Ovarian follicles with four to six developing oocytes with size measures from 240 µm to 360 µm in diameter. and in the follicles, the female follicles shows developing ova of varying sizes. The size of the oocytes measures from 48 µm to 224 µm in diameter, the size of the nucleus varies from 24 µm to 64 µm in diameter while the size of the nucleolus varies from 04 µm to 24 µm in diameter. Majority of the oocytes were between 56 µm to 160 µm in diameter. The oocytes of different stages of development such as oogonia, primary oocytes, vitellogenic oocytes, mature oocytes and degenerative oocytes are also found among female gonads.

The 6 micron thick sections were stained by Methyl green-Pyronin Y stain to study the changes in nucleolar structure. But, due to high rate of transcription of rRNA copies on each gene, the staining of DNA by methyl green become poor and methyl green pyronin Y stain could not differentiate the DNA and rRNA rich areas in the nucleolus. Different photomicrographs of control and treated bivalve's oocytes are given in the Photo plates I, II, III, IV, X, XVI, XVIII.

Figures 3.1.1(a and b), 3.1.2 (a and b) and 3.1.3 (a and b) in photoplates I, II and III shows the normal oocytes from control bivalves, stained by Methyl green-Pyronin Y stain; Methyl green stain and Pyronin Y stain respectively. Micrometer scale measures 16 µm per ocular division at 100x magnification and 04 µm per ocular division at 400x magnifications. Each oocyte shows large nucleus and a single large nucleolus. Due to high amount of nucleic acids (i.e. DNA and RNA), nucleolus is stained darkly as per the stain used.

Figures 3.1.1 (a and b) in plate I, Figures 3.1.2 (a and b) in plate II and Figures 3.1.3 (a and b) in plate III shows most oocytes with prominent nucleus and small darkly stained spherical nucleolus and some oocytes without nucleolus which may be due to the random plane of cutting that does not include nucleolus, since the size of the nucleus is much larger than that of nucleolus. Most of the oocytes are large, spherical, and subspherical in shape, and their size measures from 48 µm to 224 µm in diameter, the size of the nucleus varies from 24 µm to 64 µm in diameter while the size of the nucleolus varies from 04 µm to 24 µm in diameter. Majority of the oocytes were between 56 µm to 160 µm in diameter.

Figures 3.2.1 in plate IV shows the oocytes stained by Methyl green-Pyronin Y stain from the bivalves exposed to chronic dose of cisplatin (1.007 ppm) for 10 days. Figure 3.2.1 (a) in plate IV shows the oocyte containing

nucleus with single nucleolus with conical extra outgrowths while figure 3.2.1 (b) shows somewhat elongated nucleolus in the nucleus.

Figures 3.4.1 in plate X shows the oocytes stained by Methyl green-Pyronin Y stain from the bivalves exposed to chronic dose of cisplatin (1.007 ppm) for 20 days. Figure 3.4.1 (a) in plate X shows the oocyte containing nucleus with two nucleoli with extra outgrowths and condensed chromatin while figure 3.4.1 (b) shows two nucleoli with extra outgrowths and condensed chromatin.

Figures 3.6.1 in plate XVI shows the oocytes stained by Methyl green-Pyronin Y stain from the bivalves exposed to chronic dose of cisplatin (1.007 ppm) for 30 days. Figure 3.6.1 (a) in plate XVI shows the oocyte containing nucleus with three nucleoli with extra outgrowths and condensed chromatin while figure 3.6.1 (b) also shows three nucleoli with extra outgrowths and condensed chromatin.

Figure 3.6.3 (a) in plate XVIII shows the oocyte containing nucleus with three nucleoli with extra outgrowths while figure 3.6.3 (b) also shows oocyte containing nucleus with three nucleoli with extra outgrowths.

The present investigation study clearly indicates that the nucleolus can be used as a biomarker for the primary screening of the DNA replication and transcription inhibitors for development of new anticancer drugs.

Figures:(Photoplates I-XVIII)

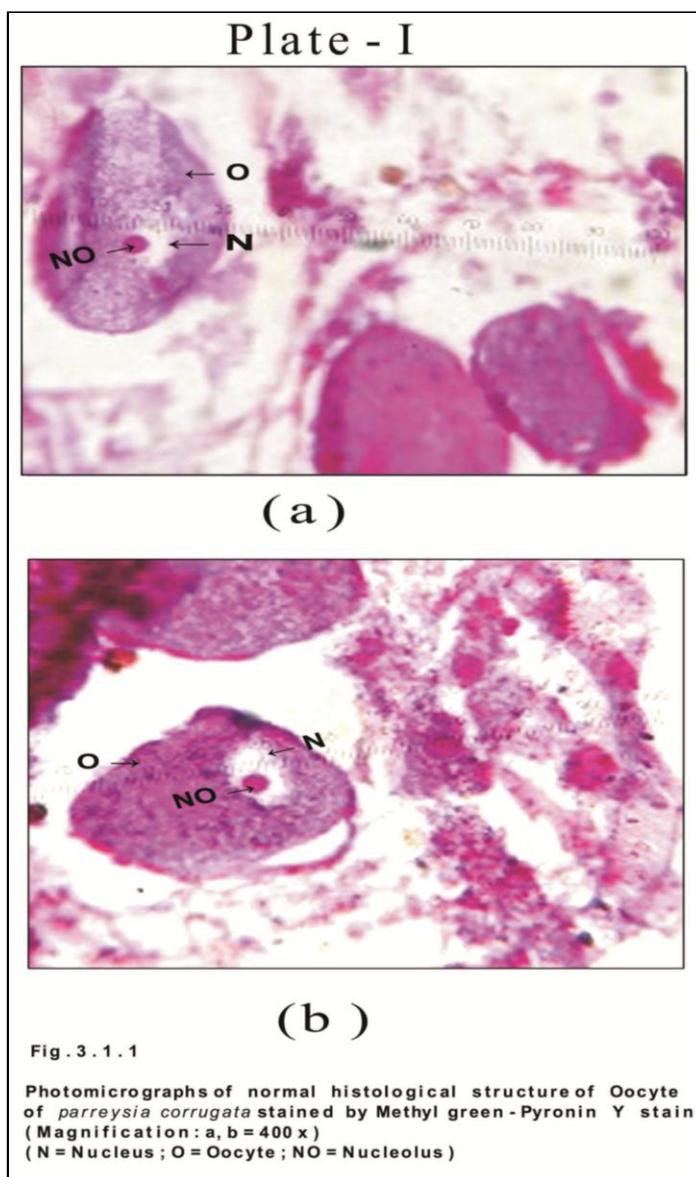
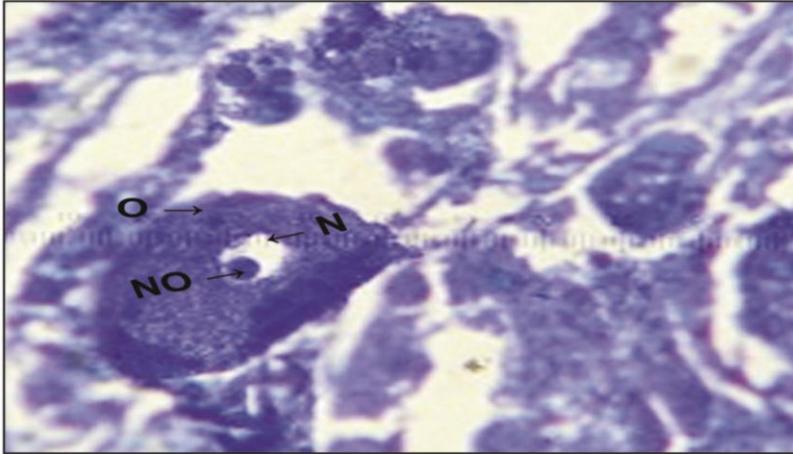
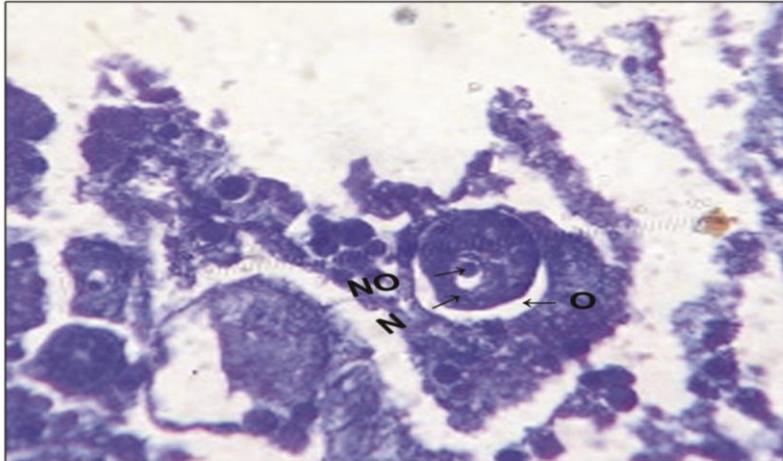


Plate - II



(a)

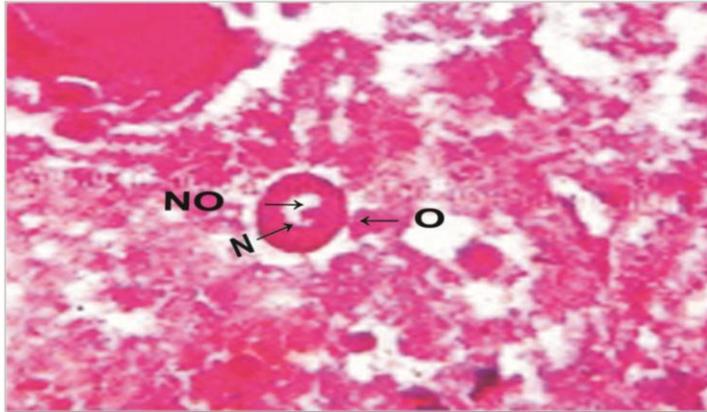


(b)

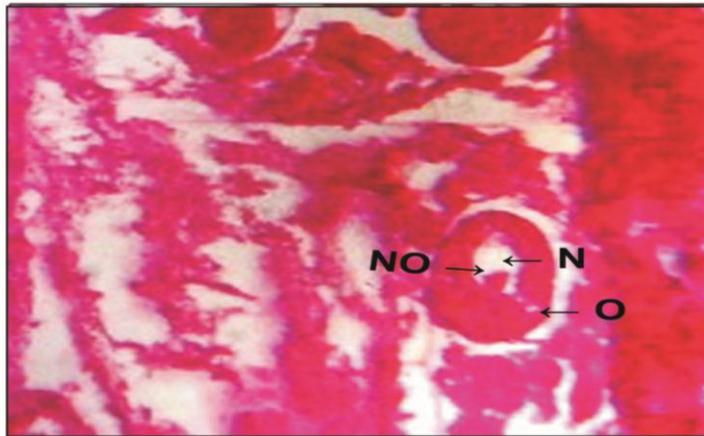
Fig. 3.1.2

Photomicrographs of normal histological structure of Oocytes of *parreysia corrugata* stained by Methyl green stain (Magnification: a, b = 400 x)
(N = Nucleus ; O = Oocyte ; NO = Nucleolus)

Plate - III



(a)



(b)

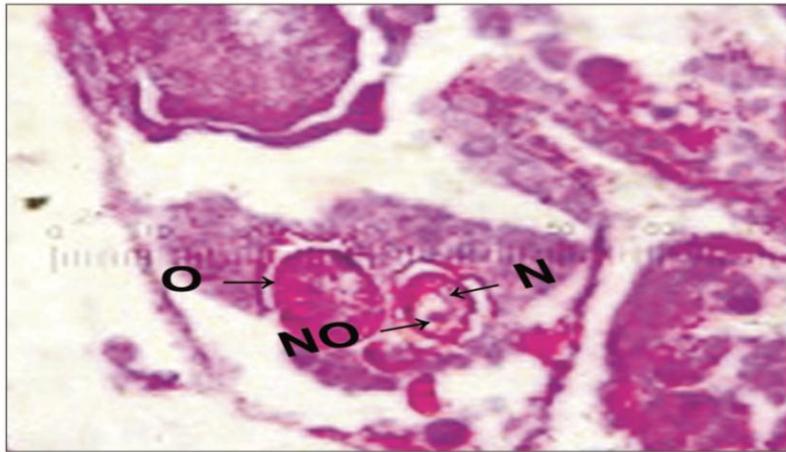
Fig . 3 . 1 . 3

Photomicrographs of normal histological structure of Oocytes of *parreysia corrugata* stained by Pyronin Y stain (Magnification: a, b = 400 x)
(N = Nucleus ; O = Oocyte ; NO = Nucleolus)

Plate - IV



(a)

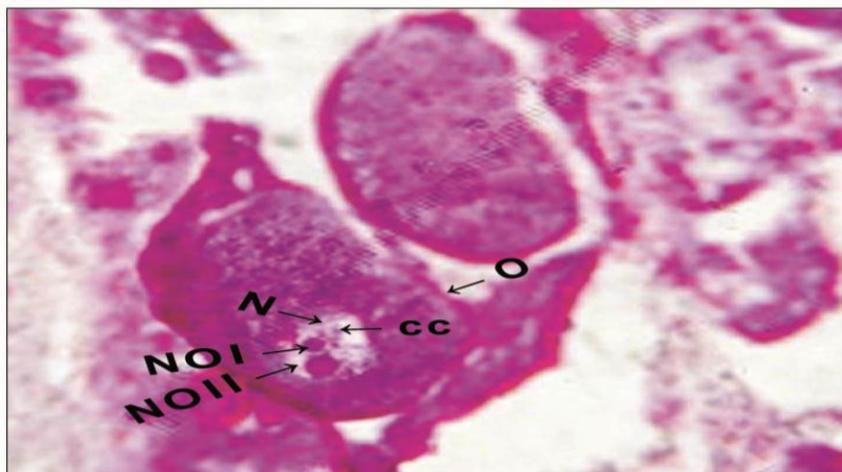


(b)

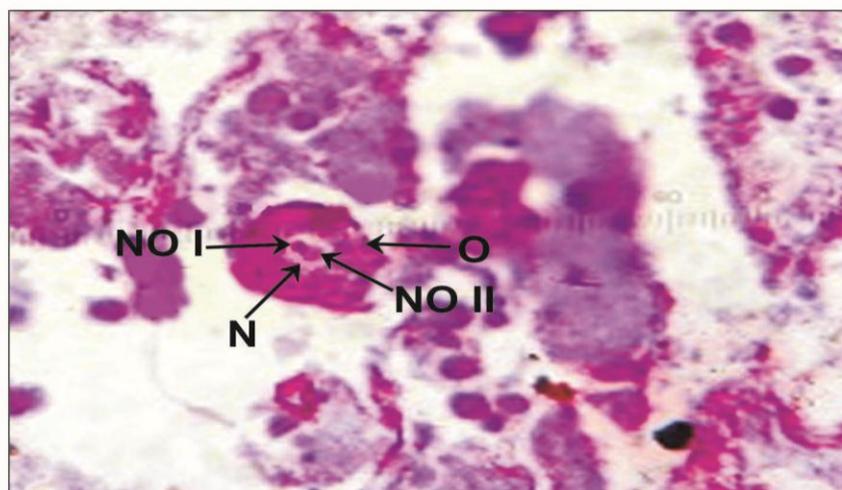
Fig. 3.2.1

Photomicrographs of histological structure of Oocytes stained by Methyl green - Pyronin Y stain after exposure of *parreysia corrugata* to Cisplatin for 10 days (Magnification: a, b = 400 x)
(N = Nucleus ; O = Oocyte ; NO = Nucleolus)

Plate - X



(a)

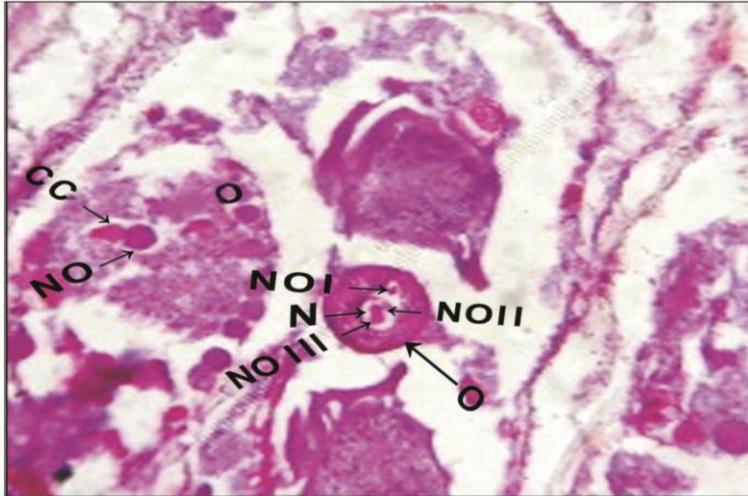


(b)

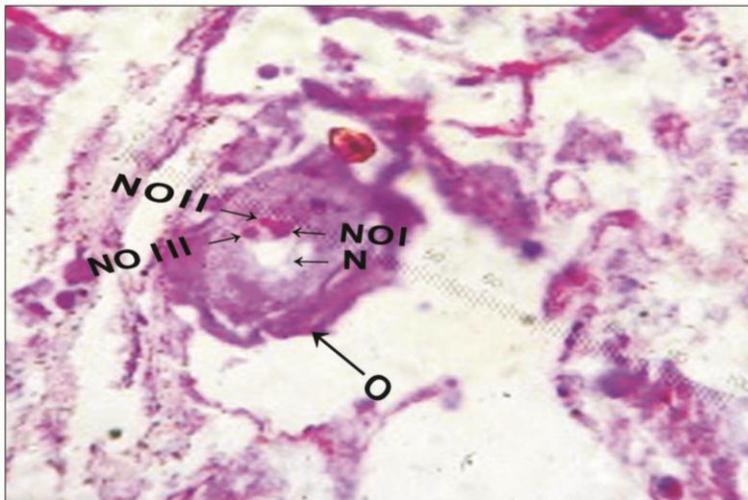
Fig . 3 . 4 . 1

Photomicrographs of histological structure of Oocytes stained by Methyl green - Pyronin Y stain after exposure of *parreysia corrugata* to Cisplatin for 20 days (Magnification : a , b = 400x)
(N = Nucleus ; O = Oocyte ; NOI = Nucleolus I ; NOII = Nucleolus II)

Plate - XVI



(a)

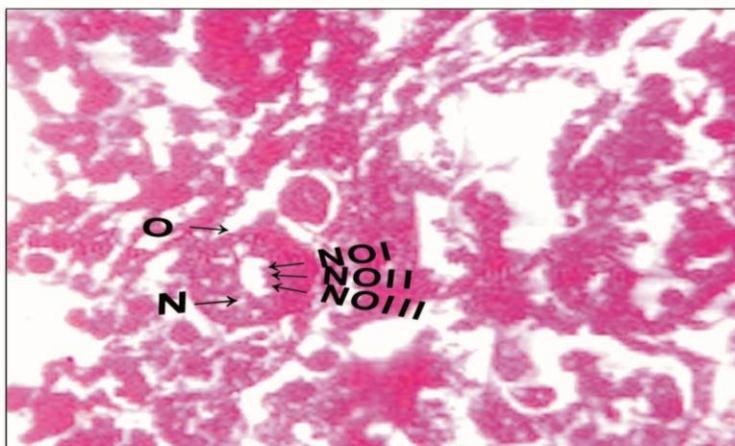


(b)

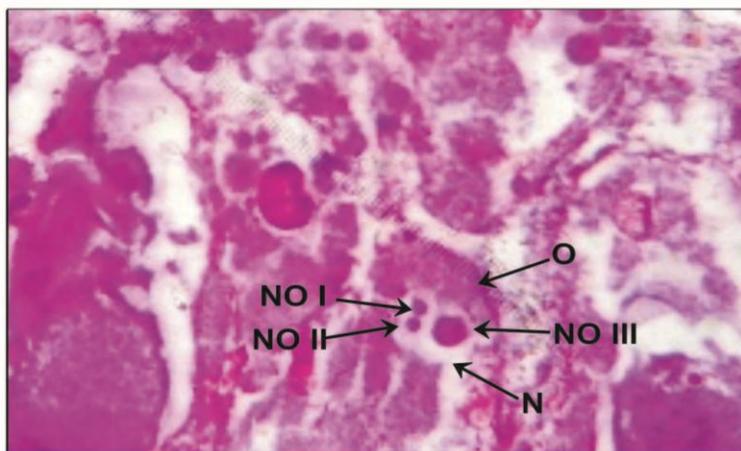
Fig . 3 . 6 . 1

Photomicrographs of histological structure of Oocytes stained by Methyl green - Pyronin Y stain after exposure of *parreysia corrugata* to Cisplatin for 30 days (Magnification : a , b = 400 x)
(N=Nucleus ; O=Oocyte ; NOI=NucleolusI ; NOII=NucleolusII ; NOIII=NucleolusIII)

Plate -XVIII



(a)



(b)

Fig . 3 . 6 . 3

Photomicrographs of histological structure of Oocytes stained by Pylonin Y stain after exposure of *parreysia corrugata* to Cisplatin for 30 days (Magnification : a, b= 400 x)
(N=Nucleus ; O=Oocyte ; NOI=Nucleolus I ;
NOII = Nucleolus II ; NOIII = Nucleolus III)

Discussion

Since the nucleolus is the site of speedy replication and transcription, any blockage or inhibition of these mechanisms reflects on its size, as there is single large nucleolus in the oocytes of the *Parreysia corrugata*. Nucleolar organizer region of the chromosomes are responsible for the development of nucleolus after mitotic phase of cell division, since nucleolus disappears during cell division. There may not be more NOR regions in a cell or chromosomes, but the number of nucleoli is specific to the cell type and species. However, when in demand more NOR may be involved in the formation of additional nucleoli. At the time of replication and transcription inhibition in the nucleolus, due to increased need of ribosomes, additional nucleoli can be derived from other NOR, and it can thus act as a biomarker for the indication of toxicant, if it is transcription or replication inhibitor. The present work is concerned with the nucleolar changes in the vitellogenic oocytes.

Zambare (1991) reported his primary studies during the reproductive cycle in *Corbicula striatella* and revealed that single nucleolus grows in size from 2.27 microns to 18.16 microns and showed differential staining, thus it is the best study material to show the intra-nucleolar organization and its interaction with the growing oocytes. It can thus act as the best biomarker for the screening of the anticancer drugs.

Cisplatin crosslinks DNA material and resulting into DNA adducts that interacts with proteins containing high mobility group domains like upstream binding factor, which is transcription factor that binds with the promoter of rRNA genes thereby supporting inhibition of transcription by enzyme RNA polymerase-I. Cisplatin causes a redistribution of upstream binding factor in the nucleoli of human cells, similar to that found after inhibition of rRNA synthesis. Similar redistribution was found to be observed for the major components of the rRNA transcription machinery. Jordan and Carmo-Fonseca (1998) also provided for the first time direct *in vivo* evidence regarding the action of cisplatin and 5-fluorouracil that they block the synthesis of rRNA, while activity of RNA polymerase-II continues to be detected through the nucleus. The clinically ineffective trans-isomer does not change the localization of upstream binding factor or other components of the RNA polymerase-I transcription machinery. These results indicate that there is disruption of rRNA synthesis, which is induced in rapidly proliferating cells, thus exhibit an important role in the clinical success of cisplatin and 5-fluorouracil chemotherapy (Jordan and Carmo-Fonseca, 1998).

Bhosale, (2009) reported, effect of anticancer drugs cisplatin and 5-fluorouracil on nucleolar changes in developing oocytes of *Corbicula striatella* and reported that, the condensation among nucleoli, change in shape of the nucleoli, induction of super numerary nucleoli after the exposure to the anticancer drugs such as cisplatin and 5-fluorouracil indicating the biomarker capacity of the nucleolus, results of research work proves, the biomarker potential of the nucleolus of the developing oocytes of *Corbicula striatella* and it is an indicator of both replication and transcription. The results shown that binding of cisplatin with the DNA molecule and inhibits the replication of the DNA from their binding sites.

The results of histopathological studies to study nucleolar changes in developing oocytes of *Parreysia corrugata* shows the condensation of chromatin material in nucleus, condensation of nucleoli, change in the shape of nucleoli, extra growth of the nucleoli, induction and formation of the supernumerary nucleoli after the exposure to the anticancer drugs, Cisplatin indicates the biomarker capacity of nucleolus. Effect of cisplatin after chronic exposure of *parreysia corrugata* for 30 days, has showed increased number of nucleoli in developing oocytes.

The results shows that the binding of cisplatin with the DNA molecule, which can inhibit the replication of the DNA from their binding sites. Since the oocytes are highly active in the process of protein, ribosome synthesis because most of the ribosomes required during cleavage, are synthesized and stored in the ooplasm. As cleavage involves repeated process of cell division, there is no time for the synthesis of required protein synthesis machinery. Increased demand of more ribosomal rRNA may leads to increased number of the tandem repeats from the nucleolus organizer region seems to be increased and hence an extra growth on some sides of the nucleoli were found. This can also be the reason for the induction and formation of the supernumerary nucleoli. Thus present work clearly proves the biomarker potential of the nucleolus of the developing oocytes of *Parreysia corrugata* and nucleolus as an indicator of both replication and transcription.

Conclusion

The chronic exposure of Cisplatin (1.007 ppm) induced alterations in the structure of nucleolus and hence the nucleolus of developing oocytes showed condensation of the chromatin, aggregation of the RNA at certain locations, overgrowth of the nucleolus and induction of increased number of nucleoli. Extra nucleoli were more prominent in cisplatin treated bivalves after 30 days of exposure.

The results also indicates that nucleolus of developing oocytes is the best biomarker, as it shows the changes on exposure to replication and transcription inhibitors. The nucleolus thus can be used as biomarker for the primary screening of anticancer drugs reacting at replication and transcription level. There may be signals from the ooplasm to the nucleus, more specifically to the NOR regions to replicate the rDNA genes for the formation of the nucleolus.

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Study of Fresh Water Gastropods from Northern Region of Ahmednagar District, (M S) India

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ABSTRACT:

Background: Ahmednagar is a foremost historical district of (M S) India. Watersheds are totally depends on riverine system beside some dams, ponds, niches, streams etc. We performed an investigation on the occurrence of freshwater snails (Mollusca: Gastropoda) from upstairs of three rivers viz. Godavari, Mula and Pravara rivers in the period July-2015 to June-2018.

Result: The study revealed occurrence of total 11 different gastropod species from 08 genera with 06 families viz., *Bellamya dissimilis*, *Bellamya bengalensis*, *Melanoides tuberculata*, *Tarebia lineata*, *Tarebia granifera*, *Thiara scabra*, *Indoplanorbis exustus*, *Lymnaea acuminata*, *Lymnaea luteola*, *Physa acuta*, *Gyraulus convexiusculus* besides some species of bivalves.

Conclusion: In this paper we presented the taxonomic description of the some freshwater molluscs from above mentioned rivers (northern region) of Ahmednagar district (M S) India. The present research work can be considered as pioneering and will definitely help to enrich the data on faunal resources of India as whole and Maharashtra state in Particular.

Keywords: Ahmednagar district, freshwater snails, Maharashtra state

Introduction

Aquatic macro invertebrates are found worldwide and abundant in most all possible aquatic habitat. Among aquatic invertebrates, the Mollusca is in second position behind Arthropodan. Mollusca includes six classes, Class Gastropoda is largest one, fitting marine, freshwater and terrestrial snails. Most of snail species prefer clean, stable, and firm river bottoms, some prefer the soft substrates. Bode *et al.*, 2002 said, many freshwater snails are known to be tolerant to organic pollution and are used in bio monitoring programs. As per (Balian *et al.* 2008), there are an estimated 5,000 freshwater molluscs for which valid descriptions exist, in addition to a possible additional 10,000 undescribed species. (Subba Rao, 1989) reported 213 species from India. (Tonapi, 1971) published an account of land and freshwater molluscs from Pune. (Subba Rao & Ghose, 2001) done an extensive investigation exclusively on gastropods. (Amit Kumar Prabhakar and Roy, 2009) studied the taxonomic diversity of shell; shell fishes from Kosi region of North Bihar, India, 20 species of Gastropod were discovered besides 10 species of Pelecypoda. (Subba Rao and Dey, 1989) and (Garg *et al.* 2009) studied a correlation between the molluscan diversity with physiochemical parameter with effect of water from Ramasagar reservoir from located in north way site of Dhatia city, Madhya Pradesh. (Dey, 2006) reported 100 species of molluscs from the mangrove areas of Indian subcontinent. (Ganapathi & Rao, 1959) published a report on the incidence of marine wood borers in the mangroves of the Godavari estuary. (Radhakrishnan & Janakiram, 1975) studied the mangrove molluscs of the Godavari and Krishna estuaries.

The freshwater snail's diversity is associated with type of vegetation, presence of snail predators, topography and chemical composition. Similarly water quality and environmental parameters might also be considered as good biological indicators to dictate the freshwater snail biodiversity richness in a given habitat. They actively participated in way of life of many organisms and show symbiotic relationships (commensal, trophic, parasitic, etc.). They maintenance the wetland ecosystems by controlling of water quality and nutrient balance through filter-feeding and algal-grazing behavior. They serves as a food source for predators including a number of fish species, crustaceans etc. In some parts of the world they compose a significant food resource, especially for the rural poor. (Appleton, 1996) said that some freshwater snails mostly serve as intermediate hosts to the trematode parasites, namely *Fasciola* spp. and *Schistosoma* spp. of humans and animals.

Pimm *et al.*, 1995 believed that freshwater molluscs have suffered a severe decline in diversity, distribution and abundance due to human induced alteration of habitats, pollution, siltation, deforestation, poor agricultural practices, the destruction of riparian zones and invasion by introduced species. Gastropod diversity density of each species fluctuate seasonally. Freshwater gastropods have a significant ecological role to play in the riverine systems and very little is known on the gastropod diversity of riverine system. Hence it is essential to document the diversity of freshwater snails from riverine system.

Study Area

Present species distribution study in northern region of Ahmednagar district were studied in three different rivers Mula, Pravara and Godavari. Habitat includes semi-arid to arid areas. The study area is situated in a climatic region regarded as sub-tropical and sub-humid, with moderate rainfall level and with mean minimum temperature 6-10°C in winter and mean maximum temperature 36-42°C in summer.

Materials and Methods

A comprehensive snail search was undertaken throughout provinces in northern region of Ahmednagar district, (M S) India, during July 2015 to June 2018. For this purpose three rivers viz. Mula, Pravara and Godavari were selected and studied as per the methodology described by Subba Rao (1989) and Ramakrishna and Dey (2007). The assortment of animals were done after every two months period. The gastropod animals were searched visually. The dominant sized gastropods were collected manually by hand picking method. The small sized specimens were collected by using forcep and brush. The floating animals were collected with the help of water net. The collected gastropod samples were brought to the laboratory. The shells, deeply covered with mineral deposit and alga, were cleaned by brush and washed in water in order to study conchological characters. The shells were dried at room temperature and preserved for future studies. Gastropods with maximum sized were selected, photographed, identified and classified primarily by using standard and relevant literature and key given by Subba Rao, Zoological Survey, Calcutta, India (1989) and Ramakrishna and Anirudha Dey, Zoological Survey, Pune, India (2007). Final identification and classification of specimens was verified from Zoological Survey of India, Pune.

Observations and Results

During the present monitoring work of fresh water gastropod of north region of Ahmednagar district, total 11 different gastropod species from 08 genera with 06 families were found. Most of the freshwater mollusc species were conveniently identified by their conchological characters. The data presented on diversity of fresh water gastropods from four different habitat like rocky, shore, muddy, and sandy beach. The Table No. 1 shows taxonomy of gastropod species found during present investigation with their taxonomy.

Table 1: Classification chart of Gastropod species collected from Northern region of Ahmednagar District, (M S) India.

Phylum	Class	Order	Family	Genus	Species
Mollusca	Gastropoda	Mesogastropoda	Viviparidae	<i>Bellamya</i>	<i>dissimilis</i> (Mueller, 1774)
					<i>bengalensis</i> (Lamarck, 1822)
			Thiaridae	<i>Melanooides</i>	<i>tuberculata</i> (Mueller 1774)
					<i>lineata</i> (Gray, 1828)
				<i>Tarebia</i>	<i>granifera</i> (Lamarck 1822)
					<i>Thiara</i>
		Basommatophora	Bullinidae	<i>Indoplanorbis</i>	<i>exustus</i> (Deshayes, 1834)
					<i>acuminate</i> (Lamarck, 1822)
			Lymnaeidae	<i>Lymnaea</i>	<i>luteola</i> (Lamarck, 1822)
					<i>Physidae</i>
Planorbidae	<i>Gyraulus</i>	<i>Convexiusculus</i> (Hutton, 1849)			

Species Study

- Bellamya dissimilis* (Mueller, 1774): The shell is thin, medium and delicate with more or less smooth. Three primary rows of chaetae are present. Shell consists of many ridges, lowermost ridge is well developed. Average number of whorls are 04. Shell is reddish brown in colour. Body whorl is larger in size.
- Bellamya bengalensis* (Lamarck, 1822): The Shell is thin, medium in size and more or less smooth. On the shell three or more color bands observed. Many ridges are present on shell, the lower most is well developed. Spire is acuminate type. Average number of whorls is 05. Shell is reddish brown in colour. Body whorl convex and larger.

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3. *Melanoides tuberculata* (Mueller 1774): Shell is thin, elongated with a high spire. Length of spire is five times more than body whorl. Shell consist rounded dark red-brown dots and flames. Sculpture is conspicuously with vertical ribs and spiral striae. Average number of whorls is 12-14. Body whorl is moderately larger in size.
4. *Tarebia lineate* (Gray, 1828): Shell is thick, elongated. Shell consist of conical rows of nodules which are less distinct. On the shell dark spiral lines are present and are distinct. Apex is acute type. Shell is reddish brown in colour. Average number of whorls is 08. Body whorl is moderately large.
5. *Tarebia granifera* (Lamarck 1822): Shell is elongate and conical in shape. Sculpture consist of distinct spiral rows of nodules. Spire is sharp with flat whorls. Average number of whorls is 06. Height of body whorl more than half of the shell.
6. *Indoplanorbis exustus* (Deshayes, 1834): Shell is thick and larger in size. Shell is discoidal, sinistrally coiled and rounded at periphery. Aperture is ear shaped, suture deeply impressed. Average number of whorls is 03.
7. *Lymnaea acuminata* (Lamarck, 1822): Shell is thin, delicate and ovate. Spire of the shell is short and acuminate type. Shell is some time transparent. Average number of whorls is 04. Body whorl is much inflated, a little angular above, with a large aperture.
8. *Lymnaea luteola* (Lamarck, 1822): Shell is thin, delicate, less inflated and glossy. Relatively smaller and laterally compressed. Spire of the shell gradually tapering and more produced. Average number of whorls is 04. Aperture is narrow.
9. *Physa acuta* (Draparnaud, 1805): Shell is thick, transparent and moderate in size. Shell is sinistral and ovate type. Apex is sharply pointed. Spire is also sharp and pointed, sutures oblique. Sculpture smooth. Average number of whorls is 04. Body whorl is large and rounded.
10. *Thiara scabra* (Mueller, 1974): Shell is thick with spiral ridges. Spire almost equal to the body whorl (Mueller). Shell is elongate, turreted and whorls regularly increasing in size. Spire as high as body whorls. Sutures distinct. Whorls often shouldered above and rounded below the row of spines. On the body whorls near the umbilical region striation form strong ridges. Shell colour is pale brown. Average number of whorls is 07.
11. *Gyraulus convexiusculus*: Shell is very small, discoidal and consist of 4-5 depressed whorls. Diameter is not more than 5 mm. Umbilicus wide, transparent and periphery sub angulate type. Aperture ovate and lunate type.

Photo plate 1: Photographs of fresh water gastropod species from northern Ahmednagar district (M S) India



Bellamya bengalensis (Lamarck)

Bellamya dissimilis (Lamarck)



Melanoides tuberculata (Mueller 1774)



Tarebia lineata (Gray, 1828)



Tarebia granifera (Lamarck 1822)



Indoplanorbis exustus (Deshayes, 1834)



Lymnaea luteola (Lamarck, 1822)



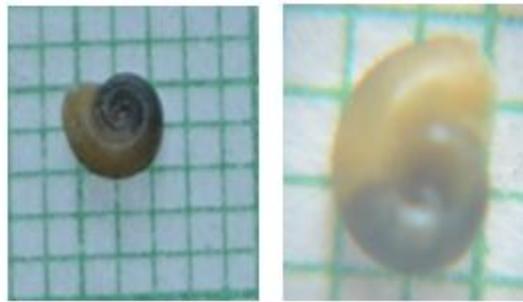
Lymnaea acuminata (Lamarck, 1822)



Physa acuta (Draparnaud, 1805)



Thira scabra (Mueller, 1774)



Gyraulus convexiusculus (Hutton, 1849)

Discussion

Human activities have adverse effects on both the physical and the chemical characteristics of aquatic system. These activities include agricultural practices, municipal waste treatment and recreational development. The river systems, which have traditionally supported base of the country, are being subjected to increased environmental distresses due to population explosion, increased perception of water for various purposes, discharge of Industrial effluents and domestic sewage and wastes. This has resulted in habitat modifications affecting the biodiversity of the systems.

As per 89 world conservation Monitoring Centre about 170 species of molluscs have become extinct since 1800 A.D., while the 1990 IUCN Red List recorded 425 species of molluscs under the threatened category. According to (Alfred, 1998) the freshwater mollusc fauna of Maharashtra state have not been studied thoroughly and the accessible data on the freshwater molluscs is insufficient and scattered. (Patil and Talmale, 2005) published a checklist of land and freshwater Mollusca of Maharashtra state in which they recorded altogether 142 molluscan species belonging to 48 genera and 23 families. Besides this, (Tonapi and Mulherkar, 1963), (Subba Rao and Mitra, 1979), (N. Pemola Devi, R.K. Jauhari, 2007), (Madhusudan V. Amrutsagar and Prakash S. Lohar, 2011) also made contribution in Gastropod study.

(Ollerenshaw, 1958; Yilma, 1985) told that, the availability of these species is regulated by various physico-chemical factors viz., temperature, hardness, pH, altitude, size of water bodies, vegetation and pollution are among the significant factors influencing the distribution and abundance of gastropods. (Ollerenshaw, 1971; Villegas, 1984) said that the optimum habitats for snails belonging to genus *Lymnaea* were permanent water and also found in marshy areas during dry season. (Tonapi and Mulherkar, 1963; Tonapi, 1971; Subba Rao and Mitra, 1979; Arvind *et al.*, 2005) studied malacofauna from adjacent Pune district and from Aurangabad district (Nagabhushnam and Kulkarni, 1973).

It is worth mentioning to mention that the 11 different gastropod species from 08 genera with 06 families [Lymnaeidae (2 species), Bullinidae (01 species), Thiariidae (04 species), Viviparidae (02 species), Planorbidae (01 species) and Physidae (01 species)] were recorded from Northern region of Ahmednagar District, (M S) India.

The most widely distributed local species are probably *Lymnaea acuminata*, *Lymnaea luteola* and *Physa acuta*, these species commonly sighted on monsoon canal walls and mangrove trees, sometimes numbering in the hundreds in a single location and which was found in more than 60-70% of the sampling sites.

This result has immense significance as there is no published record of mollusk fauna of Ahmednagar district so far. In this context, the present research work can be considered as pioneering and will definitely help to enrich the data on faunal resources of India as whole and Maharashtra state in Particular.

Conclusions

Total, 11 gastropod species were recorded from the riverine system of Northern Ahmednagar district. All the sampled species are believed to be native because Ahmednagar is within their well-known geographical distribution range. The high proportion of new records may be indorsed to the lack of taxonomical work and under sampling of the local malacofauna, which was evident throughout the available literature. Future surveys, particularly of other locations not concealed in this study may reveal species yet to be recorded and increase the distribution ranges of known species. Interpretations have shown that local malacological fauna do not appear to be under threat from exotic species or collection. Although major renovation works over the past few decades have drastically changed the environment of Ahmednagar district. As such, the conservation of remaining freshwater habitats may be vital to the survival of these species in Ahmednagar.

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Major Air Pollutants and Its Effects on Human Health

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Introduction

Air pollution is much big problem on our earth surface prior human evolution, at that time volcanic eruptions, forest fires and meteoroid impacts are certain sources of air pollution. It is historic phenomena as old as human culture. The black linings of caves inhabited by some of our ancestors are evidence of indoor air pollution with wood or coal smoke, pollutants which have drawn more attention recently as a significant risk factor in the development of lung cancer.¹ Problem of Air pollution becomes more severe after industrial revolution. In Industrial revolution added so many pollutants and decreases ambient quality of air. According to World Health Organization Air pollution kills an estimated 7 million people worldwide every year. WHO data shows that 9 out of 10 people breathe air containing high levels of pollutants.² Development in automotive vehicles leads to great extent of air pollution in developed and developing countries, Being developing country India is not exception to that fact. Major source of air pollution in country is Automatic vehicle fuel combustion, biomass and fuel wood burning. Indian Cities are depicting different pattern of Air pollution. The four major Indian cities, air pollution was consistently worse in Delhi, every year over 5-year period (2004–2008). Kolkata was a close second, followed by Mumbai. Chennai air pollution was least of the four.³ Air pollution is responsible for lung cell damage, inflammatory responses, impairment of pulmonary host defenses, and acute changes in lung function and respiratory symptoms as well as chronic changes in lung cells and airways. Many Indian cities are not safe for breathing. Therefore this paper tries to compare pollution level in four metropolitan cities of Maharashtra.

Objectives

This Research paper have following Objectives:

- 1.To study Polluting agents and their effect on human health.
- 2.To study Air Quality Index AQI and its parameter for ambient quality of air.

Data base

As this is descriptive and informative type of paper. For this study Data has been collected through secondary source from authentic and authorized Central Pollution Control Board website. Live tracking of pollution level have displayed on this website. This is reliable and accurate data for this kind of study.

Results and Discussion

The majority of Indian cities suffer from extremely high levels of urban air pollution, particularly in the form of suspended particulate matter SO₂ and NO₂, Levels of all pollutants are increasing due to industrial processes, agri- cultural activities, building construction, and road traffic, as well as reductions in natural habitat and other natural sources.⁴ The focus of this study is on the air pollutants as determined and generated through anthropogenic activities. Unplanned and rapid development of cities resulted in to polluting air quality. This study shows how major pollutant level like ozone, sulfur dioxide, and carbon monoxide and particulate matters deteriorates air quality.

The Clean Air Act of 1963 have formed of the Environmental Protection Agency. This Agency has to implemented of National Ambient Air Quality standards for major pollutants (Photochemical oxidants [ozone], Sulfur oxides, Nitrogen oxides, Carbon monoxide, Hydrocarbons, and Particulate matter; lead was added later).

1. Ozone

Generally Ozone is form when pollutants released by various sources (Oil refinery, Chemical Plants, Cars, Power plants etc) react chemically in presence of sunlight in lower level of atmosphere on ground. Ozone at ground level is hazardous pollutant.This pollutant is responsible for alterations in lung function, breathing

pattern. Some study shows that people who came in to exposure of ozone becomes hyper responsiveness. It is observed that ambient ozone exposure is associated with increased asthma attacks in asthmatics⁵.

2. Sulfur Dioxide

Sulfur Dioxide is major pollutant. It reacts with other substances and form hazardous compound like sulfuric acid, sulfurous acid and sulfate particles. Major sources of SO₂ are fossil fuel like coal, oil and gas burning. Maximum SO₂ comes from anthropogenic activities and Motor vehicle emission is also one of the prime sources of Sulfur Di oxide. It results cough, Shortness of breathing. Most of the people exposed to SO₂ are resulted Asthma and respiratory Diseases.

In 1953, Amdur and co-workers examined the responses of men breathing up to 8 ppm SO₂ in one of the first controlled studies of humans exposed to air pollutants. They observed that SO₂ caused a change in respiratory pattern and that the effect was concentration dependent. The tolerance level of inhalation was individually different.⁶

3. Carbon Monoxide

Incomplete combustion of fuels is responsible for CO. Carbon Monoxide is highly poisoning because after inhalation it mix with hemoglobin and disturb to proportion of oxygen transport to the tissues. The high affinity of CO for hemoglobin (Hb) was studied in a series of experiments by Haldane before the turn of the century. In experiments conducted on himself and his colleagues he established that the relative affinity of CO for Hb was about 250-300 times that of oxygen.⁷ High concentration of CO leads to suffocation, headache, and Increases risk of chest pain for heart patients.

4. Oxides Of Nitrogen

Likewise others Nitrogen dioxide is a result of road traffic and other fossil fuel combustion processes. NO₂ reduce immunity of lungs infection and bronchitis. The major health hazard that is associated with NO₂ are increased incidence of lower respiratory tract infections in children and increased airway responsiveness in asthma patients. Study done by Neas, L. M et al shows Long-term exposure to NO₂, typically in homes with gas burning appliances, appears to be associated with increased susceptibility to lower respiratory tract illness⁸

5. Particulate Matter(10)

PM₁₀ is particulate matter of 10 micrometers or less in diameter. It could be inhalable dust particles, mist or smoke. If it is Biological it can lead to bacterial or fungal infection in human body. It is Allergic. If PM like Asbestos and chromates are frequently absorbed by human body it leads to cancer.

6. Particulate Matter (2.5)

These are fine particles less than 2.5 micrometer. This is major air pollutant in lower atmosphere. These particles are tiny and lighter than PM₁₀. These particles remain longer in air. Inhalation leads to asthma, heart attack, bronchitis and other respiratory Diseases.

7. Lead

Airborne lead is result of extensive use of lead in gasoline, it is accounted for 90% of airborne lead in motor vehicle fuels. Some of the most vital health issues are associated with low-level lead exposure which resulted in to the complex of neurological deficits. , particularly in children, modest elevations in blood pressure in adults, and developmental problems.⁹ Many study shows that high blood lead (PbB) concentrations cause frank brain damage and slowing of nerve conduction. Intelligence (IQ) deficiency is also seen in children associated with PbB levels as low as 10-15 ig/dL.

Air Quality Index**Table No.1:**National Air Quality Index Given By Central Pollution Control Board

AQI	Remark	Color Code	Possible Health Impacts
0-50	Good		Minimal impact
51-100	Satisfactory		Minor breathing discomfort to sensitive people
101-200	Moderate		Breathing discomfort to the people with lungs, asthma and heart diseases
01-300	Poor		Breathing discomfort to most people on prolonged exposure
301-400	Very Poor		Respiratory illness on prolonged exposure
401-500	Severe		Affects healthy people and seriously impacts those with existing diseases

IIT Kanpur and the Expert Group recommended an AQI scheme in 2014. This AQI was launched in New Delhi on September 17, 2014 under the Swachh Bharat Abhiyan. It is a precise method for determining Pollution level. Initially there are only three parameters for air quality monitoring, but now it is improved with eight parameters. There are six basic AQI categories predominantly Good, Satisfactory, Moderately Polluted, Poor, Very Poor and Severe. In this National Ambient Air Quality Standards are prescribed

Conclusions

The ambient air can be expressed by the sum of the controlled levels of the pollutants. There are so many improvements that have been taken place to maintain and purify air quality in many areas of the globe like as China, India, South Africa and Mexico. In few countries like China Pure Air pockets are available for marketing it is a symbol of severe air pollution. From last few decades attempt has been made to study impact of air pollution on human health but still so many areas of health are untouched. In many cases insufficient mechanism, risk of exposure is a major lacuna in more progressive invention in air pollution. Air pollution is becoming a havoc for coming generations small children are more vulnerable and susceptible for air pollution. So we should not wait for more damage. Like the principle "Precaution is better than cure" We should become more prepared for coming health hazards by air pollution.

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Studies on Allelopathic Effect of *Ocimum sanctum* on a Common Weed *Cassia uniflora*

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ABSTRACT: The metabolite secreted by plants through the roots are allelochemicals which are directly or indirectly affecting the seed germination and growth of the other plants. This allelopathic interaction is sometime is detrimental to the crop and beneficial in the other way. In the present investigation attempt were made to study the effect of medicinal plant herb *Ocimum sanctum* on the seed germination and the growth of common weed *Cassia uniflora*. The dried powder of the *Ocimum* was used for the allelopathic effect on *Cassia*. The different concentration of *Ocimum* powder such as 1%,5%,10%,15%,20% are used to see the effect on seed germination and growth of *Cassia uniflora*, the treatment were compared with control plants the *Ocimum* powder with different concentrations was placed on the top of the soil and irrigated for 4 to 5 days to get exudates. Pre-soaked seed of *Cassia uniflora* were placed in the above said soil mixture. Observation were recorded in the form of percent seed germination, time taken for seed germination and growth of the seedlings etc. In the present investigation it was observed that there was not much effect of *Ocimum* leachates on the seedling of *Cassia* in 5% and control the seed germination and growth rate was very slow in 15% whereas no seed germination was observed in 20% *Ocimum* powder. It clearly indicate that *Ocimum* plant as useful to control the growth of weed.

Keywords: Allelochemicals, *Ocimum sanctum*, *cassia uniflora*

Introduction

Allelopathic chemicals can be present in any part of the plant they can be found in leaves, flower, fruits or stem. They can also be found in the surrounding soil. Targets species are affected by these toxins in many different ways. The toxic chemicals may inhibit shoot/ root growth they may inhibit nutrient up take or they may attach a naturally occurring symbiotic relationship thereby destroying the plants usable source of a nutrient.

Materials and Methods

Plant material: Medicinal plant-*Ocimum sanctum* leaves powder.

Weed – *Cassia uniflora* seeds.

Selected weed were *cassia uniflora*, selection was based on their frequent occurrence in selected road sides around Solapur highway road, Ahmednagar. The medicinal plant *Ocimum sanctum* L. was collected from surrounding where it is growing widely.

Preparation of extract was done as leaves of *Ocimum sanctum* were kept in shade for 1 week. Then 100 or dry leaf powder was soaked in 100 ml or dry leaf powder was soaked in 100 ml distilled water for 24 hrs. to make serial dilutions the extract was filtered with what'sman filter paper -1 then dilution with distilled water 1%,5%,10%,15%,20% concentration were prepared.

Preparation of different grade concentration:

The different grade concentration of 1%, 5%, 10%, 15%, 20% and control for preparation or grade conc. Collect the fine soil. After that this soil are clean well remove different and soil are autoclaved above 15 lbs for 45 min.

- 1) 1% concentration: 950 gm of soil +50gm o. *sanctum* leaves powder put into glasses or pots. Then add water 2-3 days. Then after 2-3 days it mix well.
- 2) 5% concentration -900gm of solid +100gm of *Ocimum sanctum* leaf powder into the glasses then add water 2-3 days mix it well after 2-3 days.
- 3) 10% concentration – 850gm and soil + 150 gm 80 *Ocimum sanctum* leaf powder put into glasses then add water 2 -3 days. Mix it was after 2-3 days.
- 4) 15% concentration -800 gm of soil + 200 *Ocimum sanctum* leaf powder put into glasses then add water 2-3 days mix it well after 2-3 days.
- 5) 20 Concentration 700 gm 8 soil + 350 gm of *Ocimum sanctum* leaf powder put into glasses .Then add water 2-3 days mix it well after 2-3 days .

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For seed germination

A) Preparation of extract of different concentrations making the different extract concentration using serial dilution method.

1) 100 % extract

Take 100 ml distilled water and 10 gm *Ocimum sanctum* powder then mix it well and kept for 24 hrs. to prepare mixing or dissolving the chemical which present in *Ocimum sanctum* powder. After 4 hrs filtered it by using filter paper i.e. 100% extract solution or may used as a stock solution.

Then using serial dilution method prepare concentrations 1%, 5%, 10%, 15%, 20% and control solution and were named as T1, T2, T3, T4, T5 and control respectively.

B) Soaking of seed *Cassia uniflora* into beaker collected seed of *Cassia uniflora* is treated for 4 min in conc. H₂SO₄ solution and washed for 7- 8 times with distilled water.

Now seeds as are soaked into beaker containing different one of solution Soaked 70 seeds of *Cassia uniflora* in each beaker containing different concentrations of solution for 24 hrs.

T1= 1 % concentration extract +70 seeds

T2= 5% concentration extract +70 seeds

T3= 10% concentration extract +70 seeds

T4= 15% concentration extract +70 seeds

T5= 20% concentration extract +70 seeds

C) Transfer of seed from beaker to petridish after socking seeds of *Cassia uniflora* for 24 hrs in to beaker transfer this seed from beaker to petridish. T5 sets of petriplate concentration take and wash it with distilled water and sterilised it labelled each petridish according to concentration of extract solution.

A germination paper was out it according to size of petriplate, wet it and placed it in each petriplate then transferred the 70 seeds from beaker of solution to petridish in likewise transfer 70 seeds in each petridish according to concentration of extract solution.

70 seeds of *Cassia uniflora* were taken in petridish with germination paper and labelled as control. i.e. 100 ml distilled water + 70 seeds allow all these petriplate containing seeds to germinate in a dark and concentration for that placed there petriplate in dark condition.

Observations of seeds in a petriplate

The seeds which were kept in a petriplate observe daily after 1- 2 days, the seeds begin to sprout and germinated. After 3- 4 days plumule and radical was sprout from feeds of each set of petriplate.

Seeds in petriplate of control petriplate shows maximum growth the seeds kept in T5 petriplate shows very less growth. The seeds kept in T4 petriplate shows minimum growth as compare to T3 petriplate. The kept in T3 petriplate shows medium growth as compare to T2, the seeds kept in T2 petriplate show higher growth as compare to T1, the seeds kept in T1 petriplate shows maximum growth as compare to T2.

Results and Discussion

Ocimum sanctum

Kingdom	Plantae
Division	Angiospermae
Class	Radicots
Unranked	Asterids
Order	Lamilase
Family	Lamilaceae
Genus	<i>Ocimum</i>
Species	<i>sanctum</i>

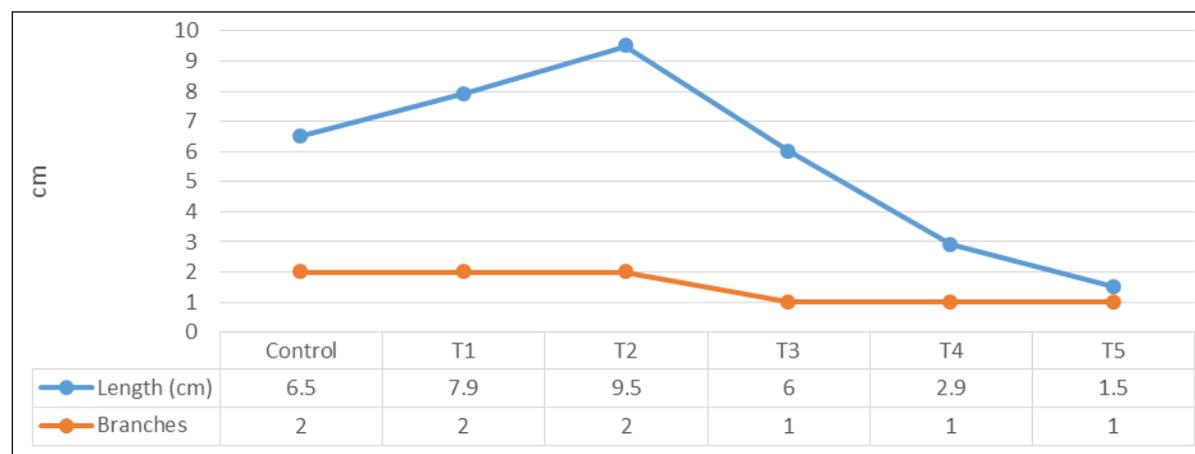
Ocimum sanctum is cultivated in India for its medicinal and religious purposes; it belongs to family Lamiaceae

Description

Ocimum sanctum is an erect many branch of subshrub, 30- 60 cm tall with hairy stem leaves are green or purple, they are simple. Petaloid with an ovate, upto 5 cm (2.0 in) oblong blade which usually has lightly toothed margin they are strongly scouted. Its leaves are rich in secondary metabolite like a steroid urosolic acid and n-irigonctanol eugenol (70.5), its methyl ether (4.8) nerol (6.4), areyophyllene (7.5), terpine (0.4), decylaldehyde (0.2), selinene (0.4), comphene (0.2) and apinene (3.5). Its main uses are as antistress, anti ulcerogenic, antihypertensive, cough release and as insecticides.

Table 1. Allelopathic effect of *Ocimum sanctum* on a common weed *Cassia uniflora*.

Parameter	Length in cms	Branches	Fresh weight in gm	Dry weight in gm
Control	6.5	2	0.060	0.020
T1	7.9	2	0.090	0.020
T2	9.5	2	0.099	0.024
T3	6.0	1	0.050	0.019
T4	2.9	1	0.039	0.012
T5	1.5	1	0.020	0.09



Results

In the present investigation, allelopathy effect leaves of medium plant *Ocimum sanctum* was studied on germination or a seed *Cassia uniflora*.

Different concentration of leaves powder compared with control and it has been observed that as the concentration was increased it show the effect of decreases in growth of *cassia uniflora* with different parameters like length, branches, fresh weight , dry weight of treated plant was recorded during investigation. In the untreated plant the length of shoot was 6.5cm which was gradually reduced from 1% (7.9), 5% (9.6) and more from 15% (6.0), 10% (2.9), 15% (1.5). Similar effect were in number of branching were as control has maximum number (2) were gradually more than 10%, 15%, 20% treatments. After the completion of experiments fresh weight and dry weigh of treated and untreated plant were recorded it has been observed that control plant has maximum fresh weight (0.060) dry weight (0.020gm) were gradually increased in both fresh and dry weight from 1%,5%,10%,15%,20%,50% treatment from this result it has been concluded that we increased the concentration or leaves powder it showed negative effect on growth parameter.

This clearly indicates that weed *cassia uniflora* secretes certain chemical which are affecting growth of medicinal plant *Ocimum sanctum*. Further studies are required to study allelopathic effect on biochemical parametes on yield of *Ocimum sanctum*.

Conclusions

From this result it has been concluded that as we increased the concentration of leaves powder it shows negative effect on growth parameter. From the present investigation it is concluded that medicinal plant like *Ocimum sanctum* showed very good effect on the weeds growing in regular cultivated crops. These medicinal

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plants are known because of their active principles present in their parts. Some of the compounds must have got released in soil through allelochemicals. These compounds could be responsible for controlling the germination and growth of weed plants. Hence the medicinal plant like *O. sanctum* could be used as bio-control agent or bio weedicides to the weeds and eliminate the competition with weeds and eliminate competition with crop plant. These biological agents are excellent ecofriendly bio-controlling factors which would help in minimizing the losses due to synthetic or chemical weedicides.

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Survey of Family Fabaceae from the Area of Kopergaon Tehsil

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ABSTRACT: Family Fabaceae or Leguminosae is a large and economically important Family of flowering plants which is commonly known as legume family of pea, beans or pulses. This is the third largest family of flowering plants behind Orchidiaceae & Asteraceae. 10 members of this family were surveyed based on which the above data is generated for the studied area of Kopergaon tehsil. *Melilotus alba*, *Clitorea ternatea*, *Cicer arietinum* are the members frequently found in the studied area of Kopergaon tehsil. This was followed by *Cullen carylifolia*, *Alysicarpus monolifer*, *Alysicarpus tetragonolobus* and rest all were found to be in the least number. Some members of the fabaceae family are cultivated plant for ornamental purposes. The current survey stated that variation in climatic & geographic conditions also changes flowering and fruiting period of the species and their number from the study area.

Keywords: Kopergaon tehsil, Family Fabaceae, Cultivated, Legumes.

Introduction

The Family Fabaceae or Leguminosae is commonly known as the legume, pea, or bean family, is a large and economically important family of flowering plants. It includes trees, shrubs, and perennial or annual herbaceous plants, which are easily recognized by their fruit (legume) and their compound, stipulated leaves. Many legumes have characteristics of flowers and fruits. The family is widely distributed, and is the third-largest land plant family in terms of number of species, behind only the Orchidaceae and Asteraceae, with about 751 genera and some 19,000 known species.

The five largest of the genera are *Astragals* (over 3,000 species), *Acacia* (over 1000 species), *Indigofera* (around 700 species), *Crotalaria* (around 700 species) and *Mimosa* (around 500 species), which constitute about a quarter of all legume species. The ca. 19,000 known legume species amount to about 7% of flowering plant species. Fabaceae is the most common family found in tropical rainforests and in dry forests in the Americas and Africa. Fabaceae range in habit from giant trees (Like *Koompassia excelsa*) to small annual herbs, with the majority being herbaceous perennials. Plants have indeterminate inflorescences, which are sometimes reduced to a single flower. The flowers have a short hypanthia and a single carpel with short gynophores, and after fertilization produce fruits that are legumes. Growth habits the Leguminosae have a wide variety of growth forms including trees, shrubs or herbaceous plants or even vines or lianas. The herbaceous plants can be annuals, biennials or perennials, without basal or terminal leaf aggregations. Many Legumes have tendrils. They are upright plants, epiphytes or vines. The latter support themselves by means of shoots that twist around a support or through cauline or foliar tendrils. Plants can be heliophytes, mesophytes or xerophytes. The leaves are usually alternate and compound. Most often they are even- or odd-pinnately compound (e.g. *Caragana* and *Robinia* respectively), often trifoliate (e.g. *Trifolium*, *Medicago*) and rarely palmately compound (e.g. *Lupinus*), in the Mimosoideae and the Caesalpinoideae commonly bipinnate (e.g. *Acacia*, *Mimosa*). They always have stipules, which can be leaf-like (e.g. *Pisum*), thorn-like (e.g. *Robinia*) or be rather inconspicuous. Leaf margins are entire or, occasionally, serrate. Both the leaves and the leaflets often have wrinkled pulvini to permit nastic movements. In some species, leaflets have evolved into tendrils (e.g. *Vicia*). Many species have leaves with structures that attractants that protect the plant from herbivore insects (a form of mutualism). Extra floral nectaries are common among the Mimosoideae and the Caesalpinoideae, and are also found in some Faboideae (e.g. *Vicia sativa*). In some *Acacia*, the modified hollow stipules are inhabited by ants and are known as domatia. Roots Main article: Root nodules of many members of Fabaceae are with host bacteria in their roots within structures called root nodules. These bacteria, known as rhizobia, have the ability to take nitrogen gas (N₂) out of the air and convert it to a form of nitrogen that is usable to the host plant (NO₃ – or NH₃). This process is called nitrogen fixation. The legume, acting as a host, and rhizobia, acting as a provider of usable nitrate, form a symbiotic relationship.

Materials and Methods

An extensive and intensive survey of plants was carried out from Kopergaon area and were collected in flowering and fruiting period throughout the year from this region. The method of plant collection and their identification was done through methods used earlier by plants were collected in flowering and fruiting period throughout the year in the region. The method of plant collection and their identification was done through methods used earlier by Salunkhe *et al.* (2001), Chavan *et al.* (1973) and Khairnar (2003).

The collected specimens were identified with the help of available floras, literature, matching with standard herbarium and relevant books. The plants of this family mostly found in open area as well as in fallow field.

Taxonomical Account of Plants***Alysicarpus monilifer***

Prostrate, annual herb, branches spreading, closed with deciduous, long spreading hairs, leaves one foliate, leaflet elliptic oblong or obovate, flowers erect, closed in 4-10 flowered axillary or leaf opposed, short racemes pods moniliform 5-8 jointed, joints clothed with glandular and hook hairs.

Alysicarpus tetragonolobus

Procumbent annual herb leaves unifoliate, leaflets linear, oblanceolate or elliptic oblong, flowers in 10X axillary and terminal racemes, petals uniformly deep pink or standard petals, sometimes with yellow spot, pods 4 gonous, moniliform 2-6 jointed, joints tranversely ribbed, glabrous.

Clitoria ternatea

Twining, rather woody, annual or perennial shrubs, leaves 5-9 foliate leaflets elliptic oblong, flowers large, axillary, solitary, corolla light or dark blue, stamens diadelphous, pods flattened, nearly straight sharply beaked, seeds 6-10, quadrate yellowish brown.

Cicer arietinum

Much branched herbs, leaves pinnate stipules often lobed, leaflets ovate oblong or obovate, 9-15 pairs, flowers axillary, solitary, petals pink, slightly exceeding the calyx, pods often 2-seeded, seeds shortly beaked.

Cullen corylifolia

Erect, annual herbs, stem and branches grooved, conspicuously glands dotted. leaves 1-foliolate rarely 3-foliolate, broadly elliptic, nigro-punctate below, flowers in dens axillary racemes, corolla twice as long the calyx, blue or white, pods compressed, black, punctate, seeds solitary adhering to pericarp.

Melilotus alba

Erect, annual herbs, leaves 3-foliolate, leaflet obovate oblong, flowers small in groups of two compact, terminal racemes, pods turgid, reticulate venose, seeds single globose.

Melilotus indica

Erect, annual herbs, leaves 3-foliolate, leaflets elliptic-obovate, or oblanceolate flowers small, in slender spikes or racemes, pods ellipsoid, compressed, tapering at both ends, reticulate venose, glabrous 1-2 seeded, seeds brown.

Crotolaria clavata

Shrubs, small, branches ascending aruculatate, leaflet obovate, thick and fleshy obtuse at apex, connate at base, racemes terminal and lateral, 20-30 flowered, up to 15 cm long, calyx silky hairy, corolla yellow, pods shortly stalked, 10-20 seeded.

Erythrina fusca

Trees, branches pale green, prickly black, leaves trifoliate, leaflet twice as long as broad, subcoriaceous, terminal upto 10-15 cm long, ovate or obovate-oblong, obtuse or subacute at apex, velvety, standard deep scarlet, pods is long, distinctly torulose narrowed into stalk, 6-8 seeds.

Vigna Hasei

Creeping herbs, stem 3-3.5m long, sparsely covered with 0.7 mm long, brown hairs, leaves trifoliate, terminal leaflet elliptic ovate, lateral leaflet obliquely ovate, stipule ovate to triangular, basely fixed, inflorescence 3-4 flowered, flowers golden yellow, pale brown when mature, seeds obliquely rectangular or elliptic, usually 2 per pod, smooth, shiny, mottled grey or black 5.5×3.2×3 mm, aril developed.

Plants recorded from the study area are listed below

Sr. No.	Botanical Name	Habit	Flowering season
1.	<i>Alysicarpus monolifer</i>	Herb	Pink
2.	<i>Alysicarpus tetragonolobus</i>	Herb	Deep pink
3.	<i>Clitoria ternatea</i>	Shrub	Dark blue
4.	<i>Cicer arietantum</i>	Herb	White
5.	<i>Cullen corylifolia</i>	Herb	Blue or white
6.	<i>Melilotus alba</i>	herb	White
7.	<i>Melilotus indica</i>	Herb	Yellow
8.	<i>Crotolaria cavata</i>	Shrub	Yellow
9.	<i>Erythrina fusca</i>	Tree	Prickly black
10.	<i>Vigna hasei</i>	Herb	Golden yellow

Results and Discussion

As mentioned earlier, the above study has been carried out to know the species abundance of the members of family Fabaceae. As it is shown in the above observation table, 13 members of this family in Kopargaon Tehsil were survey based on which the above data is generated. *Melilotus alba*, *Clitoria ternatea*, *Cicer arietantum* are the members found in maximum amount in Kopargaon Tehsil followed by *Cullen corylifolia*, *Alysicarpus monolifer*, *Alysicarpus tetragonolobus* rest all were found to be in the least number.

The some members of Fabaceae family are cultivated plants for ornamental purposes. The current survey states that the variation in the climatic and geographic conditions also changes the flowering and fruiting period of the species and their number from the study area.

Conclusions

The 10 members of the family in Kopargaon Tahsil were surveyed based on which the above data is generated *Alysicarpus* sp. and *Melilotus*, *Clitorea ternatea* are the members found in maximum amount in Kopargaon region followed by other .



Alysicarpus monolifer



Alysicarpus tetragonolobus



Clitoria ternatea



Cicer arietinum



Cullen corylifolia



Melilotus alba



Melilotus indica



Crotolaria clavata



Erythrina fusca



Vigna hasei

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Effect of Ablation of Cerebral Ganglia and Injection of Their Extracts on Rate of Oxygen Consumption of Freshwater Bivalve: *Lamellidens Corrianus* (Lea) During Different Seasons

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ABSTRACT: Present investigation focus on the effect of bilateral cerebrolactomy & injection of cerebral ganglionic extract on oxygen consumption on freshwater bivalve: *Lamellidens corrianus* during monsoon, winter and summer season. Dissolved oxygen content (DO) is one of the most important abiotic parameters influencing the life in an aquatic environment; depletion of dissolved oxygen to the level of anaerobia is the most critical manifestation of pollution. Lester (1975) has suggested the usefulness of dissolved oxygen as an indicator parameter for organic pollution. While working on the freshwater bivalves from water bodies in Maharashtra state a decrease in the dissolved oxygen during summer and high dissolve oxygen during monsoon season were observed by different researchers. The studies carried out on *Lamellidens corrianus* revealed that data of respiration is considerably affected through different seasons at the time of animal experiences different environmental parameters. The study carried out for twelve days under laboratory conditions and since no food was given to the animals it is expected that the starvation effect might have also occurred. Cerebral ganglia ablated bivalves shows significant increase in oxygen consumption during summer season throughout experimental period as compare to monsoon and winter season.

Keywords: Freshwater bivalve, *Lamellidens corrianus*, Oxygen consumption, seasonal variation.

Introduction

Measurement of uptake of oxygen in aquatic animals is the key in identifying the health of those individuals and aquatic ecosystems too as they also act as indicator of aquatic ecosystem. Being a filter feeder filtering huge gallons of water throughout life, get worst affected by pollution in water. Freshwater bivalve molluscs has ganglionated nervous system, different nerve ganglia like cerebral, visceral and pedal present at different regions of the body secreting neurosecretion and controlling the various body activity. Knowles and Bern (1966) stated that the significance of NSCs as connecting link between nervous and endocrine systems and neurosecretory neurons "participate either directly or indirectly in endocrine control and form all or part of endocrine organ".

Dissolved oxygen content (DO) is one of the most important abiotic parameter influencing the life in an aquatic environment. There are two main sources of dissolved oxygen in water (a) diffusion from air which depends on factors like wind action, temperature and salinity and (b) photosynthesis which depends on transparency, turbidity, and algal biomass. Lester (1975) has suggested the usefulness of dissolved oxygen as an indicator parameter for organic pollution. Berg (1952) stressed the importance of measurement of respiration and it was emphasized "that further experiments have to be carried out to test the seasonal variation of the respiration, i.e. its magnitude, and the possible correlation between reproductive period and oxygen consumption". The bivalve has to (1) expend energy only when the water being pumped which contains sufficient nourishment essential to allow a net gain of energy generally required for the work being done and (2) to accumulate the reserve of potential energy which can be favor the development of gonadal tissue as the spawning season approaches (Collier, 1959).

Evidence for the occurrence of a wide variety of neurotransmitters indifferent tissues of *Lamellibranchs* including the nerve ganglia has been discussed from the functional point of view (Leak and Walker, 1980).

In bivalve molluscs, nervous system and hormonal apparatus are not sharply separated and no endocrine glands have so far been encountered. It is, therefore, possible that hormonal activity is restricted to the nervous system itself. Thus, nervous system and hormonal system are interrelated structurally and functionally, which is supported by the fact that the secretary cells occur in ganglia of these molluscs. The nervous system plays a role in neurotransmission as well as in the synthesis and discharge of secretion. Neurons secrete both neurohumors and neurohormones (R. Naghabhushnam & U.H. Mane 1987). Removal of

cerebral ganglia considerable decrease in rate of respiration in initial and later phase of experiment conducted, In summer and monsoon the animal in the phase of gametogenesis and vitelogenesis with probable effect of starvation, particularly in summer season, and the absence of ganglia revealed decreased rate of respiration (D.A. Kulkarni 1987).

In the present investigation removal of cerebral ganglia shows considerable change in the oxygen uptake in *Lamellidens corrianus* during summer, winter and monsoon season.

Materials and Methods

The freshwater bivalve molluscs, *Lamellidens corrianus* (Lea) were collected from Jayakwadi backwaters (Nathsagar) at Paithan, 45 km. away from Aurangabad. After brought to the laboratory, the shells of the bivalves were brushed and washed with fresh reservoir water so as to remove the fouling algal biomass and mud. The animals of 80-85 mm shell length were selected for experiment and they were acclimatized for 24 h. at laboratory condition in fresh aerated reservoir water (with renewal of water at the interval of 12-13 h.) and stocking capacity was given during this period and no food was given to the bivalves during laboratory acclimatization and subsequent experimentation.

After 24 h., reservoir water was once again renewed and aeration was given. After a lapse of 1 h. the animals extended their organs (foot, mantle, siphons) to maximum and soon surgical operations and injection of the ganglionic extract were done. For removal of both the cerebral ganglia (bilateral cerebralectomy) following method was used. Active animal was chosen from the aquarium and a wedge (4-5 mm thick) was kept between the valves of the shell. Both the cerebral ganglia were removed by performing minimum injury to the animals within 30 seconds, with the help of fine, pointed sterilized forceps.

For injection of ganglionic extracts, cerebral ganglionic extract was prepared in ice cold distilled water (10 ganglia in 1ml cold distilled water was centrifuged and the supernatant (0.2 ml/animal i.e. equivalent to 2ganglia/animal) was injected into the foot (muscular region) of normal control and gangliatomized (both cerebral ganglia ablated) bivalves. In sham operated control animals were injected by 0.2ml cold distilled water. The result for control and sham operated groups were similar and hence a comparison was made between gangliatomized and control group and extract injected to normal control as well as ablated and control group of animals only. Soon after the operation and injection of ganglionic extracts to normal control, extirpated 30 animals of cerebralectomy, 30 animals of extract injected, and 30 animals of extract injected to ablated bivalves were transferred to separate aquaria. Each aquarium contained 15 liter well aerated reservoir water, and experiment was run for 12 days. The water from each aquarium was changed at an approximate interval of 12 - 13 h. throughout experimental period.

It was observed that whatever the degree of wound occurred, the complete healing in all the animals took place within 5-6 days after surgical operations. Hence, sham operated controls were not run. The temperature and pH of the water were recorded daily during the water renewal, and total carbonate and dissolved oxygen were also determined using methods described by APHA *et al.*, (1985) at regular intervals of seven days over the experimental period. The behavior and mortality of the bivalves were recorded before each change of water from all the aquaria. The experiments were conducted for 12 days on freshly collected animals in each season i.e. summer (April - May), monsoon (July - August), and winter (December -January).

The rate of oxygen consumption of the animals in each group during different seasons was determined according to Winkler's modified technique (Golterman H.L., 1969), in a specially prepared brown colored respiratory glass jar of one liter capacity. The jars were fitted with rubber cork having inlet and outlet of glass tubes connected with rubber tubes and clips. Each individual bivalve from each group was labeled on the shell. The marked bivalve was placed one in each jar and the constant flow of reservoir water was allowed to flow for 1-2 minutes, through inlet and then the tube was pinched tightly without leaving any air bubble in the jar. Soon after opening the valves, the time was counted till one hour. After one hour, from each respiratory jar the water was carefully siphoned out in the Stoppard bottle of 300 ml capacity and oxygen content was determined. The flesh of the individual animal was then taken out carefully from the shell and blotted on the filter paper to remove excess water. This flesh was then weighed to obtain the wet-weight of the individual. The oxygen consumed by each animal was then calculated and expressed as oxygen mg O₂/l/h wet-weight of the flesh. The rate of the oxygen consumption of each group was measured between 11.00 to 12.00 pm. in a day time. The wet flesh weights of four individual animals were noted.

The adult bivalves were placed individually in respiratory jars with 1liter water. Every time four individual animals of each group were used and mean of triplicate of water samples were estimated for each group. The statistical analysis was done to express final data. The atomic equivalent values of oxygen consumption and

ammonia excretion obtained for the same individual. All the values were subjected to statistical analysis for confirmation using student 't' test (Dowdeswell, 1957). Statistical and percentage differences were also calculated in experimental animals.

Results

The variations in the rate of oxygen consumption in the bivalves *Lamellidens corrianus* from control, ablation of cerebral ganglia and injection of ganglionic extract groups on 2nd, 7th and 12th day during different seasons were given in the table-1. All the values of the rate of oxygen consumption were expressed as mg oxygen per gram body weight per liter per hour. During summer season, the rate of oxygen consumption in control group was (0.2908 ± 0.0328) on 2nd and (0.2415 ± 0.0103) on 7th and (0.2305 ± 0.0160) on 12th day. The rate of oxygen consumption decreased (3.70%) on 7th and (8.08%) on 12th day compared to 2nd day. The rate of oxygen consumption showed significant increase (0.3174 ± 0.0184, P < 0.05, 26.55%) in cerebral ganglia ablated group on 2nd day. While the rate was significantly increased (0.2912 ± 0.0229, P < 0.05, 20.57%) in ganglia ablated and significantly decreased (0.2139 ± 0.0127, P < 0.05, 11.42%) in extract injected group compared to control on 7th day. The rate also showed significant increase (0.2654 ± 0.0087, P < 0.05, 15.12 %) in ganglia ablated group and non significant decreased (0.2244 ± 0.0105, 2.65 %) in extract injected group on 12th day. During monsoon season the rate of oxygen consumption in control group was (0.2314 ± 0.0058) on 2nd, (0.2243 ± 0.0105) on 7th, and (0.2146 ± 0.0221) on 12th day. The rate of oxygen consumption was decreased (3.08 %) 7th, and (7.25 %) on 12th day compared to 2nd day. The rate was significantly increased (0.3078 ± 0.1008, P < 0.001, 33.02 %) in ganglia ablated and (0.3021 ± 0.0189, P < 0.01, 30.52 %) in extract injected group on 2nd day. The rate of oxygen consumption also showed significant increase (0.2891 ± 0.0091, P < 0.01, 28.88 %) in ganglia ablated animals on 7th day. The rate of oxygen consumption does not show significant change in both the groups on 12th day. During the winter season the rate of oxygen consumption in control group was (0.2743 ± 0.0297) on 2nd, (0.22005 ± 0.0122) on 7th and (0.2105 ± 0.0144) on 12th day. The rate of oxygen consumption was decreased (19.78 %) on 7th and (23.26 %) on 12th day, as compared to 2nd day. The rate of oxygen consumption in ganglia ablated animals was increased non-significantly (0.3011 ± 0.0169, 9.77 %) on 2nd day during winter season. The rate was increased significantly (0.2841 ± 0.0159, P < 0.01, 29.13 %) on 7th day and (0.2467 ± 0.0118, P < 0.05, 17.19 %) on 12th day compared to respective control. While the rate of oxygen consumption was decreased non-significantly in ganglionic extract injected group (0.2356 ± 0.0083, 14.10 %) on 2nd day. While the rate showed non-significant increase (0.2435 ± 0.0212, 10.68 %) on 7th and (0.2328 ± 0.0263, 10.59 %) on 12th day as compared to respective control.

Discussion

In the present study, the experiments carried out using reservoir water in different seasons revealed that in summer high temperature depleted the oxygen content of the water and also depleted total carbonates. This is also true with the water samples from the habitat of *Lamellidens marginalis* (Akarte, 1985).

The studies carried out on *Lamellidens carrianus* revealed that the data of respiration is considerably affected through different seasons at the time animal experiences different environmental parameters. The study carried out for 12 days at intervals of 5 days are under laboratory conditions and since no food was given to the animals it is expected that the starvation effect might have also occurred. Masthanamma *et al.*, (1985) stated that the starvation effect, in *Lamellidens marginalis* occurs under laboratory conditions from 10 days onwards. Their observations were based on break down of biochemical reserves of the whole body of this bivalve. Thus, in the present study this dual effect of changes in environmental parameters and starvation revealed that in summer though the rate of oxygen consumption was decreased initially up to 12 days. In winter and monsoon the rate of oxygen consumption decreased on 7th and 12th day. This indicates that there is starvation effect during this period. Bivalve molluscs are very sensitive to changes in their environment (Jorrgenson, 1966). It is interesting to note from the present study that prevailing high temperature in summer increased the rate of oxygen consumption (it ranged between 0.23052 ± 0.01603 to 0.2908 ± 0.0388 O₂ mg/l/h/g) and in winter prevailing low temperature decreased it (it ranged between 0.2105 ± 0.01440 to 0.27431 ± 0.2975 and in monsoon it was ranged from (0.21465 ± 0.0225 to 0.23145 ± 0.0059 O₂ mg/l/h/g). Many workers have stated that the rate of respiration increases with temperature (Galtsoff and whipple, 1930; Ishida, 1935; Van Dam, 1954; Berg *et al.*, 1962; Nagabhushanam, 1966; Mane, 1975). Thompson and Bayne (1972) while studying the metabolism associated with feeding in *Mytilus edulis* stated that routine metabolic rate represents an increase over the standard metabolic rate due to sum of the "active cost" and the "physiological cost" of feeding. The authors concluded that the activity cost represents the energy cost of ventilation and the filtration, and the physiological cost represents the increased oxygen requirement that results from the intake of food and subsequent digestion and metabolism of ingested nutrients.

Table 1: Effect of ablation of cerebral ganglia and injection of their extracts on the rate of oxygen consumption of *Lamellidens carrianus* during different seasons. (Bracket Values represents percentage difference) = P <0.001, .. =P<0.01, ... =P<0.05

	Summer season				Monsoon season				Winter season			
Days	Control	Ablation of cerebral ganglia	Injection of distilled water	Injection of cerebral ganglionic extra	Control	Ablation of cerebral ganglia	Injection of distilled water	Injection of cerebral ganglionic extra	Control	Ablation of cerebral ganglia	Injection of distilled water	Injection of cerebral ganglionic extra
On 2 nd	0.2908 ±0.03228	0.3174 ±0.0184 (26.55) ...	0.2389 ±0.0158	0.3001 ±0.0212 (19.66)	0.2314 ±0.0058	0.3078 ±0.0100 (33.02) .	0.2389 ±0.0161	0.3021 ±0.0189 (30.52) ...	0.2743 ±0.0297	0.3011 ±0.169 (09.77)	0.2567 ±0.0276	0.2356 ±0.0083 (14.10)
On 7 th	0.2415 ±0.0103 (03.70) ...	0.2911 ±0.0229 (20.57) ...	0.2427 ±0.0249	0.2139 ±0.0127 (11.42) ...	0.2243 ±0.0105 (03.08)	0.2891 ±0.0091 (28.88) ..	0.2642 ±0.0223 (17.78)	0.2589 ±0.0193	0.2200 ±0.0122 (19.78)	0.2841 ±0.159 (29.13) ..	0.2425 ±0.0213	0.2435 ±0.0212 (10.68)
On 12 th	0.2305 ±0.0160	0.2654 ±0.0087 (15.13) ...	0.2265 ±0.0092	0.2244 ±0.0105 (02.65)	0.2146 ±0.0221 (07.25)	0.2479 ±0.0122 (15.49)	0.2252 ±0.0159	0.2420 ±0.0134 (12.76)	0.2105 ±0.0144 (23.26)	0.2467 ±0.0118 (17.19) ...	0.2331 ±0.0128	0.2328 ±0.0263 (10.59)

However, in the present study, fluctuation in the rate of oxygen consumption during summer and winter revealed reciprocal relationship during the later period. In summer, the rate decreased till 12 days in winter also the rate decreased till 12 days. This effect is likely to be due to environmental effect including starvation and the physiological status of the animal. Minor fluctuation in the rate of respiration over the experimental period in monsoon shows clearly that the animal could withstand to the starvation effect in the laboratory. In monsoon the availability of plenty of food material and high oxygen content of water lead to susceptibility towards starvation effect. Berg *et al.*, (1958) suggested that seasonal changes in metabolic activity are more closely related to food supply or reproductive activity than to temperature. The relationship between gametogenesis, body reserves and routine rate of oxygen consumption in bivalves has been documented by Bayne and Thompson (1970), Widdows and Bayne (1971) and Bayne (1973). These authors have stated that during active gametogenesis the routine oxygen consumption rate increase and when it is completed the energy reserve of the body is considerably reduced and the starvation results in rapid decline. This may perhaps lead the animal to give a quicker response in the direction of the changed environment conditions and hence lead in increase in the oxygen consumption. In *Lamellidens corrianus*, it has been observed that summer months are the period of gametogenesis, in monsoon maturation takes place and in winter the gonad gets ripe and spawning occurs. Comparing the reproductive state and the internal status of *Lamellidens corrianus*, with oxygen consumption, it can be stated that the high rate of oxygen consumption during summer probably correlates with both the animals greater energy demand for gametogenesis as well as to survive in decreased oxygen medium at the time of increased temperature and low food availability. It is reported in bivalves that the rate of oxygen consumption is also affected with animal's reproductive status (Gabbott and Bayne, 1973). Bayne (1973) stated that the routine rate is seasonally variable with high values in winter and low values in summer. The author also observed the temperature and nutritive stress to alter seasonal physiological indices in *Mytilus edulis*.

Removal of cerebral ganglia in different seasons revealed that the rate of oxygen consumption increased in both ablated and injected group compared to controls. This increase in the rate was more pronounced in summer and generally the rate of oxygen consumption in ablated groups increased than extract injection groups. Based on the results of the present findings it has been concluded that the cerebral ganglia possess factor/factors regulating the rate of oxygen consumption in different seasons. Based on the available data and the existing literature the factor/factors can be considered in terms of actions via neurohumors and neurohormones.

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Diversity of Cyanobacteria of Pravara River Basin of Newasa Tehsil

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ABSTRACT: The algal samples from freshwater bodies and field soils were collected from in and around Pravara river basin of Newasa tehsil of Ahmednagar District (Maharashtra). The cultures were initiated in the laboratory. The initiated cultures were screened for cyanobacteria and purified by streaking on agar plate and serial dilution method. Single filaments were washed with sterile distilled water and inoculated in BG-11 medium. The microscopic and other observations were made by following the guidelines described by Desikachary (1959) and Rappaka (1979) for identification of cyanobacterial forms. The axenic, unialgal cultures of cyanobacteria were established in the laboratory. Large scale biomass production and utilization of biomass of these cyanobacterial forms for pharmaceutical purpose can be done in the future.

Keywords: Cyanobacteria, Pravara basin, BG-11, Desikachary, Biomass.

Introduction

Cyanobacterial biomass has been considered since long as a source of proteins that could supplement conventional food and feed production (Subramanain, 1996, Singh *et al.*, 2003). They are the dominant micro flora in rice fields where they significantly contribute to the fertility as a natural biofertilisers (Sinha *et al.*, 2003). The interests in these organisms as generators of pharmacologically active and industrially important compounds have been stimulated by the recent results (Singh *et al.*, 2002). The metabolites from the cyanobacteria have shown the properties like antimalarial, antibacterial, antiviral, antifungal, cytotoxic, etc. (Richmond, 1990, Falch *et al.* 1995, Subramanian and Uma, 1996). Some metabolites show industrially important properties like emulsifying, surfactant, flocculent, viscosity, etc. (Roberto and Vincenzini, 1998, Judith *et al.*, 1994).

Only few species of Cyanobacteria have been screened for bioactive metabolites and are most prolific producers of some novel Cytotoxins termed as Scytophycins and Tolytoxin, (Paterson *et al.* 1994, Singh *et al.*, 2002). So far, meager information is available on screening of Indian Cyanobacteria species for the presence of scytophycins and tolytoxins and their enhanced production. The results of the present investigation will signify the potentiality of Cyanobacterial species for the production of biomass and its utilization.

Therefore, there is need to screen additional species of the Cyanobacteria and efforts have to be made to enhance the production of biomass and its utilization as biofertilizer, antitumor and antifungal agents.

Materials and Methods

The habitat of cyanobacteria varies from species to species. In order to get maximum number of cyanobacterial species, soil samples from different locations were collected. Fresh biomass from various water bodies of different regions was collected & maintained separately. The cultures were established by using various culture media. Mixed cyanobacterial biomass obtained was separated and species were isolated & identified. Individual species of cyanobacteria were maintained separately in culture room. Standard procedure was followed for collection, isolation & establishment of culture of all species of cyanobacteria.

A. Area of Collection

In order to get maximum number of cyanobacterial species, different locations of Pravara river basin of Newasa tehsil of Ahmednagar district were selected for collection of soil samples & fresh biomass. For collection of soil samples, irrigated area was preferred. The fresh biomass was collected from the rivers as well from stagnant waters of the various locations.

B. Method of Collection

Soil samples were collected in sterilized polythene bags of size 6X4 inches. Each bag was tied with the help of rubber band. Soil samples from irrigated areas and occasionally irrigated and dry areas were preferred. All the bags containing soil samples were labelled giving information regarding location, date of collection and soil type. Each soil sample was carefully handled & brought to the laboratory for further study. Fresh biomass from

various places was also collected. These labelled bottles with collected biomass were brought to laboratory & maintained under the appropriate conditions of light & temperature for further experiments.

C. Isolation of Cyanobacterial Species

Cyanobacterial species were isolated by culturing them on solid agar medium. First of all, soil samples were cleaned up by removing sand, gravels, etc. Soil solution of fine soil was made by using sterile distilled water. Different concentrations were made by following serial dilution method.

The same procedure was followed for each soil sample. The solid agar media namely BG-11 (Rippka *et al.*, 1979), Fog's medium (Jacobson, 1951) and Allen & Arnon (Allen and Arnon, 1955) medium were used for isolation of cyanobacterial species.

The soil solutions of different concentrations were spread on the agar plates containing different media. These plates were then placed under diffused light under room temperature. The algal colonies started appearing after 1-2 weeks. The algal colonies were isolated for unialgal cultures. These unialgal colonies were isolated and maintained in liquid culture media.

For the isolation of cyanobacterial species from collected biomass following procedure was followed. In the beginning from the collected biomass, small portion was taken to prepare slides & observed under binocular microscope under loox magnification for the presence of cyanobacterial species. From this biomass, few Filaments were isolated and grown on solid agar media. For each sample of Fresh biomass, the same procedure was followed. The inoculated Petriplates containing solid agar media were kept for inoculation in the culture room. After fifteen days, the petriplates with unialgal cultures were isolated. Unialgal colonies were carefully isolated and observed under light microscope.

D. Culture Media

The culture media used were BG-11 (Rippka *et al.*, 1979), Fogg's medium (Jacobson, 1951) and Allen and Arnon's medium (Allen and Arnon, 1955), for the rich growth of cyanobacterial species. These media were separately used in different sets.

E. Identification

The unialgal cultures were isolated separately and maintained in various media such as BG-11, Fogg's medium & Allen & Arnon's Medium. All the unialgal colonies were observed under binocular research microscope with the help of slides. Identification of Cyanobacteria was done by using standard monograph of Desikachary (1959).

Results & Discussion

In total water and soil samples collected from various localities of Pravara river basin of Newasa tehsil of Ahmednagar district blue green algal species belonging to 14 genera were identified. Their taxonomical characterization was made by using standard literature following Desikachary (1959). Patil and Satav (1986) reported 66 blue-green algal species from Western Maharashtra. Shinde (1995) reported 21 blue-green algae from soils of Pravaranagar area (Maharashtra).

Following are the different genera of cyanobacteria found in various samples of soil and fresh biomass collected from different locations.

1) *Anabaena* sp., 2) *Nostoc* sp.; 3) *Oscillatoria* sp.; 4) *Westiellopsis* sp.; 5) *Phormidium* sp.; 6) *Hapalosiphon* sp., 7) *Scytonema* sp.; 8) *Lyngbya* sp.; 9) *Calothrix* sp.; 10) *Cylindrospermum* sp.; 11) *Tolypothrix* sp.; 12) *Stigonema* sp.; 13) *Microcoleus* sp.; 14) *Westiella* sp.

After the collection of algal samples from study area, it was noticed that Newasa tehsil of Ahmednagar region is rich in cyanobacterial flora. Among all the species found, *Westiellopsis* is the dominant with 54.24% abundance followed by *Anabaena* (49.44%), *Oscillatoria* (41%) and *Phormidium* (40.48%). The dominance of these species might be due to their tolerance to salinity (Jha *et al.*, 1987). The blue-green algal genera like *Cylindrospermum*, *Nostoc*, *Anabaena*, *Wolleea*, *Aulosira*, *Scytonema*, *Nostochopsis*, *Plectonema*, *Calothrix*, *Hapalosiphon* and *Westiellopsis* were investigated from salt affected soils of Uttar Pradesh and Maharashtra (Singh, 1961; Madane and Shinde, 1993; Shinde, 1995). In the present study, cyanobacterial population in the water samples collected was very less. Species of cyanobacteria were commonly found in moist soil.

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Indigenous Traditional Knowledge in Treating Jaundice from Toranmal Region of Nandurbar District, Maharashtra, India

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ABSTRACT: Present paper deals with the plants utilised for treating of jaundice by tribal communities in Toranmal region of Nandurbar district, Maharashtra. An ethno-medico-botanical survey was carried out in and around Toranmal during 2016-2018 to gather information from medicine men and other knowledgeable people regarding the use of plants for jaundice. Information about herbal medicine / formulation used in treating jaundice was gathered using structured questionnaire and individual interviews. The present communication provides information of 25 plant species 20 families used by the forest dweller of the region in treating jaundice. Plants are listed alphabetically by botanical name, family, local name, uses include part(s) used, mode of preparation/administration, etc.

Keywords: Indigenous Traditional Knowledge, Jaundice, Toranmal, Nandurbar, Maharashtra.

Introduction

Toranmal region is a part of Satpura mountain of central India. Toranmal fall in the Shahada Taluka of Nandurbar the district. The highest elevation is recorded at hills of Toranmal rising up to 3373 feet with a lake on its top surrounded by mountain ranges. Mountains in this part of Satpura range forms about seven major folds with an average height of 600 mts above sea level and slopes down sharply towards river Narmada in the North. Two of these ranges of hills unite at Toranmal and enclose an irregular plateau of about 50 × 25 km broad. Northern part of this area is occupied by dry deciduous forest, while the southern plains towards river 'Tapi' is predominantly agricultural. Tribes in Toranmal include the Bhils, Pawaras, Gomits, Kokanis, Gavits, etc. Bhil and Pawara are the dominant tribes in the region.

Human civilisation, since time immemorial have been mostly dependent on natural resource for their basic needs like food, medicine, fodder, shelter, etc. Previously, they were directly dependent on plants resources but as a result of development and with advancement of science and technology this dependence on plants as a straight source has been substantially reduced. However, the people, who have traditionally lived in the forests, continue their dependence on plants for their survival.

Residing in and around forests since ages, these people have assimilated unique knowledge about plant utilization for different purposes through the course of their years old practise. The medicine men/ informers are experts for one or the other diseases in the region. Their enormous knowledge needs to be gathered and properly documented. One of the causes to undertake the present ethnobotanical survey is as Toranmal region is rich in floristic as well as in ethnic diversity.

Present communication deals with the plant resources utilised for treating jaundice. According to the WHO estimates about 1.4 million cases of hepatitis A occur annually and 2 billion people worldwide are infected with the virus of hepatitis B (WHO, 2002). In spite of incredible advances made in medical practices by using modern medicines, herbal medicine still play significant role in the treating wide variety of diseases. A large number of plants are reported to be used for treating jaundice (particularly hepatitis B). Traditional medicinal practices relating to human health are practiced in India since centuries. This treasure of knowledge may lost in coming days as traditional culture is gradually vanishing. The present study is an effort to gather and document the information about plants used for treatment of jaundice from the region.

Methodology

Ethno-medico-botanical survey of the region was carried out during July 2016 to 2018. The area was frequently visited. Local people were interviewed and the information on medicinal uses of plants was gathered using semi-structured questionnaire and discussions with local people. Data on plants botanical names, local names, plant part/s used for medicine, mode of consumption, doses, etc. were recorded. Plants were identified using relevant scientific literature, Cooke (1967, Reprinted ed.); Sharma et al. (1996), Singh and Karthikeyan(2000),

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Singh *et al.* (2001), Patil (2003), Voucher specimens were collected and deposited in herbarium Shri Muktanand College, Gangapur.

Enumeration

1. *Achrysanthes aspera* L. (Amaranthaceae) 'Agheda'.
Use: Fresh root is crushed and boiled in water with 4-5 black pepper and pinch of salt. 30-40ml of root decoction is given empty stomach early in the morning for 10-15 days.
2. *Adhatoda vasica* Nees. (Acanthaceae) 'Adulsa'.
Use: 3-5 leaves crushed with water to make a paste is given thrice a day with jaggary or honey for about 15 days.
3. *Aegle marmelos* (L.) Corr. (Rutaceae) 'Bel'.
Use: 30-40ml of decoction of handful leaves is given twice a day for 8 – 10 days.
4. *Aloe vera* (L.) Burm.f. (Asphodelaceae), 'Korphad'.
Use: The leaf pulp is mixed with *Curcuma longa* L. rhizome paste in 80:20 proportion, given with cow milk twice a day for 15 days.
5. *Andrographis paniculata* (Burm. f.) Wal ex. Nees (Acanthaceae) 'Kirayat'.
Use: Roots are crushed to make a paste, one teaspoonful of paste taken thrice a day for 10-15 days.
6. *Azadirachta indica* A. Juss. (Meliaceae) 'Limb'.
Use: 30-40ml of extract of the inner bark is mixed with honey and given twice a day for 10-15 days.
7. *Boerhaavia diffusa* L. (Nyctaginaceae) 'Punarnava'.
Use: One teaspoonful paste of handful herb mixed with jaggary is given twice a day for 15 days.
8. *Carica papaya* L. (Caricaceae) 'Papai'.
Use: Juice made by ripe fruit with few drops of lemon juice and pinch of salt is given twice a day for 15 days.
9. *Cassia fistula* L. (Fabaceae), 'Bahawa'.
Use: Sweet dark brownish septum of fruits crushed in water to prepare extract, 20-30ml of which is given twice a day for 8-10 days.
10. *Coriandrum sativum* L. (Apiaceae), 'Kothambir'.
Use: 30-40 ml of fruit decoction is given twice a day for 10-15 days.
11. *Cuscuta reflexa* Roxb. (Cuscutaceae) 'Amaravel'.
Use: Handful of stem crushed to prepare extract, 20-30 ml of which is given twice a day for 8-10 days.
12. *Diplocyclos palmatus* (L.) C. Jeffrey. (Cucurbitaceae) 'Shivlingi'.
Unripe fruits are cooked and eaten as a vegetable till cure.
13. *Eclipta prostrata* L. (Asteraceae) 'Maka'.
Use: 20-30ml of whole plant extract is given empty stomach early morning for 15 days.
14. *Indigofera tinctoria* L. (Fabaceae) 'Neel'.
Use: Handful of leaves are crushed to prepare extract, 25ml of which is given twice a day for 8-10 days.
15. *Mimosa pudica* L. (Mimosaceae) 'Lajalu'.
25-30ml extract of the leaves is given twice a day for 8-10 days.
16. *Ocimum tenuiflorum* L. (Lamiaceae) 'Tulashi'.
Use: 30-40ml extract of the whole plant is taken twice a day for 15 days.
17. *Oroxylum indicum* (L.) Vent. (Bignoniaceae) 'Tetav'.
Use: Inner stem bark is crushed and soaked overnight in a water and 25-30ml filtrate is given twice a day for 15 days.
18. *Phyllanthus fraternus* Webster (Euphorbiaceae) 'Bhuiawala'.
Use: One teaspoon of fresh root extract is mixed with half-cup milk or rice water and given daily in morning regularly for a week to cure liver diseases.
19. *Plumbago zeylanica* L. (Plumbaginaceae) 'Chitrak'.
Use: Plant is burnt to ash, 1-2gm of it is given with water once a day for 8-10 days.
20. *Sphaeranthus indicus* L. (Asteraceae) 'Mundi'.
Use: 25-30ml decoction of whole plant is given once a day for 10-12 days
21. *Syzygium cumini* (L.) Skeels. (Myrtaceae) 'Jambul'.
Use: Fruit juice with pinch of salt, one glass of it is given once a day for 15 days.
22. *Tecomella undulata* (Sm.) Seem. (Bignoniaceae) 'Raktrohida'.

Use: 20-30ml decoction of the inner bark with milk and jaggary is given empty stomach early in the morning for 15 days.

23. *Tephrosia purpurea* (L.) Pers. (Fabaceae) 'Unhali'.

Use: 20 – 30ml of root extract is given twice a day for 8-10 days.

24. *Terminalia chebula* Retz. (Combretaceae), 'Hirada'.

Use: 20-30 ml decoction of fresh fruits is given twice a day for about 10-15 days.

25. *Tinospora cordifolia* (Thunb). Miers (Menispermaceae) 'Gulvel'

Use: Pieces of stems are crushed in water, extract 20-30ml given in the empty stomach in morning with honey.

Results and Discussions

In present paper, 25 plant species belongs to 20 families which are used in treating jaundice by the people of this region have been reported. The plant parts used in 25 formulations are leaf in 25 formulations, root in 4 medicinal formulations, bark - 3, stem - 2, fruit – 6 while 5 formulations of whole plants used as medicine for jaundice. The reported plants were generally administered as decoction, extracts, paste, juice and infusion with different additives.

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Response of Wheat (*Triticum aestivum* L.) to Water Stress in Relation to the RWC, MSI and Lipid Peroxidation

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ABSTRACT: Water stress is one the most important environmental stress, severely affects plant growth and development, limits plant production and the performance of crop plants. The present study was aimed to determine the effect of different levels of water stress conditions on RWC, MSI and Lipid Peroxidation in wheat (*Triticum aestivum* L.) at seedling and anthesis stage. Wheat cultivar (var.496) was subjected to water stress (FC) percent treatment in pot culture. The pot culture experiment was carried out in three replications by using five water stress treatments. Results revealed that the metabolites such as relative water content and membrane stability index were decreased with increasing level of drought stress treatments. The amount of lipid peroxidation enhanced gradually and significantly with increase in level of drought stress.

Keywords: Water stress, *Triticum aestivum*, RWC, MSI, Lipid peroxidation

Introduction

Wheat is the most important agricultural good in international market and also it is one of the strategic agricultural productions which have daily and universal consumption (Mollasadeghi *et al.*, 2011). Wheat is the staple food for more than 35% of world population, its anti-drought physiological study is important to maximize yield under water stress condition. In developing countries, almost 32% of wheat crop face various types of drought stress during the growth season (Morris *et al.*, 1991).

The response of plants to water stress depends on several factors such as developmental stage, severity and duration of stress. Among different environmental abiotic stresses, drought is one the most important environmental stress, severely impairs plant growth and development, limits plant production and the performance of crop plants (Shao *et al.*, 2009). Plant experiences drought stress either when the water supply to roots becomes difficult or when the transpiration rate becomes very high. Available water resources for successful crop production have been decreasing in recent years. Furthermore, scientists suggested that in many regions of world, crop losses due to increasing water shortage will further intensify its impacts (Anjum *et al.*, 2011). To avoid the stress or stress tolerance, plants can modify at morphological, metabolic and cellular levels. Sarkar *et al.* (2016) reported that decrease in RWC with increase in water stress in *Citrus reticulata*. Abdalla and El-Khoshiban (2007) reported that increase in water stress adversely affect the RWC content in selected cultivars of *Triticum aestivum*. Alteration in cell membrane stability is an important mechanism to resist drought. Soil water deficit result the decrease in cell membrane stability in different varieties of wheat (Razzaq *et al.*, 2013). Accumulation of MDA is an indication of oxidative stress in plant tissue. Increase in MDA levels under water stress condition have been recorded in different plants like, *Citrus reticulata* (Sarkar *et al.*, 2016) and wheat (Tatar and Gevrek, 2008). The plants response to water stress is a complex physiochemical process in which many biological macro-molecules and micro-molecules are involved (Ahmadizadeh, 2013). The aim of this study was to determine the physiological and biochemical response of wheat to water stress conditions.

Material and Methods

The authentic seeds of wheat cultivar variety GW 496 were procured from the Mahatma Phule Agricultural University, Rahuri, Dist. Ahmednagar, (MS) for experimental work.

Preparation of different moisture regimes (FC %)

The pot culture experiment was laid out in a randomized block design with three replications and five treatments of moisture regimes e. g. 100% FC, 80% FC, 60% FC, 40% FC and 20% FC. For making different moisture regimes gravimetric method was followed with some modifications for which garden soil was used after determining its water holding capacity (Narkhede, 1989). The methodology used for analyses is briefly described below,

Measurement of Relative Water Content (RWC)

The relative water content was determined by using the formula given by Barrs and Weatherley (1962). RWC was determined with the formula given below,

$$\text{RWC (\%)} = \frac{\text{Fresh weight} - \text{Dry weight}}{\text{Turgid weight} - \text{Dry weight}} \times 100$$

Membrane Stability Index (MSI)

Leaf membrane stability index (MSI) was determined according to the method of Deshmukh *et al.* (1991). Leaf membrane stability index (MSI) was calculated as: $\text{MSI} = [1 - C_1 / C_2] \times 100$
 C1= Electrical Conductivity 1; C2= Electrical Conductivity 2

Lipid Peroxidation

The level of lipid peroxidation was measured in terms of malondialdehyde (MDA) content, a product of lipid peroxidation by following the method of Heath and Packer (1968).

Statistical analysis

The data obtained from RWC, MSI and lipid peroxidation parameters were analyzed statistically for mean, standard error (SE), critical difference (CD), and correlation coefficient. Standard statistical methods were followed for estimating correlation coefficients (Snedecor and Cochran, 1980). CD was calculated at 5% probability and correlation coefficient was calculated at 5% and 1% probability. The correlation between agronomic characters was estimated by using software SPSS 9.0.

Results and Discussion

Table 1: Effect of water stress on Relative Water Content, Membrane Stability Index and Lipid Peroxidation in leaves of wheat at seedling and anthesis stage.

Field Capacity %	Relative water Content (%)		Membrane Stability Index (%)		Lipid Peroxidation ($\mu\text{mole MDA g}^{-1} \text{F.W.}$)	
	Seedling Stage	Anthesis Stage	Seedling Stage	Anthesis Stage	Seedling Stage	Anthesis Stage
100	85.72	82.63	48.77	78.14	2.22	3.05
80	82.57	79.44	47.59	74.23	3.13	5.09
60	70.13	67.60	32.66	68.00	3.80	5.87
40	59.19	56.27	26.89	61.34	4.47	7.10
20	54.35	51.02	18.09	52.66	5.20	8.48
SE	6.19	6.20	5.94	4.56	0.52	0.92
CD at 5%	17.21	17.24	16.51	12.61	1.44	2.55

Relative Water Content

Relative water content is the appropriate measure of plant water status in terms of physiological consequence of cellular water deficit. It is one of the important parameter used to evaluate the effect of various stress/treatments.

Effect of water stress on relative water content (RWC)

The relative water content determines the ability of plant to absorb water under moisture stress condition and used as one of the indices to determine drought effect. It is a reliable and less error prone criterion for measurement of plant water status. In present water stress treatment the relative water content was significantly decreased with increase in level of drought stress from 80, 60, 40 and 20 % field capacity. The lowest relative water content(54.35 and 51.02%) was recorded in 20 % field capacity stress treated wheat plants in comparison to control plants (85.72 and 82.63%) at seedling and anthesis stage respectively (Table 1). Similarly various researchers had confirmed that RWC was negatively affected by water stress. Taherianfaret *al.* (2013) reported that the water stress significantly decreased RWC in soybean plant. Very

recently, Sarkar *et al.* (2016) reported gradual and significant decrease in RWC in *Citrus* leaves under water stress condition.

Membrane Stability Index (MSI)

A major impact of plant environmental stress is cellular membrane modification, which results in its perturbed function or total dysfunction. The estimation of membrane dysfunction under stress by measuring cellular electrolyte leakage from affected leaf tissue into an aqueous medium is used as a measure of MSI and as a screen for stress resistance.

Effect of water stress treatment on Membrane Stability Index (MSI)

Stability of cell membrane under drought is an important mechanism to resist the drought. In recent investigation the lowest membrane stability index (18.09 and 52.66%) was recorded in 20% field capacity stress treated wheat plants in comparison to control plants (48.77 and 78.14%) at seedling and anthesis stage respectively (Table 1). Like RWC, the MSI was also significantly decreased with increase in level of drought stress. Under environmental stresses plant membranes are subject to changes often associated with the increases in permeability and loss of integrity (Blokhina *et al.*, 2003). Chandrasekhar *et al.* (2000) reported reduction in MSI under drought condition in hexaploid and tetraploid wheat. Similarly, Chorfi and Taibi (2011) observed reduced percentage of MSI in two different cultivars of wheat as compared to their respective controls under water stress condition.

Lipid Peroxidation

The degree of lipid peroxidation measured in terms of malondialdehyde (MDA) content is one of the determinants which indicate the severity of stress experienced by any plant.

Effect of water stress treatment on lipid peroxidation

It is indicated that the accumulation of MDA, a product of fatty acid peroxidation is a measure of oxidative stress induced membrane damage during water stress. In the present study, the obtained results clearly indicate that the amount of lipid peroxidation increased with decreasing field capacity at seedling and anthesis stage. The amount of lipid peroxidation enhanced gradually and significantly with increase in level of drought stress from 80, 60, 40 and 20% field capacity over control plants. The highest amount of lipid peroxidation (5.20 and 8.48 $\mu\text{mole/gm FW}$) in comparison to control (2.22 and 3.05 $\mu\text{mole/gm FW}$) was recorded at 20% field capacity at seedling and anthesis stage respectively (Table 1). Sultan *et al.* (2012) evaluate several wheat species and reported that all species exhibited a significant rise in their MDA content after 48 hours of water stress. Chakraborty and Pradhan (2012) also observed increased values of MDA with increase in amount of water stress in different varieties of wheat.

Conclusion

According to results, it can be concluded that plants in drought stress time make changes in some of their physiological and biochemical features. The results from this study showed that as the metabolites such as relative water content and membrane stability index was decreased with increasing level of drought stress treatments. The amount of lipid peroxidation enhanced gradually and significantly with increase in level of drought stress.

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Estimation of Growth and Carbohydrates Content in a Cyanobacterium *Anabaena circinalis*

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ABSTRACT: *Anabaena circinalis* was isolated from the collected soil samples from different locations. Identification was carried out using morphological variation and taxonomical approaches according to Desikachary (1959). The axenic culture of *Anabaena circinalis* was obtained in the laboratory. For the biomass production, different culture media were used namely BG-11, Fogg's medium, Allen and Arnon medium, Zarrouk's medium and CFTRI medium. The biomass was harvested by filtration through double layered muslin cloth and dried using air blower. After harvesting, the biomass obtained was subjected to the growth analysis. The total carbohydrates were estimated by following Anthrone method (Hedge and Hofreiter, 1962). Out of the different culture media used, BG-11 medium supported the growth of *Anabaena circinalis* properly as compared to other media used. The total carbohydrates content was more in *Anabaena circinalis* grown in CFTRI medium followed by the Allen and Arnon medium.

Keywords: *Anabaena circinalis*, Carbohydrates, BG-11, Fogg's medium, Allen and Arnon medium, Zarrouk's medium and CFTRI medium.

Introduction

Cyanobacteria (blue-green algae, BGA) are morphologically diverse group of phototrophic prokaryotes, which occur in almost every habitat on earth and useful to mankind in various ways (Thajuddin and Subramanian, 2005). They constitute a vast potential resource in varied applications such as food, feed, fuel, fertilizer, medicine, industry and in combating pollution (Thajuddin and Subramanian, 2005). Until past few decades of research, cyanobacteria were of academic interests and were mostly ignored as nuisance but, now are proved as potential organisms for much biotechnological utilization (Richmond, 1990; Sundararaman and Sekar, 2001; Thajuddin and Subramanian, 2005). The interest in these organisms as generators of pharmacologically active and industrially important compounds has been stimulated by recent results (Singh *et al.*, 2002). The carbohydrates produced by cyanobacteria have important commercial uses. Since carbohydrates are non-toxic, they are desirable and used in the food industry (Bauernfeind, 1981). Carbohydrates are frequently used in dietary additives for poultry and aquaculture farming (Hirschberg and Chamoritz, 1994).

Materials and Methods

Method of collection-The soil samples from 5-10 cm deep soil layers were collected using the scalpels. Soil samples were collected in polythene bags of size 6 x 4 inches.

Nutrient media-The different culture media namely BG-11 (Rippka *et al.*, 1979); Fogg's medium (1949; Jacobson, 1951); Allen and Arnon's medium (Allen and Arnon, 1955); CFTRI medium (Venkataraman and Becker, 1984) and Zarrouk's medium (Zarrouk, 1966) were used for the rich growth of *Anabaena circinalis*. These media were separately used in different sets.

Isolation of cyanobacterial species-The dry soil samples were spread in petri dishes and moistened with sterilized distilled water and cultures were incubated in light. When the visible growth of cyanobacteria begins to appear in the cultures, these cultures were used for the isolation of unialgal cultures of *Anabaena circinalis*.

Identification of the algal samples - Morphometric studies were carried out by using ocular and stage micrometer. The identification of *Anabaena circinalis* was carried out using monograph and keys of Desikachary (1959).

Biomass production-For production of biomass, glass bottles (300 mL capacity) were used. The bottles were filled with 100 mL medium and autoclaved. The inoculum was ground in the sterile mortar and pestle in laminar air flow. Then the bottles were inoculated with 5 mL of unialgal suspension of *Anabaena circinalis* and labeled properly. All the cultures were maintained in the culture room at temperature 28±2°C under 8-h light/16-h dark photoperiod with a photosynthetic photon flux density of 40 $\mu\text{moles}^{-2}\text{S}^{-1}$ provided by cool white fluorescent tube lights. After harvesting, the biomass obtained was subjected to the growth analysis

Estimation of carbohydrates

The carbohydrates were estimated by following Anthrone method (Hedge and Hofreiter, 1962). For the estimation of total carbohydrates, 1 mL of cell suspension was mixed with 4 mL of 2M H₂SO₄, and placed in boiling water bath for 3 hours after which, the solution was cooled to room temperature and centrifuged. Total carbohydrates were estimated from the supernatant liquid. D-glucose was used as a standard. The amount of carbohydrates is expressed as % of total carbohydrates on dry weight basis.

Results and Discussion

Out of the different culture media used, BG-11 medium supported the growth of *Anabaena circinalis* properly as compared to other media used. Allen and Arnon medium also supported growth but after 20 to 25 days, photo bleaching of biomass was observed. Other growth media, such as Fogg's medium and Zarrouk's medium supported the growth of *Anabaena circinalis* but the growth rate was very slow.

Table : Influence of different media on growth and carbohydrates in *Anabaena circinalis*

Sr. No	Medium	Fresh wt. (g)	Dry wt. (g)	Total Carbohydrates%
1	BG-11	2.89±0.12 ^a	0.27±0.05 ^a	15.23±1.24 ^a
2	Allen & Arnon	2.60±0.10 ^b	0.26±0.04 ^a	13.19±0.95 ^b
3	Fogg's Medium	2.21±0.09 ^c	0.20±0.03 ^b	12.84±1.12 ^b
4	Zarrouk' Medium	2.38±0.15 ^c	0.24±0.05 ^a	13.43±1.23 ^b
5	CFTRI	2.52±0.22 ^b	0.25±0.07 ^a	12.88±1.80 ^b

Values are mean±SE of three independent experiments.

Yield of biomass is one of the direct measures of quantity of biomass produced per unit area within a specific time. Higher yield indicates higher biomass produced per unit area. Comparison of *Anabaena circinalis* in different media showed that highest biomass per bottle in terms of dry weight was produced in BG-11 medium followed by Allen and Arnon medium. The carbohydrates content was more in the *Anabaena circinalis* grown in Fogg's medium followed by the CFTRI medium. Zarrouk's medium showed poor response for the carbohydrates content.

Cyanobacteria are photoautotrophic bacteria and require all the essential major and minor elements. The heterocystous cyanobacteria fix atmospheric nitrogen and they can use atmospheric nitrogen as a source of nitrogen. In bottles, the medium does not come in contact with atmospheric nitrogen and the source needs to be added in the culture medium. If the culture medium is devoid of nitrogen, it results in poor growth of cyanobacteria. Similar results were reported by Olatz (1991); medium lacking nitrogen source, results in yellowish green color of the cells which is a characteristic of nitrogen deficiency. In the culture methods like photo- bioreactors, pure nitrogen is continuously bubbled into culture medium, (Humberto *et al.*, 1989; Vonshak, 1993; Roxana *et al.*, 2000) so that cultures do not get affected due to nitrogen deficiency.

The growth of *Anabaena circinalis* was more in BG-11 medium than in other media. For optimum growth of cyanobacteria, appropriate K⁺: Na⁺ ratio is required in the cytoplasm. High Na⁺ is required by nitrogen fixing cyanobacteria for conversion of molecular nitrogen into ammonia (Becker, 1994). BG-11 medium consists moderate concentration of Na⁺ and in Allen and Arnon medium, Zarrouk's medium and CFTRI medium there is high concentration of Na⁺ while in Fogg's medium; there is no Na⁺ source. *Anabaena circinalis* from moist soil habitat, which may not require high concentration of Na⁺ ions in the medium.

Production of carbohydrates depends on composition of medium and its pH. In Fogg's medium composition and pH is moderate which resulted in higher accumulation of carbohydrates in the biomass of *Anabaena circinalis*. Cifuentes and co-workers (1996 a,b) demonstrated that low nitrogen content results in higher accumulation of carbohydrates in *Dunaliella* sp. This response can be explained by the well-known effect of limitation in this nutrient as an inductive factor of carbohydrates accumulation in *Dunaliella* (Ben-Amotz *et al.*, 1982). Fogg's medium does not contain nitrogen source, therefore the higher production of carbohydrates may be due to low nitrogen content of the medium.

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Arbuscular Cotton-Associated Mycorrhizal Fungi in Yeola Region of Maharashtra, India

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ABSTRACT: Mycorrhizae are a mutual symbiotic link between the plant root and a fungus that colonizes the cortical tissue of the roots during active plant growth periods. Both the host plant and the fungus have the potential to benefit. Mycorrhizae are ubiquitous throughout the world in terrestrial ecosystems. The purpose of this study is to evaluate the association of arbuscular mycorrhizal fungi in cotton crops with AM fungal population density in rhizosphere soils, investigate the qualitative composition of AM fungal species and the percentage of root colonization. The results showed that the number of AM fungal propagules collected from different locations in cotton crops ranged from 235 to 1580 spores per 100 g of soil. Due to the widespread nature of AM fungi, they occurred in almost all soil samples, but the number and type of spores and sporocarps varied. In total, 41 AM fungal species belonging to the genera *Glomus*, *Acaulospora* and *Scutellospora* were isolated. *Glomus* was found to be predominantly followed by *Scutellospora* in cotton soils in the rhizosphere. The distribution of spores, density and composition of AM fungi are observed to be influenced by environmental and physicochemical factors. The AM spore number, root colonization percentage and distribution vary depending on the seasonal fluctuations in moisture, temperature, pH and soil mineral nutrient status such as OC, P₂O₅, K₂O, Zn, Cu, Fe, Mn, etc. The obtained data shows that nitrogen-deficient soils had more AM fungal propagules. The soils with a high concentration of phosphorus and potassium had the least AM fungal spores. Depleted zinc, copper and manganese levels have also been positive for more fungal occurrence and distribution. The presence of high iron levels in the soil, however, encourages more AM spores and a percentage of root colonisation.

Keywords: Cotton; arbuscular mycorrhizal fungi; rhizosphere; root colonization.

Introduction

Since the Paleozoic era (Taylor 1990), Mycorrhizae has been linked to vascular plants. Arbuscular mycorrhizae (AM), the most prevalent association of plant fungi, comprises about 150 species belonging to the Zygomycotina Glomales (Morton & Bentivenga 1994; Myrold 2000; Perry *et al.*, 1989; Schenk 1981; Simon 1996). Arbuscular mycorrhizal (AM) symbiosis is an association between most terrestrial plants and a host plant class of fungi (Glomeromycota) (Schussler *et al.*, 2001). Root colonization with AM fungi has been shown to improve the productivity of many crop plants in dry soils (Al-Karaki and Al-Raddad 1997; Al-Karaki and Clark 1998; Faber *et al.*, 1990 and Sylvia *et al.*, 1993). Ultimately AM fungi improve soil structure by binding soil particles together. Cotton belongs to the family Malvaceae. It is native to the tropics and warm temperate regions. Commercial species of cotton plant are *G. hirsutum* (90% of world production), *G. barbadense* (8%), *G. arboreum* and *G. herbaceum* (together, 2%).

Nehl *et al.* (1996 and 1998) demonstrated that mycorrhizal colonization, root browning and soil properties associated with cotton growth disorder in Australia and slow mycorrhizal arbuscular colonization in field - grown cotton due to soil environmental conditions. Pattinson *et al.* (1997) studied the effect of Terrazole and Terraclor fungicides and Fenamiphos nematicide on *Glomus mosseae* root colonization and the growth of cotton seedlings. Zak *et al.* (1998) studied Arbuscular-mycorrhizal colonization dynamics of cotton (*Gossypium hirsutum* L.) growing under several production systems on the Southern High Plains of Texas. Mc Gee, *et al.* (1999) have reviewed the relationship between density of *Glomus mosseae* propagules and the initiation and spread of arbuscular mycorrhizas in cotton roots. Feng *et al.* (2002) have shown the uptake of nitrogen from indigenous soil pool by cotton plant inoculated with arbuscular mycorrhizal fungi. Hulugalle *et al.* (2004) studied soil properties, and cotton growth, yield and fiber quality in three cotton-based cropping systems. Patale and Shinde (2012b) studied effect of water stress on growth performance of Bt- cotton inoculated with AM Fungi. Patale and Shinde (2012a) described growth performance of Bt- cotton inoculated with AM Fungi on salinity stress. Patale and Shinde (2012c) studied influence of *Glomus* species and soil phosphorous on *Verticillium* wilt in Bt- cotton.

Cotton is cultivated in Maharashtra as a chief commercial crop, survey of literature do not show any report on association of AM Fungi with cotton in this area. The study of this association will definitely be useful to all

cotton growers to increase yield and to improve fertility of soil. The use of AM fungi will also reduce soil pollution due to application of Chemical fertilizers and fungicides in cotton fields as AM fungi are ecofriendly.

Materials and Methods

In the present study, cotton crop commonly grown, in and around Yeola viz., Saigaon (S1), Patoda (S2), Golhewadi (S3), Kotamgaon (S4), Bharam (S5), Kusr (S6), Gawandgaon (S7) and Mukhed (S8) were surveyed for arbuscular mycorrhizal (AM) fungal association.

Fresh samples of soil were taken to the laboratory. Fine roots were fixed in the formalin acetic acid alcohol solution (90:5:5) after washing thoroughly to determine the root infection. Soil samples were dried air in the shade for additional spores at laboratory temperature. Roots were autoclaved in KOH solution for 15 to 20 minutes (10 per cent), cleaned in distilled water and neutralized with HCl (2 per cent) and stained in lacto phenol in trypan blue (0.05 per cent). Phillips and Hayman's (1970) method measured the percentage of the root infection.

100 g of air - dried soil mixture with 1000 ml of tap water has been placed in a beaker. The mixture of the root soil has been strongly mixed with glass rod for 30 seconds. The remaining soil-root-hyphae-spore suspension was slowly poured through 240, 170, 150, 100 and 72 μm sieves after the soil particles and organic debris were settled. The extracts were washed off the sieves to what man filter paper. Spores, aggregates and sporocarps were picked by needle using trinocular research microscopes (Gerdemann and Nicolson, 1963). To each PVLG drop, 5 - 10 spores have been added. The mounting system was allowed to set for 3 - 5 minutes before a cover slip was added. The identification of isolated spores was carried out by Schenck and Perez (1990) using the key proposed.

The cotton rhizosphere soil was analyzed for the physical and chemical characteristics of soil samples such as pH, EC, OC, P, K, Zn, Cu, Fe and Mn performed using Jackson's (1973) procedure.

Results and Discussion

Ecology of AM fungi

The presence of AM fungi was screened for cotton plants belonging to the Malvaceae family. Data on fungal propagules isolated from these plants' soil samples collected from different locations are given in Table 1. Soil samples collected from eight different locations were found to be associated with AM fungus. All samples collected from the ground showed a percentage of root colonization, regardless of location (Table 1). The data indicates the number of AM fungal propagules accumulated in different crops from different locations ranging from 235 to 1580 spores per 100 g soil. Of all the 8 soil samples surveyed, Mukhed soils contain more AM propagules of 1580 per 100 g of soil; while Patoda soil samples showed less than 235 spores per 100 g of soil. In all, 41 AM fungal species representing three genera, namely *Acaulospora*, *Glomus* and *Scutellospora*, have been isolated (Table 2). *Glomus* representing twenty - two species, seven species of *Acaulospora* and twelve species of *Scutellospora*. Out of these twenty AM fungal species, the present soils are dominated by *Glomus* species followed by *Scutellospora*.

Physico-chemical factors of the Soil

Table 1 presents data on the physico-chemical characteristics of the rhizosphere soil samples of cotton collected from different locations in relation to the number of propagules. All the soils investigated in this study were of sandy loam type and were fertilized organically and chemically. The soils had a pH range of 8 to 8.95. More propagules were shown in the slightly alkaline pH soils.

Data from the soils of the rhizosphere showed that organic carbon-deficient soils had more AM fungal propagules. Soils with a low organic carbon content of 0.22% had 1580 AM fungal propagules per 100 g. While high organic carbon soil samples (1.23 percent) had a lower spore density of 240 per 100 g. These soil samples were studied for their phosphorus content and it was observed that soils containing 3 to 4 kg / ac phosphorus had a maximum number of AM fungal spores, while soils with a lower number of AM fungal spores had high phosphorus content, i.e. 12 to 16 kg per acre.

High potassium levels contain the smallest amount of AM spores compared to soils with low potassium levels. It was therefore evident that low potassium levels favored more AM fungal spore association. Similarly, soils with minimum levels of copper, zinc, iron and manganese were favorable for the occurrence and distribution of more AM funguses. However, high iron levels are favorable for more AM spore occurrence.

AM fungal root colonization

The percentage of AM cotton fungal root colonization from all selected sites is shown in table 1. It is clear from the data that the percentage of root colonization in the cotton samples collected at different locations varied. The percentage of root colonization in the Mukhed samples was found to be maximum (95%) and minimum (63.64%) in Patoda samples. Saigaon root samples were found to be heavily colonized with vesicles.

In this study, the population dynamics of AM fungi were determined by the collection of the remaining spores in and around Yeola from different soils of brinjal, tomato and cotton. Because of the widespread nature of AM fungi, these occurred in nearly all soil samples, but with a variation in the number and type of spores and sporocarps regardless of the location.

A total of 41 AM fungal species have been isolated from eight different soils of *Glomus*, *Acaulospora* and *Scutellospora* genera. Among the soil samples collected from Saigaon, there were more AM propagules followed by Mukhed soil samples, which could be due to low nutrient status and average humidity levels.

Glomus was predominantly among the 41 AM fungal species isolated from the rhizospheric soils of cotton crops, followed by *Scutellospora*. The results support the previous studies very strongly (Patale and Shinde 2010a, b; Patale 2016). Earlier reports also revealed the predominance of the above-mentioned AM fungal genera in plant cultivar rhizosphere soils (Gerdemann and Trappe, 1974; Hall and Abbott, 1984).

Effect of soil's physico-chemical factors

It has been observed that the distribution of spores, density and composition of AM fungi are influenced by environmental and physicochemical factors. The number of AM spores, the percentage of root colonization and the distribution are affected by the seasonal fluctuations in humidity, temperature, pH and soil nutrient status such as N, P, K, Zn, Fe, etc. Earlier studies in chili, sorghum, mungbean, tomato, brinjal and soybean by Bagyaraj and Sreeramulu (1982), Reddy *et al.*, (2006), Reddy *et al.*, (2007), Patale and Shinde (2010a, b) and Patale (2016) also showed similar trends.

In the present study, the population of mycorrhizal spores in rhizosphere soil and the percentage of mycorrhizal infection in plant roots fluctuated with changes in soil physico-chemical factors. The results coincide with the earlier results of Reddy *et al.*, (2007) in sorghum crops.

Light textured sandy loam soil with neutral to slightly alkaline pH, low humidity favored an extensive association of mycorrhizal roots (Sreeramulu and Bhagyaraj, 1986). The pH of the soil in our study ranged from 8 to 8.95, which was slightly alkaline and had more, AM fungal propagules.

In this study, soils with low organic carbon levels such as 0.17 percent of the soil contained 1278 AM fungal propagules per 100 gm of soil and 92 percent root colonization, but soil samples with a nitrogen content of 1.23 percent contained only 240 spores per 100 g of soil and 85.71 percent root colonization. It therefore clearly indicates that high nitrogen levels reduce the number of AM propagules and the percentage of root infection that is in line with the research published by Azcon-Aquilar and Barea (1982), Patale and Shinde (2010a, b) and Patale (2016). The deficiency of phosphorus in semi - arid soils is the rule of the association of AM plants (Williams *et al.*, 1974). Mosse (1981) observed that high levels of free soil phosphorus decreased mycorrhizal development, while Ojala *et al.*, (1983) recorded a decrease in plant mycorrhizal dependency with an increase in phosphorus available in the soil. Our study also showed the same trend that samples with a higher phosphorous content (16 kg / ac) had less AM propagules than the soil with a lower phosphorus content (3 to 4 kg / ac) with a maximum number of AM spores. AM fungi, particularly phosphorus (P), have been found to improve plant mineral nutrition. Smith and Read (1997) obtained the same results.

According to our experimental results of the soil samples, high potassium levels in the soil had less AM spores than those with low potassium levels. Our findings coincide with Barea *et al.*, (2002), and Suresh *et al.*, (2000)'s observations that low potassium levels favored more AM fungal associations than high potassium levels in the soil. Similar trends have been observed that low concentrations of Zn, copper and manganese and high iron levels favor AM fungal propaganda. These comments are consistent with the previous reports (Barea *et al.*, 2002; Brundrett, 2002; Garg and Chandel, 2010).

In the present study, the genus *Glomus* has been represented by more species than the other genera, which indicates its predominance. This study gives a clear understanding of the AM fungi ecology.

Because of the widespread nature of AM fungi, these occurred in nearly all soil samples, but with a variation in the number and type of spores and sporocarps regardless of the location. The *Glomus* genus was represented by more species than the other genera, which showed its predominance. This study gives a clear understanding of the AM fungi ecology.

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It was concluded that AM fungi were adapted to crop plants and the environment that manage indigenous fungal populations in agricultural practices so that the population of efficient indigenous fungi is increased.

Table 1: Number of AM fungal propagules in relation to physico-chemical factors in the rhizosphere soil samples of Cotton

Locality	S1	S2	S3	S4	S5	S6	S7	S8
No. of Spores /100 g	1278.00	235.00	424.00	240.00	442.00	786.00	1124.00	1580.00
% Root Infection	92.00	63.64	93.33	85.71	82.00	72.00	93.00	95.00
pH	8.10	8.95	8.80	8.85	8.00	8.30	8.30	8.00
EC	0.64	0.26	0.20	0.23	0.79	0.49	0.26	0.17
OC%	0.17	0.52	0.41	1.23	0.53	0.09	0.34	0.22
P2O5 Kg/ac	3.00	12.00	16.00	14.00	6.00	3.00	3.00	4.00
K2O Kg/ac	138.00	362.00	205.00	224.00	280.00	138.00	150.00	100.00
Zn ppm	0.31	0.29	0.76	0.67	0.47	0.21	0.42	0.26
Cu ppm	0.31	1.75	1.53	1.76	5.00	3.00	4.00	0.40
Fe ppm	10.90	7.26	9.41	11.28	5.60	0.70	12.30	11.90
Mn ppm	26.80	116.65	119.13	104.25	17.50	16.30	21.60	17.90

Saigaon (S1), Patoda (S2), Golhewadi (S3), Kotamgaon (S4), Bharam (S5), Kusur (S6), Gawandgaon (S7) and Mukhed (S8)

Table 2: Arbuscular mycorrhizal fungal spore distribution in the rhizosphere soils of Cotton collected from different locations.

Sr. No.	Name of Genus and species	S1	S2	S3	S4	S5	S6	S7	S8
1	<i>Acaulospora appendiculata</i>	+	-	+	+	-	-	-	+
2	<i>Acaulospora delicata</i>	+	-	+	-	-	-	-	+
3	<i>Acaulospora denticulata</i>	+	-	+	-	-	-	+	-
4	<i>Acaulospora foveata</i>	-	-	-	+	-	+	+	+
5	<i>Acaulospora laevis</i>	+	-	+	-	+	-	-	+
6	<i>Acaulospora nicolsonii</i>	-	+	-	-	+	-	+	-
7	<i>Acaulospora polonica</i>	+	+	+	-	-	+	-	-
8	<i>Glomus albidum</i>	+	+	+	-	-	+	+	+
9	<i>Glomus aggregatum</i>	-	-	-	+	-	-	+	+
10	<i>Glomus boreale</i>	-	-	-	-	+	-	+	+
11	<i>Glomus callosum</i>	-	-	-	+	-	+	-	+
12	<i>Glomus constrictum</i>	+	+	+	+	+	-	+	-
13	<i>Glomus convolutum</i>	-	+	-	-	-	-	+	-
14	<i>Glomus dimorphicum</i>	+	-	+	-	-	+	-	+
15	<i>Glomus etunicatum</i>	+	+	-	+	-	-	+	+
16	<i>Glomus fasciculatum</i>	+	+	+	+	-	-	+	+
17	<i>Glomus fecundisporum</i>	+	+	+	+	+	+	+	+
18	<i>Glomus fistulosum</i>	+	-	+	-	-	-	-	-
19	<i>Glomus formosanum</i>	+	-	+	-	-	-	-	+
20	<i>Glomus fragilistratum</i>	-	-	-	+	-	-	+	+
21	<i>Glomus globiferum</i>	+	+	+	+	-	-	-	+
22	<i>Glomus heterosporum</i>	-	-	-	+	+	-	+	-
23	<i>Glomus invermayanum</i>	-	+	-	-	-	-	+	+
24	<i>Glomus leptotichum</i>		+	-	-	+	+	+	-
25	<i>Glomus monosporum</i>	+	-	+	+	-	-	-	-
26	<i>Glomus mosseae</i>	-	+	-	+	+	-	+	-
27	<i>Glomus pansihalos</i>	+	-	+	+	+	+	+	+
28	<i>Glomus tenebrosum</i>	+	+	+	+	+	-	+	-
29	<i>Glomus trimurales</i>	+	+	+	-	+	-	+	-

30	<i>Scutellospora arenicola</i>	-	-	+	+	-	+	-	+
31	<i>Scutellospora auriglobosa</i>	-	-	-	-	+	-	+	-
32	<i>Scutellospora calospora</i>	+	+	+	+	+	+	+	+
33	<i>Scutellospora dipapillosa</i>	+	-	-	-	+	-	-	+
34	<i>Scutellospora dipurpurascens</i>	+	+	+	-	-	-	-	+
35	<i>Scutellospora fulgida</i>	+	+	+	-	-	+	-	+
36	<i>Scutellospora gregaria</i>	-	-	-	-	-	-	+	-
37	<i>Scutellospora heterogama</i>	+	+	+	+	-	-	-	+
38	<i>Scutellospora minuta</i>	+	+	+	+	+	+	+	+
39	<i>Scuellospora pellucida</i>	+	+	+	+	+	+	+	+
40	<i>Scutellospora persica</i>	+	-	+	+	-	-	-	-
41	<i>Scuellospora weresubiae</i>	+	-	+	-	+	-	-	+

+ Present, - Absent, Saigaon (S1), Patoda (S2), Golhewadi (S3), Kotamgaon (S4), Bharam (S5), Kusr (S6), Gawandgaon (S7) and Mukhed (S8)

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Nostocales From Godavari River at Nashik, (M.S.), India

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ABSTRACT: *Nostocales is one of the orders of Blue Green Algae. The attempt was made to study the diversity of Nostocales of Godavari river. The present study was carried out for two consecutive years (2005-2007). Five sampling stations at starting stretch of Godavari river were selected for the collection of algal forms. Near about 97 km area was covered for the study from Nashik to Nandur-Madhmeshwar dam. Monthly collection of algal forms were carried out and analyzed for its qualitative study. At many sampling stations domestic wastes and municipal sewage is being dumped daily in addition to agricultural run-off, which causes the enrichment of nutrients in river water causing the luxurious growth of algae.*

During present investigations, in all, 9 genera and 17 species belonging to four families viz. Oscillatoriaceae, Nostocaceae, Scytonemataceae and Rivulariaceae of order Nostocales were encountered from all 5 sampling stations of Godavari river. It was also observed that Oscillatoriacean members were found to be the dominant group. During present studies, tremendous variations in algal diversity were noticed during summer and winter as compared to monsoon season. Change in water flow, transparency and temperature affected the growth and abundance of Nostoclean algal forms in river water.

Keywords: *Nostocales, Blue green algae, Godavari river.*

Introduction

Algae are playing very important role in human life. They are primary producers of aquatic ecosystem. Nostocales is one of the groups of Blue Green Algae. Nostocales from Godavari river was studied for two consecutive years (2005-2007). Godavari river is one of the important water resources in South India and its water is used for various purposes. It originates at Trymbakeshwar in Western Ghats just 30 km upstream of Nashik city. Flowing through Maharashtra, Andhra Pradesh, it joins the Bay of Bengal. River receives huge quantity of domestic waste and municipal sewage of Nashik city causing organic pollution. It resulted the growth and population of number of phytoplankton. Many workers has studied the algae in relation to water pollution and used algae as pollution indicators (Rana and Palria, 1988). However, algal studies at starting stretch of Godavari river remained untouched. Therefore, it is intended to assess the river water with special reference to Nostoclean flora.

Materials and Methods

Monthly collection of water samples was done from five different sampling stations. The plastic containers of two liter sized were used for the collection of water samples, while for estimation of dissolved oxygen and biological oxygen demand, samples were collected in 250 ml sized BOD bottles and fixed at sampling sites. For algal studies, samples were collected separately by using plankton net 25 meshes bolting silk and preserved in 4% formaldehyde and Lugol's solution. Some algal forms were collected by hand with the forceps. Parameters like pH, light penetration, temperature were detected at sampling sites, while remaining parameters were analyzed after reaching the laboratory. For physico-chemical parameters standard methods described in APHA (1985) and Trivedi and Goel (1986) were used, while Nostoclean forms were identified by using relevant literature like Prescott (1951), Deshikachary (1969) etc.

Results and Discussion

Nostocales

This class was represented by 9 genera and 17 species (Table.1). The commonly recorded genera were *Spirulina*, *Oscillatoria*, *Lyngbya*, *Arthrospira*, *Nostoc*, *Anabaena*, *Aulosira*, *Tolypothrix* and *Rivularia*. During summer season more number was recorded and might be due to availability of more free CO₂, sunlight, phosphate and nitrate concentration. Our results correlate with Moore (1977). The common pollution tolerant genera recorded during present studies were *Lyngbya*, *Spirulina*, *Anabaena*, *Oscillatoria*, etc. Lowest number of algal taxa of BGA were recorded during monsoon months particularly in months of July, August and September. Lowest number might be attributed to high water velocity, turbidity and dilution of nutrients due to rain. Raised

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values in temperature, low water velocity and more nutrition with bright sunlight increased the algal population during summer. Zafar (1964) was of opinion that high concentration of DO was favourable for the growth of blue green algae, while according to Pawar *et al.* (2006), high organic matter, high temperature and low DO favours the growth of blue green algae.

Lakshminarayana (1965.a), was of opinion that abundant growth of blue green algae attributed due to high pH, dissolved organic matter, more nitrates and phosphates. Prowse and Tailling (1958) reported that the growth of BGA associated with high pH, DO, transparency and phosphates. According to Venkateswarlu (1969), Cyanophyceae occurred whenever the oxidisable organic matter was high and DO was low together with low pH. Rao (1953) obtained the same results. Shukla and Shukla (1988) recorded maximum number of blue greens during the month of September and minimum during the month of March from Kanpur. According to them rainy season is favourable for Cyanophyceae members followed by winter and summer. Our results correlate with Parvateesam and Mishra (1993) who observed Cyanophycean peak during summer and low during winter.

Table 1: Nostocalean algae encountered during investigation period.

Sr. No.	Name of Algae
Family: Oscillatoriaceae	
1	<i>Spirulina laxissima</i> West G.S.
2	<i>Spirulina princeps</i> West W and G.S.
3	<i>Spirulina major</i> Kutz.
4	<i>Oscillatoria chalybea</i> (Martens) Gom
5	<i>Oscillatoria formosa</i> Borb
6	<i>Oscillatoria anguina</i> (Bory) Gomont
7	<i>Oscillatoria limosa</i> Ag.
8	<i>Lyngbya contoria</i> Lemm.
9	<i>Lyngbya birgei</i> G.M. Smith
10	<i>Arthrospira khanne</i> Drougeland and Strickland
11	<i>Arthrospira massartii</i> Kuffarth
Family: Nostocaceae	
12	<i>Nostoc commune</i> Vaucher ex Born. Et Flah
13	<i>Anabaena spiroides</i> Klebs
14	<i>Anabaena orientalis</i> Dixit
Family: Scytonemataceae	
15	<i>Aulosira bombayensis</i> Gonzalves
16	<i>Tolypothrix distorta</i> Kutz.
Family: Rivulariaceae	
17	<i>Rivularia aquatica</i> De Wilde

Taxonomical account of Nostocales:

Family – Oscillatoriaceae

- *Spirulina laxissima* West, G. S.
Desikachary, 1959: 196.
Prescott, 1951: 480, Pl. 107, Fig. 17
Trichomes 0.7-0.8 μ broad, blue green, spirals very loose but regular, end cells rounded, obtuse.
- *Spirulina princeps* W. et. G. S. West
Desikachary, 1959: 197, Pl. 36, Fig. 7
Trichomes 4.5-5 μ broad, short, blue green, regularly spirally coiled, spirals 11-12 μ broad and 9.5-11 μ distant.
- *Spirulina major* Kuetz.
Desikachary, 1959: 196, Pl. 36, Fig. 13
Trichomes 1.2 – 1.7 μ broad, regularly coiled, blue-green, spirals 2.5-4 μ broad and 2.7-5 μ distant.
- *Oscillatoria chalybea* (Martens.) Gom.
Desikachary, 1959: 218, Pl. 38, Fig. 3

Thallus dark blue green, trichomes straight or irregularly spirally coiled, slightly constricted at the cross walls, attenuated at the apex, 8-13 μ broad, blue green, 3.5-7 μ long. Septa not granulated, end cell obtuse, not capitate.

- *Oscillatoria formosa* Borb.
Desikachary, 1959: 232, Pl. 40, Fig. 15
Thallus blue green, trichome straight, slightly constricted at the cross walls, 4-5 μ broad, bright blue green, attenuated at the ends and bent, cells nearly quadrate, end cells nearly obtuse.
- *Oscillatoria anguina* (Bory.) Gomont.
Desikachary, 1959: 210, Pl. 38, Fig. 11
Thallus dark blue green, trichome straight, at the ends spirally coiled and distinctly attenuated, not constricted at the cross wall, 6-7 μ broad, cross wall sometime granulated; cells 1/3 - 1/6 as long as broad; 1.5-2.5 μ long, end cells capitate with slightly thickened membrane.
- *Oscillatoria limosa* Ag.
Desikachary, 1959: 206, Pl. 42, Fig. 11
Thallus dark blue green to brown, trichome straight, constricted; 11-18 broad, cells 3 μ long. Cross-walls frequently granulated, end cells flatly rounded with slightly thickened membrane
- *Lynghya contorta* Lemm.
Desikachary, 1959: 290, Pl. 48, Fig. 5
Filament single, free floating, regularly spirally coiled, with a delicate nearly circular coils, 1-1.2 μ broad, sheath narrow, colourless; cells 1-2 μ broad, 3-4 μ long, not constricted at the cross wall, granulated with a single granule, end cell rounded, not attenuated.
- *Lynghya birgei*. Smith, G. M
Desikachary, 1959: 296, Pl. 50, Fig. 7, 8
Filaments straight, seldom coiled, free floating, 20-21 μ broad, sheath firm, colourless, mostly unlamellated, 0.5-3 μ thick, trichome not constricted at the cross walls, 18-20 μ broad, ends rounded, not attenuated, not capitate, cells shorter than broad, 2-2.5 μ broad.
- *Arthrospira khannae* Drouet et Strickland
Desikachary, 1959: 189, Pl. 35, Fig. 12.
Trichomes planktonic blue green, forming loose spirals, spirals about 18 μ broad, not constricted at the cross walls, ends slightly attenuated and sub capitate, 3-4 μ broad, spirals about 20 μ distinct, cells short, 1/3 as long as broad, cross walls granulated, cells with large vacuole.
- *Arthrospira massartii* Kuffarth
Desikachary, 1959:191, Pl. 35, Fig. 10
Trichomes loosely coiled, spirals 28 μ broad, distance between spirals 60-90 μ , cells 5-6 μ broad, 2-4 μ long, end cells rounded, conical, cross walls not granulated.

Family - Nostocaceae

- *Nostoc commune* Vaucher ex. Born. et. Flah.
Desikachary, 1959: 387, Pl. 68, Fig. 3
Thallus gelatinous, firm, blue green, sheath distinct, trichomes 5-6 μ broad, cells barrel shaped, heterocyst 7 μ broad.
- *Anabaena spiroides* Klebs.
Desikachary, 1959: 395, Pl. 71, Fig. 9
Trichome single, free floating, regularly spirally coiled, covered with thick mucilaginous sheath, spirals 45-50 μ broad and 40-45 μ distant, cells spherical, 6.5-7 μ broad, heterocyst sub-spherical, 7 μ broad, spores at first spherical later elongate.
- *Anabaena orientalis* Dixit
Desikachary, 1959: 405, Pl. 77, Fig. 6
Trichome single, straight or slightly curved; 2.5 μ broad, cells quadrate or cylindrical, rarely barrel shaped, twice as long as broad, 3.8 μ long, end cells conical, heterocyst single, intercalary, with rounded end walls.
- *Aulosira bombayensis* Gonzalves
Desikachary, 1959: 426, Pl. 82, Fig. 1-2
Filaments 4-5 μ broad, sheath firm, hyaline, unlamellated, trichomes constricted at the joints, 2.5-3 μ broad, cells 2 or 3 times as long as broad, blue green, heterocysts intercalary, oblong with rounded ends.

Family - Scytonemataceae

- *Tolypothrix distorta* Kuetzing

Desikachary, 1959, 495, Pl.102, Fig. 1

Thallus cushion-like, blue green to brownish, filaments richly false branched, up to three cm long, 10-12 μ broad, false branches deeply erect, sheath thin, close to the trichome, trichomes 9-10 μ broad, cells as long as broad, heterocyst single, spherical or cylindrical.

Family – Rivulariaceae

- *Rivularia aquatica* De Wilde

Desikachary, 1959: 552

Thallus spherical up to 2 mm diameter, filaments slightly pressed together, sheath thin, colourless, unlamellated, regularly attenuated at the ends. Trichomes 7-8 μ broad ending a long thin hair, cells at the base longer than broad.

Conclusions

During study period it was observed that, in monsoon season the water was flowing speedily, whereas during winter river flow was slowed down and onset of summer it discontinued. It was also observed that flow of water affected the growth and Nostocalean forms. During rainy season particularly in the months of June, July, August and September, water was flowing fastly and so many algae washed out due to which it showed record of very limited number of algae during this period. During winter season (October to January), when water flow was reduced, there was slight increase in algal population and during summer (February to May) peak position of algal population was observed. Finally with commencement of monsoon the river water flows swiftly and there was decline in algal population at all stations as most of algae again washed out in flowing water of flood. Thus, because of transformation of one habitat to other, there was an overall change of biota.

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Morphology in Immature Stages of *Chironomus Tepperi*

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ABSTRACT: Fourth instar larva and pupa of *Chironomus tepperi* was described. Larva is a dark red in colour. The ventral tubules are straight and consist of one pair. Basal segment of antena relatively long and narrow. The pupa reddish in colour. Thorax consists of one pair of setae. It consists of 4 spines. Cephalothorax is swollen and dorsoventrally flattened abdomen. Pupa is exuviae type.

Keywords: *Chironomus tepperi*, larva, pupa, exuviae

Introduction

Chironomus tepperi was first of all described by Skuse. Jon Martin and D.L. Porter (1977) studied morphology of *Chironomus tepperi* from Australia. Suitability of morphological parameters of *Chironomus tepperi* followed by Dyars law investigated by Jan Frouz *et al.*, (2002) from lake country. Martin (2013) studied the morphology and cytology of oriental *Chironomus* species from Australia.

Materials and Methods

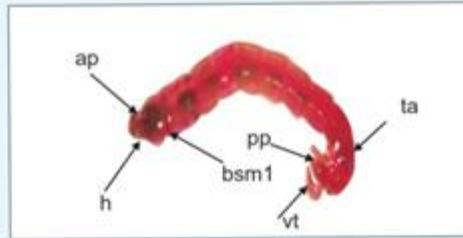
Larvae used in this study were mounted in Canada balsam. Sometime other mounting media e-g Euparal, Hoyers, CMC 10, ACS mountant were used, but the permanency of slides made with Canada balsam is well established (Epler, 2001; Donald and Mary, 1983). Larvae were kept in 10% KOH for 8-12 hours. After clearing the larva were passed in distilled water (5 min) were mounted directly into Canada balsam, methodology is suggested by Epler (2001), Papp and Darvas (2000) and Donald and Mary (1983). Photograph of specimen taken through Olympus Camera in Magnus MLXTr microscope at 10X, 40X, 100X Magnification (According to necessity). All measurements analyzed through Magnus Pro software and all are in millimeter (mm), whenever micron necessary mentioned at the text. Camera Lucida figures were drawn for morphological study of larvae of the all the species of genus *Chironomus*. The pupae were preserved in 70-80% ethanol. The sterilized plastic vials used for storage of pupa. The preservation was done as per standard method of *Chironomus* suggested by Epler, (2001), Seather, (2000), Donald and Marry (1985). Identification of larva with the help of standard manual suggested by Epler, J.H. (2001). Identification of pupa with the help of standard manual suggested by Saether *et al.*, (2000) and keys for pupa by Richard E. Jacobsen (2001). Identification of adult Donald and Marry (1973)

Results and Discussion

Larva (n=17)

Larva is a dark red in colour. The length measures up to 16 mm. The lateral tubules are poorly developed. The ventral tubules are straight and consist of one pair. The head capsule is highly sclerotized bearing 1 segmented antena. Basal segment of antena relatively long and narrow. The length measures upto 350 um. Premandible apically bifid with one inner tooth. Mandibles with two dark inner teeth. The length 0.25 um. Mentum trifold with 12 lateral teeth. The length measures upto 0.43 um. Pecten epipharyngies with 12 teeth interspersed among normal teeth. Anteromedial margin of ventromental plate is smooth with fine teeth.

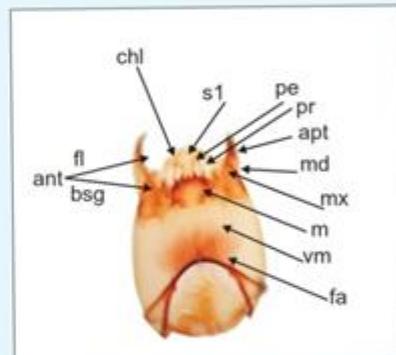
Plate-5



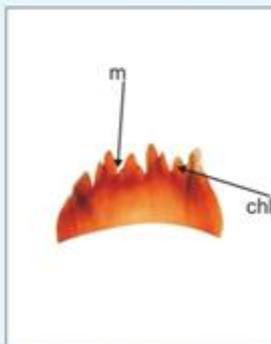
Larva



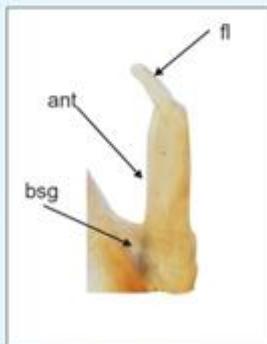
Caudal tubule



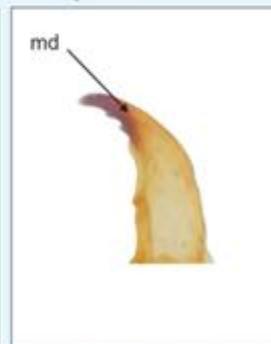
Head capsule



Mentum



Antenna

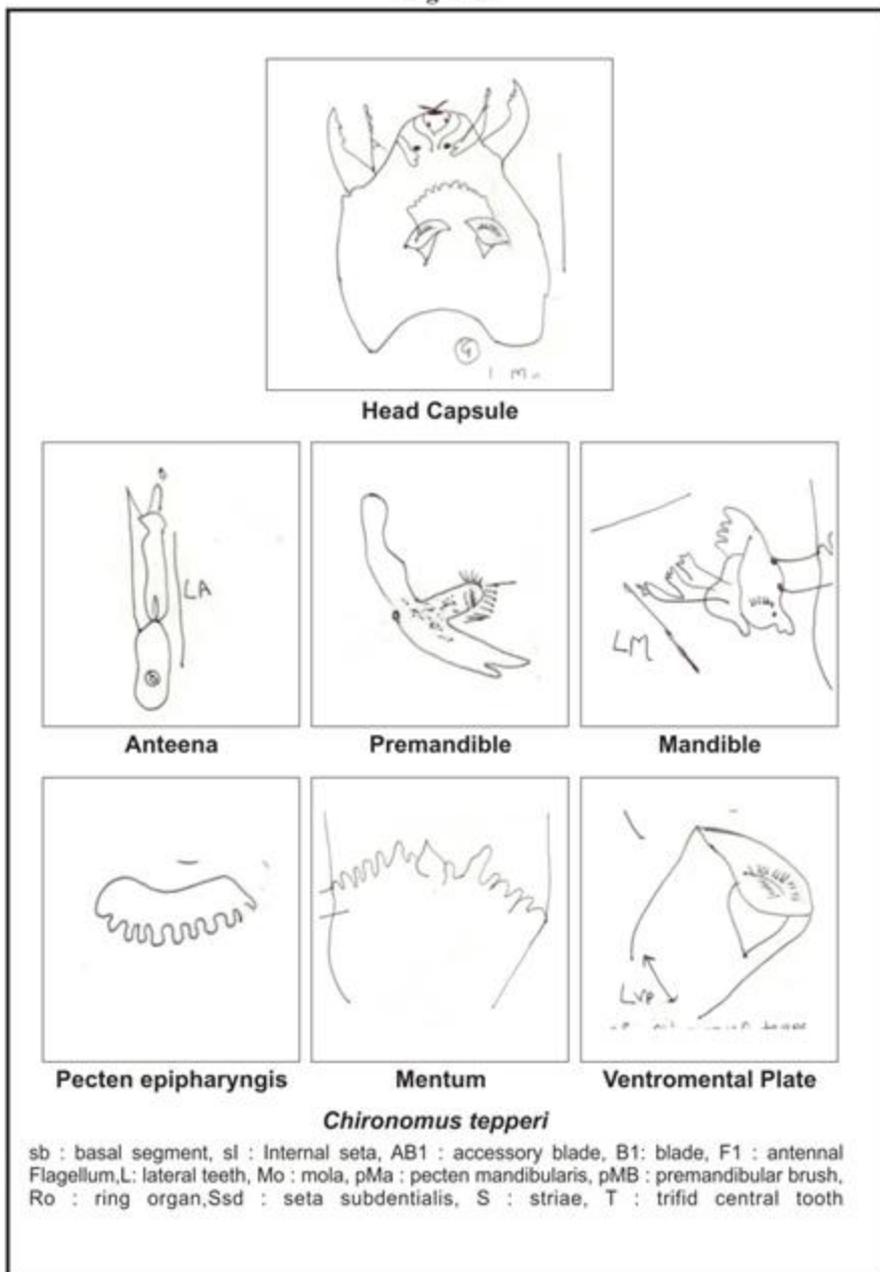


Mandible

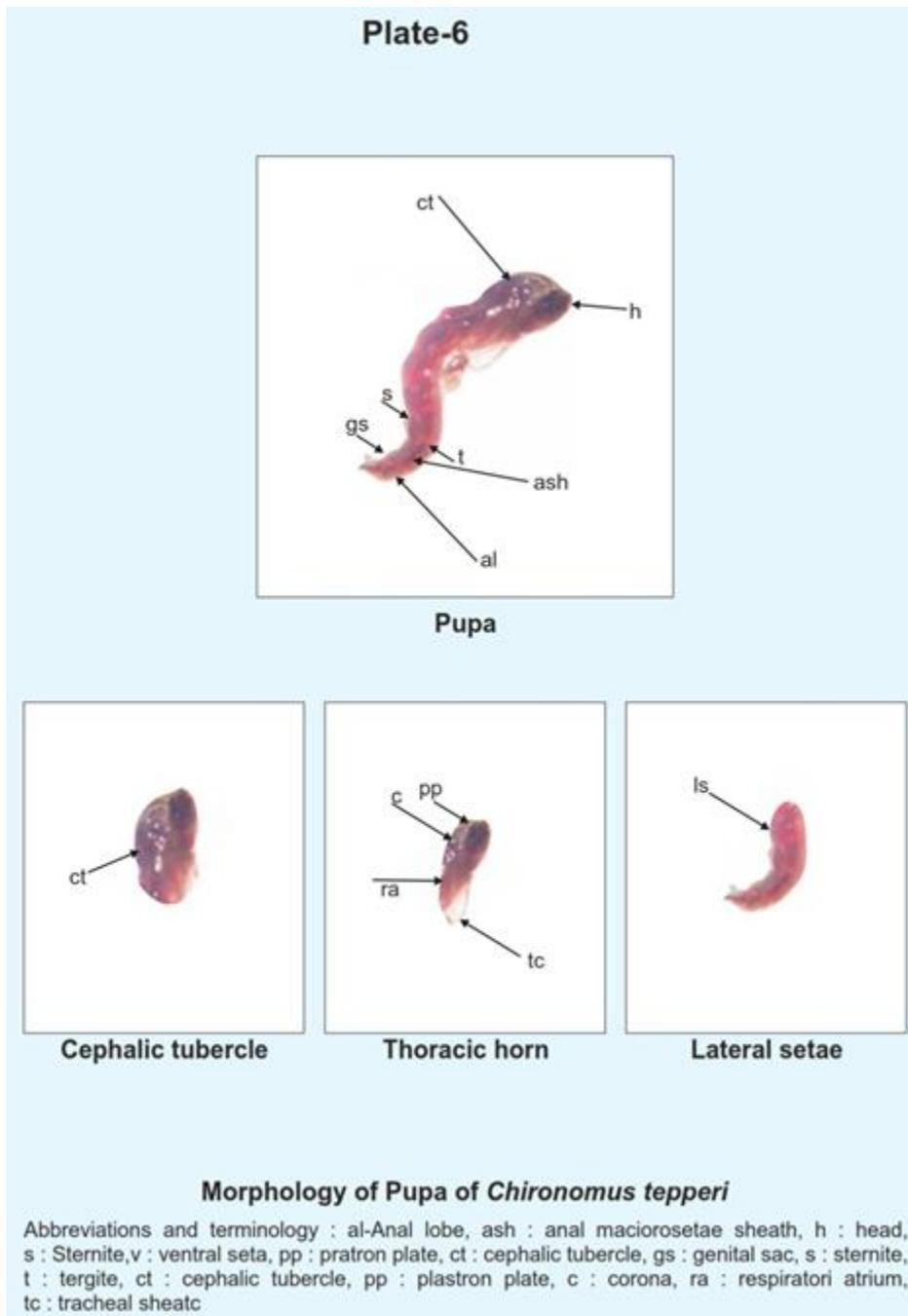
Morphology of Larva of *Chironomus tepperi*

Morphological features of larva bsm1 : body segment, h: head, ap: anterior parapods, vt : ventral tubule, pp: posterior parapods, ta: anal tubules, ant : antenna, apt : apical tooth, bsg : basal segment, fl : flagellum, pr : premandible, mx : maxilla, s1 : seta 1, chl : chaetula lateral, fa : frontal apotome, pe : pecten epipharyngis, vm : ventro mental plate.

Figure-1



Pupa (n=2)



The pupa is reddish in colour. The body length 6 mm. Thorax consists of one pair of setae. It consists of 4 spines. Cephalothorax is swollen and dorsoventrally flattened abdomen. Pupa is exuviae type. The caudolateral spur are present on 7th abdominal segment. Tergite VI consists of a pair of small patches. Segment I-IV with 0, 1, 4, 4 setae. The anal lobes with 2 stout dorsal seta.

Remark

Martin and D.L. Porter (1977) studied laboratory biology of *Chironomus tepperi* from Australia. They studied characters like larvae halophilus type i.e. ventral tubule reduced often only the posterior pair developed, head

capsule pale yellow in colour. Some darkening on the gula and frontoclypeus in region. Basal segment of antenna 3 to 3.5 times long as wide, thorax dull grey, pits of dorsocentral setae very distinct, inferior volsella of male very swollen. Larva red in colour, mandible with three dark inner teeth, ventral tubules was straight and consists of 1 pair, pectin epipharyngis 12 teeth, pupa exuviae type, caudolateral spur present on 7th abdominal segment.

Conclusion

The larva and pupal characteristics demonstrate the identification of present specimen as *Chironomus tepperi*.

Acknowledgement

Authors are thankful to Professor and Head Department Zoology, Dr. Babasaheb Ambedkar Marathwada University Aurangabad for providing necessary laboratory facilities in completion of the present research work.

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Ethno Botanical Importance of *Punica granatum* L in Islam: A Review Article

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ABSTRACT: The main aim of this study is to document the knowledge ethno botanical importance of fruits in the light of Islam. In Islam the 10 fruit plant species belonging to 10 genera of 9 families widely used i.e *Citrullus lanatus* (Thunb.) Mats. & Nakai, *Cucumis sativus* L., *Cydonia oblonga* Mill. *Ficus carica* L., *Olea europea* L., *Phoenix dactylifera* L., *Punica granatum* L., *Salvadora persica* L., *Vitis vinifera* L. and *Zizyphus mauritiana* Lam. mentioned Holy Quran-and hadith. *Punica granatum* pomegranate is deciduous shrub which have many medicinal properties. In Malegaon region agriculture sector cover by Pomegranate In Nashik distric is Identified for Grapes, Onion and now for Pomegranate. This fruit acts as Antioxidant fruit also have many medicinal properties. This article reviews the main reports of the pharmacological, traditional value and folk remedies of this plant in Scientific Studies.

Keywords: Ethno-botany, *Punica granatum* L, Biochemistry, Pharmacology

Introduction

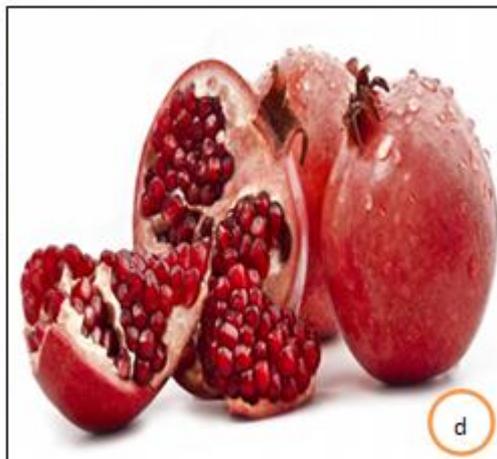
Indian Ayurveda along with the Jamu, Siddha, Tibetan, traditional Chinese and Unani systems of medicine are an important source of health and livelihood for millions of Asian people. Ayurvedic medicine is widely practiced especially in Bangladesh, India, Nepal, Pakistan and Sri Lanka. Unani medicine draws from the traditional systems of medicine of China, Egypt, India, Iraq, Persia and the Syrian Arab Republic and is also known as Arabic medicine (WHO, 2001). Plants are an essential component of the universe. Human beings have used plants as medicine from the very beginning of time. After various observations and experimentations medicinal plants were identified as a source of important medicine, therefore, treatment through these medicinal plants, began in the early stages of human civilization (Malik 2001). Approximately 70% of the homeopathic drugs are prepared from the fresh plants. Similarly more than 90% of tibbi medicines are prepared from herbs. Pakistan is very rich in plants of medicinal value (Nasreen, U. and M.A. Khan 2001). Fruits are one of the oldest forms of food known to man. There are many references to fruits in ancient literature. Vedas state that the fruits form the base of the foods of Gods. According to Quran, the fruits like grape, date, fig, olive and pomegranate are gifts and heavenly fruits of God. The people in ancient time regarded fruits to be endowed with magic or divine properties. The pomegranate (*Punica granatum* L.) is one of the oldest known edible fruits (Cam et al., 2009). It is native to the area extending from present day Iran to the Himalayas in northern India and has been cultivated since ancient times throughout the Mediterranean region of Asia, Africa, and parts of Europe (Fawole and Opara, 2013). The edible part of the pomegranate is its arils, which are usually consumed fresh and in processed forms such as fresh juice, canned beverages, jelly, jam, and paste. It is also used for flavoring and coloring drinks (Zaouay et al., 2012)

Description

An attractive shrub or small tree, to 20 or 30 ft (6 or 10 m) high, the pomegranate is much-branched, more or less spiny, and extremely long-lived. The leaves are evergreen or deciduous, opposite or in whorls of 5 or 6, short-stemmed, oblong-lanceolate, 3/8 to 4 in (1-10 cm) long, leathery. Showy flowers are borne on the branch tips singly or as many as 5 in a cluster. They are 1 1/4 in (3 cm) wide and characterized by the thick, tubular, red calyx having 5 to 8 fleshy, pointed sepals forming a vase from which emerge the 3 to 7, red, white or variegated petals enclosing the numerous stamens. Nearly round, but crowned at the base by the prominent calyx, the fruit, 2 1/2 to 5 in (6.25-12.5 cm) wide, has a tough, leathery skin or rind, basically yellow more or less overlaid with light or deep pink or rich red. The interior is separated by membranous walls and white spongy tissue (rag) into compartments packed with transparent sacs filled with tart, flavorful, fleshy, juicy, red, pink or whitish pulp (technically the aril). In each sac, there is one white or red, angular, soft or hard seed. The seeds represent about 52% of the weight of the whole fruit.

Classification

Kingdom: Plantae
Division: Angiosperm
Class: Dicot
Subclass:- Rosidae
Order: Myrtales
Family: Punicaceae
Genus: *Punica*
Species: *granatum*



a. Plant Image b. Flowering c. Fruits d. Edible seeds

Medicinal Uses

It has great nutritional values and numerous health benefits. Pomegranates used treatment for Cancer, Osteoarthritis and Other Diseases. The pomegranate has been used in natural and holistic medicine to treat sore throats, coughs, urinary infections, digestive disorders, skin disorders, arthritis, and to expel tapeworms. However, modern research suggests that pomegranates might be useful in treating such serious conditions as prostate cancer, skin cancer, osteoarthritis, and diabetes. Studies also show that pomegranate seeds might help rid the digestive system of fats. Clinical research shows that pomegranates, when part of a healthy diet, might help prevent heart disease, heart attacks and strokes. This is because pomegranates have the potential to thin the blood, increase blood flow to the heart, reduce blood pressure, reduce plaque in the arteries, and reduce bad cholesterol while increasing good cholesterol. . A decoction of seed is used to treat syphilis. Juice used to treat jaundice and diarrhoea. Juice of flower is used to treat nose bleeds. The fruit pulp and the seed are stomachic. Dried, pulverized flower buds are employed as a remedy for bronchitis.(Debjit Bhowmik and B.S. Durai etal)

Pomegranate peel attracts attention due to its apparent wound healing properties (Chidambara *et al.*, 2004), immune modulatory activity (Gracious *et al.*, 2001), and antibacterial activity (Navarro *et al.*, 1996) antiatherosclerotic and antioxidative capacities (Tzulker *et al.*, 2007). Antioxidative activity has often been associated with a decreased risk of various diseases (Whitley *et al.*, 2003).

Nutritional value and Biochemical Composition

The chemical composition of the fruits differs depending on the cultivar, growing region, climate, maturity, cultivation practice, and storage conditions (Poyrazoglu and others 2002; Barzegar and others 2004; Fadavi and others 2005). Significant variations in organic acids, phenolic compounds, sugars, water-soluble vitamins, and minerals of pomegranates have been reported over the years by various researchers (Aviram and others 2000; Davidson and others 2009; Tezcan and others 2009). About 50% of the total fruit weight corresponds to the peel, which is an important source of bioactive compounds such as phenolics, flavonoids, ellagitannins (ETs), and proanthocyanidin compounds (Li and others 2006), minerals, mainly potassium, nitrogen, calcium, phosphorus, magnesium, and sodium (Mirdehghan and Rahemi 2007), and complex polysaccharides (Jahfar and others 2003). The edible part of the pomegranate fruit (50%) consists of 40% arils and 10% seeds. Arils contain 85% water, 10% total sugars, mainly fructose and glucose, and 1.5% pectin, organic acid such as ascorbic acid, citric acid, and malic acid, and bioactive compounds such as phenolics and flavonoids, principally anthocyanins (Aviram and others 2000; Tezcan and others 2009). The seeds are a rich source of total lipids; pomegranate seed oil comprises 12% to 20% of total seed weight. The oil is characterized by a high content of polyunsaturated (n-3) fatty acids such as linolenic, linoleic, and other lipids such as punicic acid, oleic acid, stearic acid, and palmitic acid (Fadavi and others 2006). The seeds also contain protein, crude fibers, vitamins, minerals, pectin, sugars, polyphenols, isoflavones (mainly genistein), the phytoestrogen coumestrol, and the sex steroid, estrone (El-Nemr and others 2006; Syed and others 2007).

Conclusions

Punica granatum (Pomegranate-rumman) is a good food and a medicine of great value. It is a tonic for heart patients, highly efficacious in the inflammation of the stomach and effective to check heart pain. The juice of the fruit is an excellent cooling beverage and allays thirst. It acts as a good medicine for both diarrhea and dysentery. For many ailments such as colitis, anemia, jaundice, high blood pressure, piles and arthritis, its juice is an effective medicine. When given with honey, it reduces biliousness. Pomegranate fruit is also prescribed in many disorders under the Homeopathic medicine system. All parts of the plant contain unusual alkaloids, known as 'pelletierines', which paralyse tapeworms so that they are easily expelled from the body by using a laxative. The fruit is a mild astringent and refrigerant in some fevers and especially in biliousness. It is also cardiac and stomachic. The dried rind of the fruit is used in the treatment of amoebic dysentery, diarrhea etc. It is a specific remedy for tapeworm infestation (Plants for a future, 2008). Nowadays, it is widely accepted that the beneficial health effects of fruits and vegetables in the prevention of disease are due to the bioactive compounds they contain (Galaverna and others 2008). The presence of significant amounts of bioactive compounds, such as phenolic acids, flavonoids, and tannins in pomegranate fruits assures them considerable nutritional value (Aviram and others 2000).

The Consumption of pomegranates has tremendously due to high broad spectrum of health benefits. Pomegranates are used as juice, peels and seeds. The rich bioactive profile of pomegranate makes it a highly nutritious and desirable fruit crop so it has great value in Islam.

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Induced Mutations in Groundnut (*Arachis hypogaea* L.)

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ABSTRACT: An investigation entitled 'Induced Mutation in Groundnut (*Arachis hypogaea* L.)' was conducted during the kharif (rainy season) in the experimental field. The germplasm of locally adopted cultivar JL-24 (Phule Pragati) was procured from M.P.K.V.Rahuri, Dist- Ahmednagar (MS), and India. Attempts were made to induce genetic variability in yield contributing traits in groundnut employing gamma radiation to obtain genetic variations in M₂ generation. The uniform and healthy 200 dry seeds were irradiated with five different doses of Gamma rays (100, 150, 200, 250, 300Gy) at Department of Biophysics, Government Institute of Science, Aurangabad (MS), India. Both treated as well as untreated seeds were sown in the experimental field. The parameters, % seed germination, pollen sterility, survival of plants, seedling injury were studied in M₁ generation. M₂ progeny was raised from the M₁ seeds and was screened for different chlorophyll mutations. A variation in frequency of different chlorophyll mutations was observed in different doses. Three different types of chlorophyll mutants, namely, xantha, albino, striata and chlorina, were observed.

Keywords: Induced, mutation, Groundnut

Introduction

The number of desirable varieties have been developed through mutation breeding in field crops and horticulture crops. But the application and success of mutation breeding in improvement of grain legume crops is relatively limited except soybean and groundnut. Chlorophyll mutations offer one of the most reliable indices for the assessment of genetic effects of mutagenic treatments. Genotypic differences in response to induction of chlorophyll mutations can be observed as frequency of induced chlorophyll mutations in M₂ generation. Gamma Rays induce high frequencies of chlorophyll and morphological mutations with negligible frequency of chromosomal aberrations (Swami Nathan 1957). So also Von Wettstein (1980) in barley and Haque and Godward (1986) in Lectuceae reported involvement of considerable number of genes at different stages of plastid development as revealed from the plastid ultra structure of leaves. Hence, the probability of occurrence of such category of mutation is obvious in all mutagen treatments. Chlorophyll mutations are one among the few dependable parameters for evaluation of genetic effects of various mutagens and are widely used as genetic markers in basic and applied research. The present study reports the induction of different chlorophyll mutants in M₂ generation in groundnut (peanut) variety JL-24.

Materials and Methods

The germplasm of cultivar JL-24(Phule-Pragati) of Groundnut was procured from.Rahuri krishi vidyapeeth, District-A.Nagar and employed as experimental material during the present study. Seeds of this variety were irradiated with 100, 150, 200,250 and 300 Gy doses of gamma radiation at ⁶⁰Co gamma cell, Government Institute of Science, Aurangabad. The 200 seeds were presoaked in the distilled water for 14 hours at room temperature and Irradiated seeds along with control (parental variety), were grown in randomized block design and maintaining a spacing of 25×50 cm to study the M₁ generation during kharif (rainy season). The seeds obtained from M1 population were used to raise M2 generation in the next year.

The M₂ population was screened for frequency and spectrum of chlorophyll mutations. Lethal chlorophyll mutations were scored within 10 to 25 days of sowing whereas viable chlorophyll mutations were scored throughout the life period of plants. The spectrum of chlorophyll mutations was studied and the mutants were classified as per the scheme of Gustafson (1940) with modifications.

- Albino-white, lethal, no chlorophyll or carotenoids are formed.
- Xantha yellow to yellowish white, lethal, carotenoids present but chlorophyll absent.
- Chlorina – uniform green colour with white tips, viable..
- Striata – longitudinal strips of different colours,

Results and Discussion

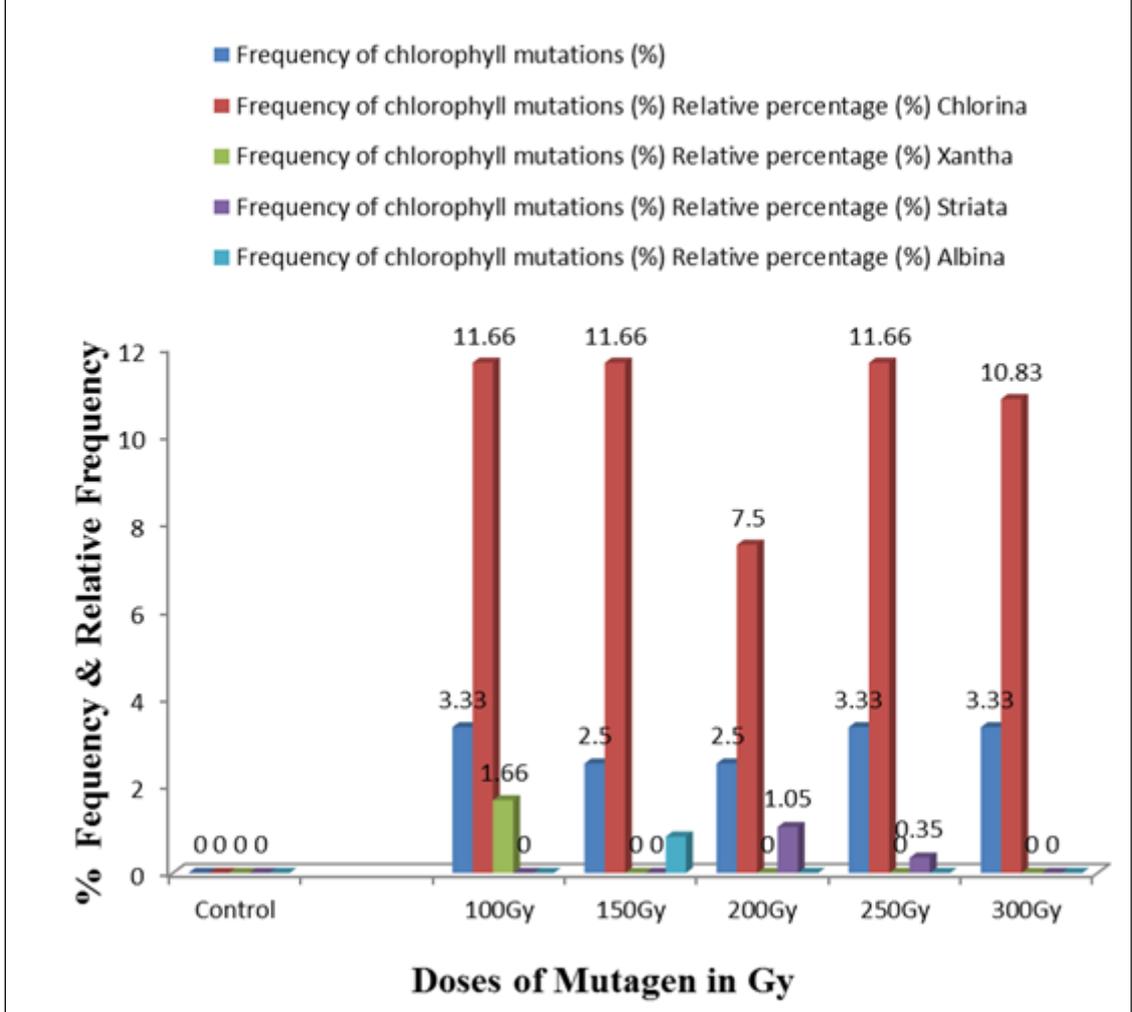
Chlorophyll mutations provide one of the most dependable indices for the evaluation of genetic effects of mutagenic treatments and have been reported in various pulse crops by several workers including Gautam *et al.* (1992). The data was recorded on the frequency of chlorophyll mutations per 500 M₂ plants. The Chlorophyll mutations were found in almost all the mutagenic treatments. In the present investigation total 4 types of chlorophyll mutations such as albina, xantha, chlorina, striata were recorded in groundnut variety JL 24. The frequency and relative spectrum of chlorophyll mutants were represented in the table (Table 1) and fig.1. Results revealed that only Chlorina chlorophyll mutant was recorded in all the treatments of the mutagens.

Table 1: Effect of different doses of gamma rays on frequency and spectrum of chlorophyll mutations in M₂ generation of groundnut.

	Conc./dose	Frequency of chlorophyll mutations (%)	Relative percentage (%)			
			Chlorina	Xantha	Striata	Albina
Control	Control	0	0	0	0	0
Gamma ray	100Gy	3.33	11.66	1.66	0	0
	150Gy	2.5	11.66	0	0	0.83
	200Gy	2.5	7.5	0	1.05	0
	250Gy	3.33	11.66	0	0.35	0
	300Gy	3.33	10.83	0	0	0

The frequency of Chlorophyll mutations in different doses (3.33%) in 100,250 and 300 Gy of gamma rays. The presence and absence of some chlorophyll mutants in some mutagenic treatments indicating differences in the availability of mutagenic loci to the mutagen. The frequency of chlorophyll mutants was higher in 100,250 and 300 Gy of gamma rays. Increase in the frequencies of chlorophyll mutations with increase in the concentration / dose reported by the results obtained in this work confirming that gamma rays was found to be more effective for inducing chlorophyll mutations. Spectrum of chlorophyll mutations in segregating M₂ generation (Table 1) indicates presence of broad chlorophyll mutant spectrum comprising 4 types of chlorophyll mutants. Chlorina mutant recorded highest relative % (11.66) in 100,150 &250 Gy doses, xantha (1.66) in case of 100 Gy) dose. Higher relative % of striata mutants (1.05) was found with 200 Gy, while albino mutants were found in 150 Gy (0.83) The viable chlorophyll mutations, i.e., chlorina were produced at all doses/concentrations of mutagen whereas lethal mutants, namely, xantha and albino was observed in 100 Gy and 150 Gy dose of gamma respectively.

Fig.1. Spectrum of Chlorophyll mutations in M2



The doses of gamma rays enhanced the frequency of chlorophyll mutations, which is supported by previous results found in various crops, such as mungbean Gautam and M ittal, 1998 in black gram, Tambe, A.B.,and Apparao, B.J. 2009 in Soybean. Four different types of chlorophyll mutants produced in the present study are in agreement with the findings of several workers in the past. Ignacimuthu and Babu, 1988 reported albino, viridis, chlorina, xantha mutants in three species of *Vigna*. Out of 4 mutants induced in the present study, chlorina was most frequent than striata mutants while albino and xantha type was the least frequent. In the present investigatio the spectrum and frequency of chlorophyll mutations in M₂ is observed. Hence the Chlorophyll mutations offer one of the most reliable indices for the assessment of genetic effects of mutagenic treatments in different crops.



Fig 2: Spectrum of chlorophyll mutations in groundnut.

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Ethnomedicinal Survey of Medicinal Plants Used for the Treatment to Cure Diarrhoea and Dysentery in Peth Region of Nashik District

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ABSTRACT: *In the present study was undertaken to collect information from traditional healers on the use of medicinal plants in peth Taluka of Nashik district Maharashtra. It was carried out during 2016-2017 and this region mostly situated in western ghats. The area is inhabited by large number of tribes viz. kokna, bhil, Mahadev-kolis, warali, thakur and katkari. Therefore, the main objective in the study to document indigenous knowledge of plants local traditional healers used for the treatment of cure diarrhoea and dysentery. During the investigation, we observed 38 different plant species belonging 28 families were recorded. They are listed along with their botanical name, family name, common name and plant parts used with present study.*

Keywords: *Indigenous, Traditional healers and Peth Taluka*

Introduction

Western Ghats in Maharashtra is one of the huge and rich biodiversity with varied geographical area. It is also blessed with rich and diverse heritage of culture traditions along with predominantly and dominantly tribal region. Along with, Peth Taluka is one of a dominantly tribal region in Nashik district in Maharashtra. It is situated in between Western Ghats and near the Gujarat bordered. This tribal community survival from ancient time and they depends on forest resources. Therefore, they have to belief on their natural resources for the treatment of their various diseases. Because of good knowledge and skill in the tribal community is playing an important role on the utilization and conservation of food and medicinal plants. Therefore, this community primary healthcare is depends on the medicinal dwellers and their knowledge (Jondhale *et al.*, 2018).

Similarly, the World Health Organization (WHO) reported that 65-80% of the world population in developing countries depends essentially on plants and plant derived compounds for their primary health care (Sharma *et al.*, 2010). Although very few ethno-botanical research work on knowledge of Peth region have been reported by Jondhale *et al.*, 2018, Patil and Patil, 2007 and 2005. Unfortunately, there is no single study on the ethanobotanical survey of medicinal plants in the treatment of specific disease. Therefore, there is urgent need to specific survey and study of medicinal plants in the treatment of specific disease. In this connection our primary objective of this study carry out to document the ethnomedicinal plants used to cure diarrhoea and dysentery by the tribal community of Peth Taluka in Nashik district of Maharashtra.

Materials and Methods

The experimental research work was conducted in the Peth Taluka situated in the Nashik District. This region is covered by western ghats and traditionally inhabited by the tribal people. The geographical location of Nashik district lying between North latitude 19°31' and 20°21' and East longitude 73°30' and 74°55' with rich forest diversity of medicinal plants. Peth Taluka is bounded by Dindori Taluka to the east, Trimbak Taluka to the south, Sargana Taluka to the north and Gujarat state boundary to west. The average rainfall is 1823mm and highest rainfall in the month of July. There are 92.92% different tribal community and they have mostly used traditional herbal medicines for curing various diseases.

An ethanobotanical survey on the plants used for cure diarrhoea and dysentery was carried out during the period 2016-2017. The information was collected from 10 different villages of the taluka. First of all, a questionnaire was prepared before interviewing local traditional practitioners in study area. All the information regarding different types of plant species, parts of the plants, habitat and local name was documented. At the same time the medicinal plant species were collected and identification of plant specimen done with help of local and regional floras (Pradhan and Singh 1999, Cooke 1901-1908 and Almeida, 2007). Then, the collecting information was arranged in Botanical name, Local name, Family name, Habit and Plant part uses.



Fig 1: Map of Peth Taluka in Nashik District Showing Study Area.

Results and Discussion

During the present investigation a total of 38 medicinal plants species have been documented to use for cure diarrhoea and dysentery by the traditional healers or practioners of Peth Taluka (Table-1). Out of 38 medicinal plants belonged to 36 genera and 28 families were study. Out of these, 4 species belonged to family Fabaceae followed by 3 species of Euphorbiace. Each of Myrtaceae, Caesalpiniaceae, Moraceae, Meliaceae and Lytherace is represented by 2 species. Among a single in each was recorded by 20 families (Table-2). It was observed that, 20 species are trees, 9 are herb, 5 are shrub, 3 are climber and 1 is grass out of 38 different plant species. The percentage is like 52.63%, 23.68%, 13.15%, 7.89% and 2.63% respectively (Table-3). The overall study, we observed that different plant parts used for the preparation of medicine, leaves (21.05%) and stem bark (21.05%) were found to be the most frequently used plant parts in the preparation of medicine followed by Root bark and Root (13.15%), Fruits (10.52%), Seeds (10.52%), whole plant (7.89%), Latex, wood and stem powder (7.89%), Tuber & Rhizome (5.26%) and Gum of Bark (2.63%) (Table-4). Therefore, the whole experimental study, we were observed that the plant parts used for the treatment included leaves, stems, roots, barks, fruits and seeds as well as whole plants. Almost 90% medicinal plants were collected from forest area and reaming 10% from local markets reported in this study. Similar studies were reported by Shanmugam *et al.*, 2011a., Shanmugam *et al.*, 2011b and Wagh *et al.*, 2011.

In our experimental result has to identified a number of important medicinal plants used by the traditional healers of the Peth Taluka region for the treatment of cure diarrhea and dysentery. It plays a very important role in the primary healthcare of the tribal people for Peth Taluka, Nashik District, Maharashtra. It is not only play an important role of primary health care but also play a vital role for future phytochemical and pharmacological investigations into the beneficial medicinal properties of such plants.

Table 1: Ethanomedicinal Survey of Medicinal Plants of Peth Taluka

Sr.No	Botanical Name	Local Name	Family	Habit	Parts Used
1.	<i>Acacia nilotica</i> L.	Babul	Fabaceae	Tree	Gum of Bark
2.	<i>Achyranthes aspera</i> L.	Aghada	Amaranthaceae	Herb	Leaves
3.	<i>Adhatoda vasica</i> Nees.	Adulsa	Acanthaceae	Shurb	Leaves
4.	<i>Aegle marmelos</i> L.	Bel	Rutaceae	Tree	Fruit
5.	<i>Annona squamosa</i> L.	Sitafal	Annonaceae	Tree	Bark
6.	<i>Asparagus racemosas</i> willd.	Satawar	Asparagaceae	Climber	Tuber
7.	<i>Azadirachta indica</i> L.	Neem	Meliaceae	Tree	Stem bark
8.	<i>Bauhinia racemosa</i> Lam.	Apta	Fabaceae	Tree	Stem Bark

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9.	<i>Calotropis gigantean</i> L.	Rui	Asclepiadaceae	Herb	Root Bark
10.	<i>Cassia fistula</i> L.	Rain Tree	Caesalpiniaceae	Tree	Bark
11.	<i>Cassia tora</i> L.	Takla	Caesalpiniaceae	Shurb	Leaves
12.	<i>Chlorophytum tuberosam</i> Baker	Safedmusli	Liliaceae	Herb	Root
13.	<i>Curcuma longa</i> Valetton	Haldi	Zingiberaceae	Herb	Rhizome
14.	<i>Cyanodon dactylon</i> L.	Durva	Poaceae	Grass	Root
15.	<i>Diospyros melanoxylon</i> Roxb.	Timburni	Ebenaceae	Tree	Leaves
16.	<i>Emblica officinalis</i> Gaertn	Amla	Euphorbiaceae	Tree	Fruit
17.	<i>Euphorbia hirta</i> L.	Dudhani	Euphorbiaceae	Herb	Whole Plant
18.	<i>Ficus benghalensis</i> L.	Vad	Moraceae	Tree	Stem bark
19.	<i>Ficus racemosa</i> L.	Umbar	Moraceae	Tree	Latex
20.	<i>Feronia limonia</i> L.	Kavath	Rutaceae	Tree	Fruits
21.	<i>Holarrhena antidysenterica</i> L.	Pandhrakuda	Apocyanaceae	Herb	Stem Bark
22.	<i>Lawsonia inermis</i> L.	Mehendi	Lythraceae	Tree	Seeds
23.	<i>Mangifera indica</i> L.	Amba	Meliaceae	Tree	Leaves
24.	<i>Mimosa pudica</i> L.	Lajalu	Fabaceae	Herb	Whole Plant
25.	<i>Moringa olerifera</i> L.	Shegava	Moringaceae	Tree	Leaves
26.	<i>Madhuca indica</i> Gmel.	Moha	Sapotaceae	Tree	Stem Bark
27.	<i>Ocimum gratissimum</i> L.	Rantulsi	Lamiaceae	Herb	Seeds
28.	<i>Psidium gaujava</i> L.	Peru	Myrtaceae	Tree	Leaves
29.	<i>Punica grantum</i> L.	Dalimb	Lythraceae	Shrub	Stem Bark
30.	<i>Ricinus communis</i> L.	Arandi	Euphorbiaceae	Shrub	Root
31.	<i>Santalum album</i> L.	Chandan	Santalaceae	Tree	Wood
32.	<i>Solanum nigrum</i> L.	Laghukavali	Solanaceae	Herb	Root
33.	<i>Syzygium cumini</i> L.	Jamun	Myrtaceae	Tree	Seeds
34.	<i>Tamarindus indica</i> L.	Chinch	Fabaceae	Tree	Whole Plant
35.	<i>Terminalia arjuana</i> Roxb.	Arjuna Sadhada	Combretaceae	Tree	Fruits
36.	<i>Tinospora cordifolia</i> Miers.	Gulvel	Menispermaceae	Climber	Stem Powder
37.	<i>Trichosanthes palmate</i> Roxb.	Kaundal	Cucurbitaceae	Climber	Seeds
38.	<i>Vitex negundo</i> L.	Nivadung	Verbenaceae	Shurb	Leaves

Table 2:List of Family, Total Number of Species and their Percentage

Sr.no	Name of Family	Total no.species	Percentage	Sr.No	Name of Family	Total no.species	Percentage
1	Fabaceae	4	10.52	15	Rutaceae	1	2.63
2	Amaranthaceae	1	2.63	16	Apocyanaceae	1	2.63
3	Acanthaceae	1	2.63	17	Lythraceae	2	5.26
4	Rutaceae	1	2.63	18	Moraceae	2	5.26
5	Annonaceae	1	2.63	19	Moringaceae	1	2.63
6	Asparagaceae	1	2.63	20	Sapotaceae	1	2.63
7	Meliaceae	2	5.26	21	Lamiaceae	1	2.63
8	Asclepiadaceae	1	2.63	22	Myrtaceae	2	5.26
9	Caesalpiniaceae	2	5.26	23	Verbenaceae	1	2.63
10	Liliaceae	1	2.63	24	Santalaceae	1	2.63
11	Zingiberaceae	1	2.63	25	Solanaceae	1	2.63
12	Poaceae	1	2.63	26	Combretaceae	1	2.63
13	Ebenaceae	1	2.63	27	Menispermaceae	1	2.63
14	Euphorbiaceae	3	7.89	28	Cucurbitaceae	1	2.63
					Total Family= 28	38	100

Table 3: Habit of Plant With their Percentage

Sr. No	Habit of Plant	No.of Plant	Percentage (%)
1	Trees	20	52.63
2	Herbs	09	23.68
3	Shurbs	05	13.15
4	Climbers	03	7.89
5	Grass	01	2.63
	Total	38	100

Table 4: Plant part used and their percentage

Sr. No	Plant Part Used	No.of Plant	Percentage (%)
1	Gum of Bark	1	2.63
2	Leaves	8	21.05
3	Fruits	4	10.52
4	Stem Bark	8	21.05
5	Tuber & Rhizome	2	5.26
6	Whole Plant	3	7.89
7	Root Bark & Root	5	13.15
8	Seeds	4	10.52
9	Latex, Wood & Stem Powder	3	7.89
	Total	38	100

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Effect of VAM Inoculation on Enhancement of Physiological and Biochemical Parameters of Groundnut (*Arachis hypogaea* Linn.) var. TAG-24

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ABSTRACT: In the present investigation different types of VAM cultures were applied to enhance the physiological and biochemical parameters of the groundnut. By using mycorrhiza viz. *Acaulospora laevis*, *Glomus fasciculatum* and *Glomus mosseae*, it is observed that different physiological and biochemical parameters like Ca, Fe, Minerals, P, Crude fiber, Carotene, Carbohydrate, and Energy were significantly increased as compared to the control.

Keywords: VAM fungi, groundnut, physiological, biochemical parameters.

Introduction

Groundnut is an important oil and protein source and is grown widely in the semiarid tropics, and fact is that Groundnut is a plant without root hairs and suggested its dependence on Vesicular Arbuscular Mycorrhiza fungi for water and mineral uptake. VAM fungi are special in their ability to translocate phosphorous from nutrient deficient soils (Jakobson *et al.*, 1992) and in stimulation of plant growth (Haas and Krikun, 1985). The fungi grow in association of root of higher host plant to several cm away from the root and pick up nutrients at a distance where they are readily available. The hyphal network of VAM fungi creates extensive surface area for absorption of nutrients from surrounding soil and supplies it to the host root (Gerdemann, 1975).

Crop plants get benefit from mycorrhizal association because of greater efficacy in nutrient and water uptake from soils (Daft and Nicolson, 1968, Gerdemann, 1968, Ross and Harper, 1970, Safir *et al.*, 1970, Azcon and Ocampo, 1981). VAM fungi brings biochemical changes in plants by increasing various enzymatic activities (Mathur and Vyas, 1996).

Materials and Methods

Culture of three mycorrhizal species viz. *Acaulospora laevis*, *Glomus fasciculatum* and *Glomus mosseae* were procured from 'Centre for Natural Biological Resources and Community Development, Bangalore'. The VAM fungi culture was multiplied by using sterilized soil and sand mixture on Guinea pig grass as a host plant.

The pods of groundnut variety TAG 24 were obtained from Mahatma Phule Krishi Vidyapeeth (MPKV), Rahuri, District- Ahmednagar. The seeds of uniform size and free from visible defects were selected for the study. The soil selected for experiment and farm yard manure used was sterilized in oven. The earthen pots of 25 cm diameter, sufficient depth and proper drainage were selected. Pots were filled with mixture of 7 kilogram sterilized soil, sand and farm yard manure. Each individual mycorrhizal treatment and control was carried in ten pots separately. The treatment of mycorrhizal fungi in each pot was given by taking 15 gram of inoculum and it was placed below the groundnut seed.

The plants were sufficiently irrigated thereafter. After harvesting 10 gram of groundnut seeds were collected from each pot to make up an quantity of 100 gm to analyze for the different physiological and biochemical parameter. This analysis was done at Botany Department of MPKV, Rahuri, Ahmednagar on ZEUTECH Spectra Analyzer. Spectra Analyzer is a dual beam near infrared spectrometer which is used to analyze the composition of samples using the near infrared reflectance characteristics of the sample spectra.

Result and Discussion

Table No 1: Groundnut seed analysis report at MPKV By using Spectra Analyzer

Sr. No.	Parameter Analyzed	Name of the Treatment			
		Control	<i>Acaulospora laevis</i>	<i>Glomus fasciculatum</i>	<i>Glomus mosseae</i>
1	Calcium (mg/100 gm)	92.6636	93.1989	93.8732	93.2925
2	Carbohydrate (%)	27.6191	27.9413	28.3486	27.9971
3	Carotene (um/100 gm)	38.4887	38.7962	39.1726	38.8456
4	Crude fiber (%)	4.0849	4.8111	5.0205	4.8339
5	Energy (Kcal)	559.3783	579.509	573.6801	571.6533
6	Iron (mg /100 gm)	2.4877	3.088	2.8697	2.9194
7	Minerals (g/100 gm)	2.1667	2.3719	2.3899	2.3146
8	Phosphorus (mg/100 gm)	357.8792	372.818	382.7695	375.9293

The plants inoculated with mycorrhiza species showed significant increase in all the physiological and biochemical parameters mentioned in table no.1. The treatment given by *Glomus fasciculatum* shows significant increase in calcium (93.8732 mg/100 gm), phosphorus (382.7695 mg/100 gm), carotene (39.1726 µm/100 gm), carbohydrate (28.3486 %), crude fibre (5.0205 %), followed by *Glomus mossae* for calcium (93.2925 mg/100 gm), phosphorus (375.9293 mg/100gm), carotene (38.845µm/100 gm), carbohydrate (27.9971%) and crude fibre (4.8339 %), in *Acaulospora laevis* and was found lowest in control as calcium (92.6636 mg /100 gm), phosphorus (357.8792 mg/100 gm), carotene (38.4887µm/100 gm), carbohydrate (27.6191 %) and crude protein (25.8401%). The same results for some of the parameters were reported by El – Azouni et al., 2008, Kameli, 1990, Manoharan et al., 2008 Smith and Read., 2008, Marschner and Dell., 1994, Schnepf et al., 2011, Chandrasekaran et al., 2014.

The treatment of *Glomus fasciculatum* also shows increase in minerals (2.3899 gm/100 gm) followed by *Acaulospora laevis* treatment (2.3719 gm/100gm), *Glomus mossae* (2.3146) and poor in control (2.1667gm/100 gm). Similar results were also reported by Gray and Gerdemann 1969; Hayman and Mosse, 1972; Tinkar, 1982. In case of iron (3.088 mg/100 gm) and energy (579.509 K cal) the treatment given by *Acaulospora laevis* has shown the significant increase followed *Glomus mosseae* for iron (2.9194 K cal) and *Glomus fasciculatum* for energy (573.6801 K cal) while it was lowest in control for iron (2.4877 mg/100gm) and for energy (559.3783 K cal). Similar observations were also made by Allen et al., 2003.

This analysis confirms that VAM fungi *Glomus fasciculatum* is the good biofertilizer which can increases the yield and quality of groundnut.

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Survey of Flowering Plants from Mokhada Taluka: A Preliminary Report

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ABSTRACT: An extensive and intensive survey of flowering plants was carried out for a period of one year (2018) from Mokhada taluka of Palghar district (M.S.). One hundred and thirty different flowering plants belonging to 57 families were collected during their flowering and fruiting period throughout the year. The present paper deals with the flowering plants along with their botanical name and family.

Keywords: Flowering plants, Mokhada

Introduction

India is one of the richest country floristically (D.N. Patil and M.J. Kothari, 2013), has around 65000 plant species; of them around 17000 are flowering plants. Mokhada is about 64 km away from Nashik district to the west side. It has good range of hills of Sahyadri lying mostly south north side. The soil is in the form of red laterite. The heavy rain falls occurs during the month of June to October.

The forests at Mokhada taluka mostly consist of tree species and even it also shows herbaceous flora. Due to overgrazing and bringing the land under cultivation, it created threats to the biodiversity of this area. Hence, necessity was felt to conduct survey of plants and was carried out from the said study area.

Materials and Methods

An extensive and intensive survey of flowering plants was carried out from Mokhada taluka in year 2018. Plants were collected in flowering and fruiting period throughout the year from this region. The method of plant collection and their identification was done through method used earlier by Salunkhe et al (2001), Chavan et al (1973) and Khairnar (2003). The collected plant specimens were identified with the help of available literature, matching with standard herbarium and relevant books (Sharma et al, 2001).

Results and Discussion

The vegetation of this region is moist mixed deciduous forests. It is a rich in varied flowering plants. Altogether 130 plants belonging to 57 families were recorded. The flowering plants collected are represented in Table 1, with their respective families, plant names and habit. The survey of flowering plants in the present study indicated that family like Fabaceae, Asteraceae and Malvaceae were found dominant one. Family Fabaceae and Asteraceae was with 11 plant while Malvaceae with 10 plant. Out of 130 plant species recorded; habit were found with diversity. Herb found predominant with 68 plants, while, tree 25, shrubs 22, climbers 8 and undershrubs 7 were recorded.

Hence, there is need to generate all round awareness in society regarding the conservation of such flowering plants that can be turn useful for upliftment of society economical status through earning of foreign exchange. It is also observed that flowering plants can be used profitably through their commercial exploitation.

Table 1: List of plants recorded

Sr. No.	Name of plant	Family	Habit
1.	<i>Clematis heynei</i> M.A. Rau.	Ranunculaceae	Climber
2.	<i>Dillenia pentagyna</i> Roxb.	Dilleniaceae	Tree
3.	<i>Annona squamosa</i> L.	Annonaceae	Tree
4.	<i>Annona reticulata</i> L.	Annonaceae	Tree
5.	<i>Cocculus hirsutus</i> (L.) Diels	Menispermaceae	Climber
6.	<i>Tinospora cordifolia</i> (Willd.) Miers ex Hook. f.&Thoms.	Menispermaceae	Climber
7.	<i>Argemone mexicana</i> L.	Papaveraceae	Herb
8.	<i>Cleome viscosa</i> L.	Cleomaceae	Herb

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9.	<i>Portulaca oleracea</i> L.	Portulacaceae	Herb
10.	<i>Tamarix ericoides</i> Rottl.	Tamaricaceae	Shrub
11.	<i>Abelmoschus manihot</i> (L.) Medik.ssp. tetraphyllus (Roxb. ex Horn.) Borssum	Malvaceae	Herb
12.	<i>Abutilon indicum</i> (L.) Sweet.	Malvaceae	Undershrub
13.	<i>Helictres isora</i> L.	Malvaceae	Small Tree
14.	<i>Malvastrum coromandelianum</i> (L.) Garcke	Malvaceae	Herb
15.	<i>Pavonia zeylanica</i> (L.) Cav.	Malvaceae	Undershrub
16.	<i>Sida acuta</i> Burm.f.	Malvaceae	Undershrub
17.	<i>Sida rhombifolia</i> L. ssp. retusa (L.) Borssum	Malvaceae	Undershrub
18.	<i>Thespesia lampas</i> (Cav.) Dalz. & Gibs.	Malvaceae	Shrub
19.	<i>Urena lobata</i> L. ssp. (L.) Borssum	Malvaceae	Shrub
20.	<i>Hibiscus rosa-sinensis</i> L.	Malvaceae	Shrub
21.	<i>Bombax ceiba</i> L.	Bombacaceae	Tree
22.	<i>Sterculia urens</i> Roxb.	Sterculiaceae	Tree
23.	<i>Corchorus olitorius</i> L.	Sterculiaceae	Herb
24.	<i>Linum mysorense</i> Heyne ex Bth.	Linaceae	Herb
25.	<i>Tribulus terrestris</i> L.	Zygophyllaceae	Herb
26.	<i>Oxalis corniculata</i> L.	Oxalidaceae	Herb
27.	<i>Impatiens balsamina</i> L.	Balsaminaceae	Herb
28.	<i>Zizyphus mauritiana</i> Lam.	Rhamnaceae	Shrub
29.	<i>Mangifera indica</i> L.	Anacardiaceae	Tree
30.	<i>Anacardium occidentale</i> L.	Anacardiaceae	Tree
31.	<i>Moringa oleifera</i> Lam.	Moringaceae	Tree
32.	<i>Aeschymone indica</i> L.	Fabaceae	Herb
33.	<i>Alysicarpous bupleurifolius</i> (L.) DC.	Fabaceae	Herb
34.	<i>Butea monosperma</i> (Lam.) Taub.	Fabaceae	Tree
35.	<i>Cajanus lineatus</i> (Wight & Arn.) van der Maesen	Fabaceae	Shrub
36.	<i>Crotalaria hebecarpa</i> (DC.) Rudd.	Fabaceae	Herb
37.	<i>Erythrina stricta</i> Roxb.	Fabaceae	Tree
38.	<i>Indigofera astragalina</i> DC	Fabaceae	Herb
39.	<i>Indigofera cordifolia</i> Heyne ex Roth	Fabaceae	Herb
40.	<i>Smithia conferata</i> J.E. Sm	Fabaceae	Herb
41.	<i>Tephrosia purpurea</i> (L.) Pers.	Fabaceae	Herb
42.	<i>Vigna radiata</i> (L.) Wilczek	Fabaceae	Herb
43.	<i>Bauhinia racemosa</i> Lam.	Caesalpinaceae	Tree
44.	<i>Caesalpinia decapetala</i> (Roth) Alst.	Caesalpinaceae	Shrub
45.	<i>Cassia auriculata</i> L.	Caesalpinaceae	Shrub
46.	<i>Cassia obtusifolia</i> L.	Caesalpinaceae	Herb
47.	<i>Cassia tora</i> L.	Caesalpinaceae	Herb
48.	<i>Acacia chundra</i> (Roxb. ex Rottl.) Willd.	Mimosaceae	Tree
49.	<i>Dichrostachys cinera</i> (L.) Wight & Arn.	Mimosaceae	Shrub
50.	<i>Mimosa hamata</i> Willd.	Mimosaceae	Shrub
51.	<i>Kalanchoe pinnata</i> (Lam.) Pers.	Crassulaceae	Herb
52.	<i>Terminalia arjuna</i> (Roxb. ex DC) Wight & Arn.	Combretaceae	Tree
53.	<i>Terminalia crenulata</i> Roth.	Combretaceae	Tree
54.	<i>Woodfordia fruticosa</i> (L.) Kurz.	Lytheraceae	Shrub
55.	<i>Ludwigia hyssopifolia</i> (G.Don) Exell.	Onagraceae	Herb
56.	<i>Diplocyclos palmatus</i> (L.) C. Jaffrey	Cucurbitaceae	Climber
57.	<i>Momordica dioica</i> Roxb. ex Willd.	Cucurbitaceae	Climber
58.	<i>Begonia crenata</i> Dryland.	Begoniaceae	Herb
59.	<i>Trianthema triquetra</i> Rottl.ex Willd.	Aizoaceae	Herb
60.	<i>Glinus lotoides</i> L.	Molluginaceae	Herb

61.	<i>Mollugo pentaphylla</i> L.	Molluginaceae	Herb
62.	<i>Pimpinella wallichiana</i> (Hoenck) Gandhi	Apiaceae	Herb
63.	<i>Pinda concanense</i> (Dalz.) Mukherjee & Constance	Apiaceae	Herb
64.	<i>Dentella repens</i> (L.) J.R. & G. Frost.	Rubiaceae	Herb
65.	<i>Oldenlandia corymbosa</i> L.	Rubiaceae	Herb
66.	<i>Spermacoce hispida</i> L.	Rubiaceae	Herb
67.	<i>Ageratum conyzoides</i> L.	Asteraceae	Herb
68.	<i>Bidens biternata</i> (Lour.) Merr. & Sherff.	Asteraceae	Herb
69.	<i>Blumea oxyodonta</i> DC.	Asteraceae	Herb
70.	<i>Caesulia axillaris</i> Roxb.	Asteraceae	Herb
71.	<i>Cyathocline purpurea</i> (D. Don) O. Ktze.	Asteraceae	Herb
72.	<i>Echinops echinatus</i> Roxb.	Asteraceae	Herb
73.	<i>Emilia sonchifolia</i> (L.) DC	Asteraceae	Herb
74.	<i>Sonchus oleraceus</i> L.	Asteraceae	Herb
75.	<i>Sphaeranthus indicus</i> L.	Asteraceae	Herb
76.	<i>Tridax procumbens</i> L.	Asteraceae	Herb
77.	<i>Xanthium indicum</i> Koen. ex Roxb.	Asteraceae	Herb
78.	<i>Madhuca longifolia</i> (Koen.) Macbride var. <i>latifolia</i> (Roxb.) Chevalier	Sapotaceae	Tree
79.	<i>Carissa congesta</i> Wight	Apocynaceae	Shrub
80.	<i>Holarrhena pubescens</i> (Buch.-Ham.) Wall. Ex G. Don.	Apocynaceae	Tree
81.	<i>Wrightia tinctoria</i> R.Br.	Apocynaceae	Tree
82.	<i>Nerium indicum</i> Mill.	Apocynaceae	Shrub
83.	<i>Calotropis gigantea</i> (L.) R.Br.	Asclepiadaceae	Shrub
84.	<i>Calotropis procera</i> (Ait.) R.Br. ssp. <i>hamiltonii</i> (Wight) Ali	Asclepiadaceae	Shrub
85.	<i>Cynanchum callialatum</i> Ham. ex Wight	Asclepiadaceae	Climber
86.	<i>Tylophora dalzielii</i> Hook.	Asclepiadaceae	Climber
87.	<i>Hemidesmus indicus</i> (L.) Schultes	Asclepiadaceae	Shrub
88.	<i>Canscora diffusa</i> (Vahl) R.Br.	Gentianaceae	Herb
89.	<i>Paracaryopsis coelestina</i> (Lindl.) R. Mill	Boraginaceae	Herb
90.	<i>Trichodesma indicum</i> (L.) R.Br.	Boraginaceae	Herb
91.	<i>Convolvulus arevensis</i> L.	Convolvulaceae	Herb
92.	<i>Ipomoea quamoclit</i> L.	Convolvulaceae	Herb
93.	<i>Cuscuta reflexa</i> Roxb.	Cuscutaceae	Climber
94.	<i>Datura inoxia</i> Mill.	Solanaceae	Herb
95.	<i>Physalis minima</i> L.	Solanaceae	Herb
96.	<i>Withania somnifera</i> (L.) Dunal	Solanaceae	Undershrub
97.	<i>Bacopa monnieri</i> (L.) Penn.	Scrophulariaceae	Herb
98.	<i>Rhamphicarpa longiflora</i> (Arn.) Bth	Scrophulariaceae	Herb
99.	<i>Heterophragma quadriloculare</i> (Roxb.) K. Schum.	Bignoniaceae	Tree
100.	<i>Sesamum orientale</i> L.	Pedaliaceae	Herb
101.	<i>Adathoda zeylanica</i> Medik.	Acanthaceae	Shrub
102.	<i>Haplanthodes tentaculata</i> (L.) R.B. Majumdar	Acanthaceae	Herb
103.	<i>Hygrophila auriculata</i> (K. Schum.) Heine	Acanthaceae	Herb
104.	<i>Justicia betonica</i> L.	Acanthaceae	Undershrub
105.	<i>Clerodendrum serratum</i> (L.) Moon	Verbenaceae	Shrub
106.	<i>Lantana camara</i> L. var. <i>aculeata</i> (L.) Moldenke	Verbenaceae	Shrub
107.	<i>Tectona grandis</i> L.	Verbenaceae	Tree
108.	<i>Vitex negundo</i> L.	Verbenaceae	Shrub
109.	<i>Hyptis suaveolens</i> (L.) Poit.	Lamiaceae	Undershrub
110.	<i>Lavandula bipinnata</i> (Roth) O. Ktze	Lamiaceae	Herb
111.	<i>Leucas longifolia</i> Bth	Lamiaceae	Herb
112.	<i>Leucas stelligera</i> Wall. Ex Bth.	Lamiaceae	Herb

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113.	<i>Ocimum americanum</i> L.	Lamiaceae	Herb
114.	<i>Boerhavia diffusa</i> L.	Nyctaginaceae	Herb
115.	<i>Achyranthes aspera</i> L.	Amaranthaceae	Herb
116.	<i>Polygonum plebeium</i> R.Br.	Polygonaceae	Herb
117.	<i>Chrozophora rottleri</i> (Geis.) A.Juss. ex Spr.	Euphorbiaceae	Herb
118.	<i>Jatropha curcas</i> L.	Euphorbiaceae	Shrub
119.	<i>Macranga peltata</i> (Roxb.) Muell.-Arg. in DC.	Euphorbiaceae	Tree
120.	<i>Phyllanthus emblica</i> L.	Euphorbiaceae	Tree
121.	<i>Girardiana diversifolia</i> (Link) Friis	Urticaceae	Herb
122.	<i>Ficus amplissima</i> J.E. Sm.	Moraceae	Tree
123.	<i>Ficus arnottiana</i> (Miq.) Miq.	Moraceae	Tree
124.	<i>Ficus racemosa</i> L.	Moraceae	Tree
125.	<i>Vallisneria spiralis</i> L.	Hydrocharitaceae	Herb
126.	<i>Habenaria grandifloriformis</i> L.	Orchidaceae	Herb
127.	<i>Costus speciosus</i> (Koenig) J.E.Sm.	Zingiberaceae	Shrub
128.	<i>Curculago orchioides</i> Gaertn.	Hypoxidaceae	Herb
129.	<i>Cyperus rotundus</i> Vahl	Cyperaceae	Herb
130.	<i>Cynodon dactylon</i> (L.) Pers.	Poaceae	Herb

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Studies on Trichomes Diversity of Selected Plant Species

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ABSTRACT: Trichomes meaning hair are fine outgrowth appendages on plants. They are of diverse structure and function. Examples are hairs, glandular hairs, scales, and papillae. They also control leaf temperature as well as water loss. The greatest significance of trichomes is in the identification of plants. Structurally, trichomes may be unicellular or multicellular, and are classified as glandular or non-glandular. Trichomes arise from epidermal cells and they are common in all terrestrial plants. Trichomes, as a plant protective barrier against natural hazard such as herbivores, plants from extreme high or low temperature, drought, ultraviolet (UV) irradiation, pathogen attacks and excessive transpiration. In this study there are 22 plants belonging to 11 families were studied. Trichomes are widely found on the aerial parts of a range of plants e.g. stem, leaf region has majority of trichomes present on it. The present study shows the diversity of trichomes, their morphological differences and which type of trichome found majority among studied plants. According to plants growing in different habitat to improve the environmental adaptability and yield of the plans, we can promote or inhibit the trichomes formation by altering the certain physiological characteristic of trichomes for different plants in the future. So it deduced from this work more comprehensive research is necessary for their further elaboration.

Keywords: Trichomes, Diversity of trichomes, Glandular hair, Non-glandular hair, Filiform

Introduction

Trichomes arise from epidermal cells and they are common in all terrestrial plants. They have different shapes, can be easily observed and also, they serve as an excellent model system to analyse molecular mechanism corresponding to plant cell differentiation, such as cellular cycle and morphogenesis (Yang and Ye, 2013). Structurally, trichomes may be unicellular or multicellular, and are classified as either glandular or non-glandular (Werker, 2000). However, trichomes are of interest across a broad of disciplines including Phylogenetic analysis (Belisteinet *al.* 2008).

Leaf trichome density is variable and determined by genetic and environmental factors (Walker and Marks, 2000).

Uphof (1962) and Johnson (1975) reviewed 19th and 20th century literature on the ecological aspect of plant pubescence, but much has been learned about their role in Plant Ecophysiology over the last 40 years. Trichomes, as a plant protective barrier against natural hazard such as herbivores, ultraviolet (UV) irradiation, pathogen attacks and excessive transpiration, play a key role in development of plant and occur widely in various plants. Trichomes may be unicellular or multicellular and are derived from aerial epidermal cells in leaves, stem and floral organs. They are classified as either glandular the former can contribute to the accumulation and secretion of some alkaloids to resist insects, such as nicotine and terpenoids alkaloids, and the latter can strengthen the role of resistance in biotic stress by promoting normal plant growth, under condition of extreme high or low temperature, drought and UV irradiation. The origination and spatial and temporal distribution of trichomes are well suited mechanisms for studying cell differentiation, fate choices and morphogenesis.

The term trichomes are applied to epidermal outgrowth of diverse forms, structures and functions (Essau, 1898). Trichomes are formed on all parts of the plants including stamens (For e.g. *Tradescantia*) and seed (For e.g. *Gossypium*) (Cutter, 1977). The adaptive values of trichomes and their possible role in plants delimitations are areas of investigations that have just began to be utilized by the systematists, evolutionists and ecologists. The description about the morphology of individual trichomes is not easy. The structure and nature of trichomes are somehow given great importance in phylogeny. According to Netolitzky (1932) and Carlquist (1961) papillae unicellular trichomes and radially symmetrical trichomes are parallel to the leaf surfaces which are considered to be more primitive, while those complicated ones are considered as advanced. They can also protect against herbivores, pathogens and act in storage and secretion of secondary metabolites (Agren and Schemaske, 1994). Although morphology of trichomes varies considerably, there are two major classes of trichomes; the glandular and non-glandular or epiglandular trichomes (Sinha *et al.*, 2001). Glandular trichomes have received considerable attention in view of their capacity to synthesize, store and secrete secondary metabolites that help to protect plants against insects predation and other biotic challenges (Wagner, 1991;

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Ranger and Hower, 2001; Wagner *et al.*, 2004). For example, the peltate glandular trichomes of mint produce a suit of defensive monoterpenes which are their major components and give the characteristic smell and flavour to mint oil (McCaskill *et al.*, 1992; Voirin and Bayet, 1996). The taxonomic significance of epidermal morphogeny is well documented in botanical literature (Dehgan 1980). Some particular group of plants or taxa seem to be characterized by specific type of epidermal features, which are the epidermis, stomata, gland and trichomes (Park 1994; Hong and Oh, Hong and son 1999-2000).

Trichomes meaning hair are fine outgrowth appendages on plants. They are of diverse structure and function. Examples are hairs, glandular hairs, scales, and papillae. A covering of any kind of hairs on plant is an indumentum and the surface bearing them is said to be pubescent.

The trichome appendages arise from anticlinal and periclinal division of epidermal cells to form trichomes. Differences in the habitat of plant trichomes are used in plant classification i.e. taxonomically very useful. They also control leaf temperature as well as water loss. Trichomes were among the first anatomical features of plants to be recognized by early microscopists and they have played a key role in plant taxonomy (Behnke, 1984). Simple or non-glandular trichomes serve the plant and humans in many ways. The morphological and anatomical features (density, size, shape, surface texture, hair orientation) of trichomes can influence many aspects of plants physiology and ecology (Wagner *et al.*, 2003). Trichomes may serve to protect buds of some plants until defence phytochemicals are produced (Johnson 1975). The trichome types are not only useful in the identification of species, but also their corresponding parts, thus being important in Pharmacognosy, Archaeobotany, Paleobotany and Agronomy (Raote & Ramayya, 1977).

However Uphof (1962) for the first time gave a comprehensive account of various types of trichomes. He classified epidermal outgrowths into categories, viz. non-glandular and glandular. Trichomes are of two types: glandular and non-glandular. Glandular trichomes secrete water, salt, mucilage, nectar, alkaloid, terpenes, resins etc. They are also known as secretory trichomes or glands. They can also be classified on the basis of number of cells (unicellular/ multicellular) and layers (uniseriate/ multiseriate). Multicellular or multiseriate trichomes are also known as Shaggy e.g. *Anabasis*, *Cleome*.

Aims and Objectives

- To know the diversity of trichomes.
- To study the morphology of different trichomes.
- To observe which type of trichome is higher number

Materials and Methods

- The fresh plants were collected from Shrirampur tahsil, District Ahmednagar, State Maharashtra, India.
- They were taken into laboratory immediately with fresh conditions and then identified with the help of 'The Flora of the Presidency of Bombay'; Volume-1 by Theodore Cooke (Author).
- After the correct identification, several sections were taken by free hand sectioning technique.
- After that sections were stained with saffranin and glycerin.
- Good slides were prepared and observed under (Besto, Model 10B) compound light microscope (10x, 45x) as well as 'METZER-M,' Bionocular Microscope, photographs of trichomes were taken by digital photographic camera and android mobile camera phone (Model Oppo F1s and Samsung J2) by 'Metzer-M Biowizard software' with Computer Imaging System.
- Types of trichomes were identified with help of experts and books of 'Plant Anatomy' by Author Dr. B.P Pandey, S. Chand Publication-2012, and other anatomy books.

Table No 1: Observation of plant family and types of trichomes.

Sr. No.	Plant Names	Family	Types of Trichomes
1.	<i>Datura stramonium</i> L.	Solanaceae	Multicellular trichomes
2.	<i>Withania somnifera</i> (L.) Dunal	Solanaceae	Multicellular Branched, Non-glandular
3.	<i>Solanum lycopersicum</i> L.	Solanaceae	Multicellular Glandular Capitate, Uniseriate
4.	<i>Lantana camara</i> L.	Verbenaceae	Unicellular Sessile, Filiform
5.	<i>Tridax procumbens</i> L.	Asteraceae	Multicellular Glandular Capitate, Uniseriate
6.	<i>Helianthus annuus</i> L.	Asteraceae	Multicellular Uniseriate trichomes
7.	<i>Parthenium hysterophorus</i> L.	Asteraceae	Multicellular Filiform
8.	<i>Leucas aspera</i> L.	Lamiaceae	Multicellular Filiform

9.	<i>Ocimum tenuiflorum</i> L.	Lamiaceae	Multicellular Trichomes
10.	<i>Hibiscus rosa-sinensis</i> L.	Malvaceae	Unicellular Glandular, Sessile
11.	<i>Gossypium arboreum</i> L.	Malvaceae	Unicellular Sessile, Filiform and Branched
12.	<i>Abutilon indicum</i> (Link) Sweet	Malvaceae	Multicellular Filiform
13.	<i>Ixora coccinea</i> L.	Rubiaceae	Unicellular Filiform
14.	<i>Hamelia patens</i> Jacq.	Rubiaceae	Unicellular trichomes
15.	<i>Mimosa pudica</i> L.	Fabaceae	Unicellular serrate, Papillate barrel shaped
16.	<i>Cicer arietinum</i> L.	Fabaceae	Multicellular Glandular, Filiform
17.	<i>Arachis hypogaea</i> L.	Fabaceae	Unicellular Filiform
18.	<i>Rosa indica</i> L.	Rosaceae	Unicellular Glandular, Branched
19.	<i>Allamanda blanchetii</i> L.	Apocynaceae	Sharp Unicellular
20.	<i>Ruellia tuberosa</i> L.	Acanthaceae	Multicellular Filiform
21.	<i>Justicia adhatoda</i> L.	Acanthaceae	Multicellular trichomes
22.	<i>Jatropha gossypifolia</i> L.	Euphorbiaceae	Unicellular Glandular trichomes

Table No 2: Name of the families and their number of plants studied for trichomes diversity.

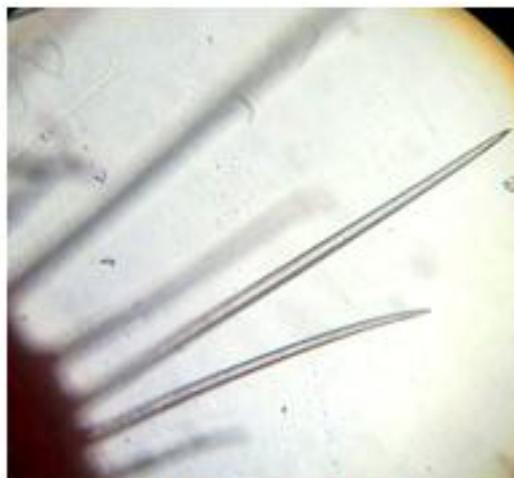
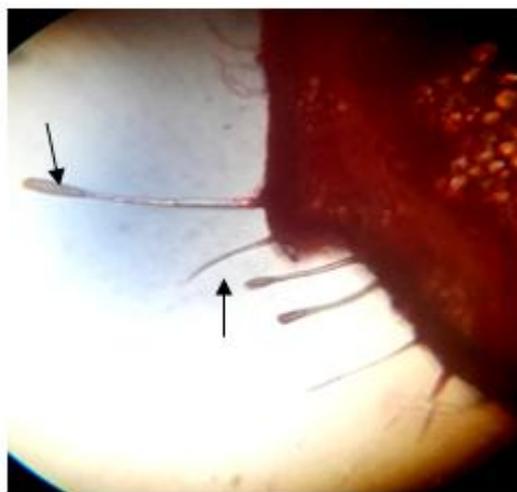
Sr.No.	Types of Trichomes	Total No.
1	Only Unicellular	06
2	Unicellular glandular	04
3	Unicellular capitate	00
4	Unicellular sessile	03
5	Unicellular non-glandular	00
6	Unicellular filiform	05
7	Unicellular conical	00
8	Unicellular uniseriate	00
9	Unicellular serrate	01
10	Unicellular papillate	01
11	Unicellular branched	03

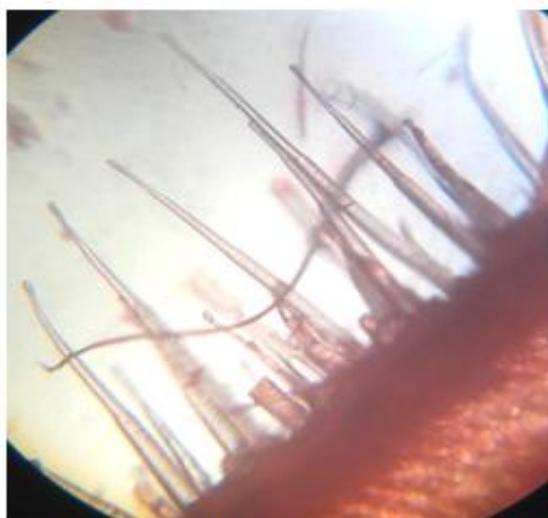
Table No 3: Types of unicellular trichomes and their total number notified out of 22 plants species.

Sr. No.	Name of Families	No. of Plants
1	Acanthaceae	02
2	Apocynaceae	01
3	Asteraceae	03
4	Fabaceae	03
5	Lamiaceae	02
6	Malvaceae	03
7	Rosaceae	01
8	Rubiaceae	02
9	Solanaceae	03
10	Verbenaceae	01
11	Euphorbiaceae	01

Table No 4: Types of multicellular trichomes and their total number notified out of 22 plant's species.

Sr.No.	Types of Trichomes	Total No.
1	Only Multicellular	01
2	Multicellular glandular	03
3	Multicellular capitate	02
4	Multicellular sessile	00
5	Multicellular non-glandular	00
6	Multicellular filiform	06
7	Multicellular conical	00
8	Multicellular uniseriate	03
9	Multicellular serrate	00
10	Multicellular papillate	00
11	Multicellular branched	01

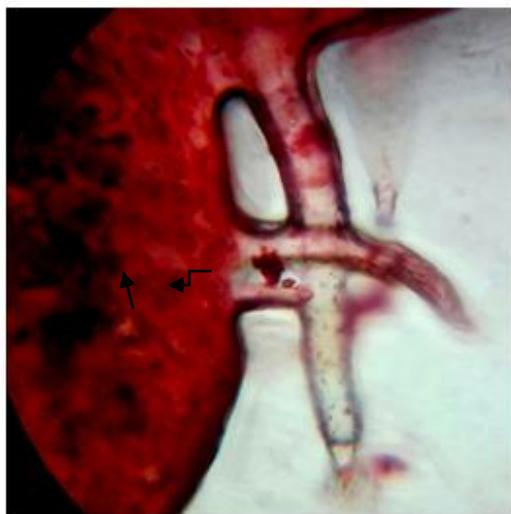
**a) Multicellular glandular, uniseriate.****b) Sharp unicellular****c) Unicellular filiform****d) Multicellular glandular, filiform**



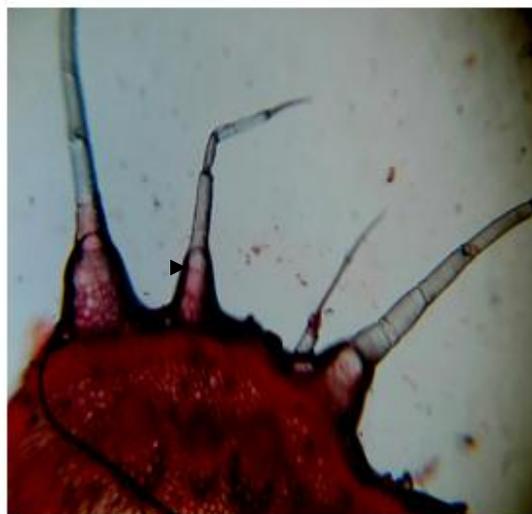
e) Multicellular trichome



f) Unicellular sessile, filiform and branched



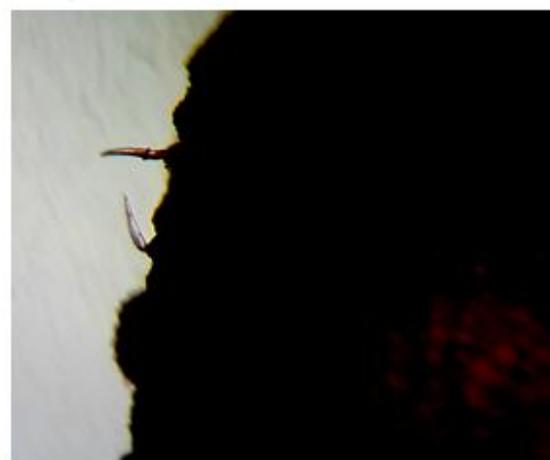
g) Unicellular trichome



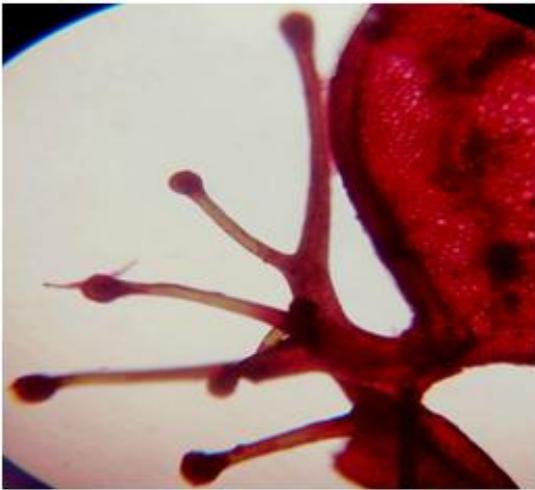
h) Multicellular uniseriate trichome



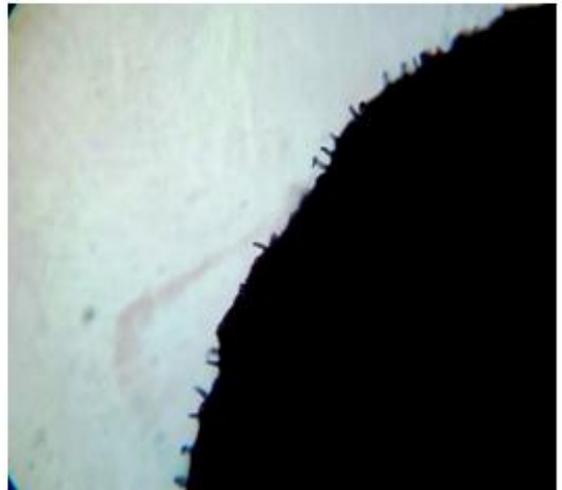
i) Unicellular glandular trichomes



j) Unicellular filiform



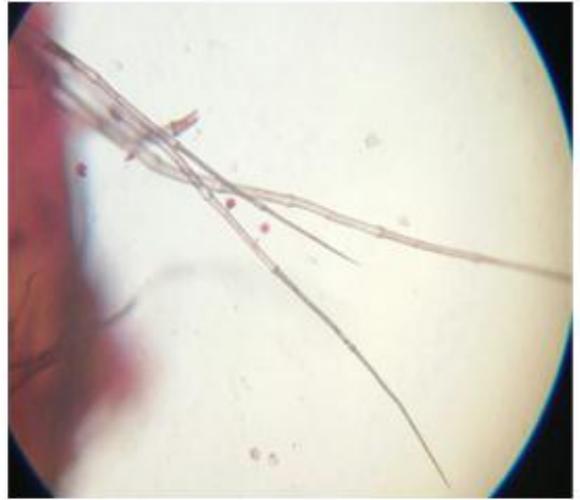
k) Unicellular glandular trichome



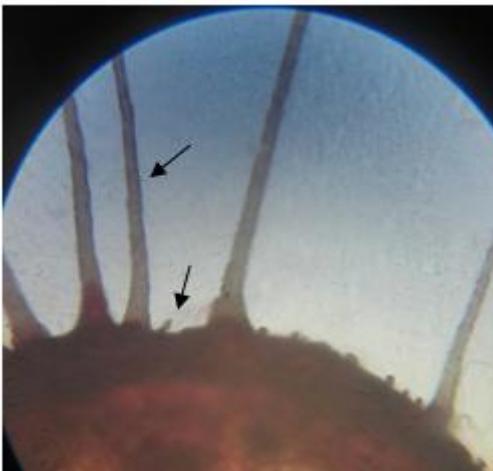
l) Multicellular filiform



m) Unicellular sessile, filiform



n) Multicellular filiform



o) Unicellular serrate papillate barrel shaped



p) Multicellular trichomes



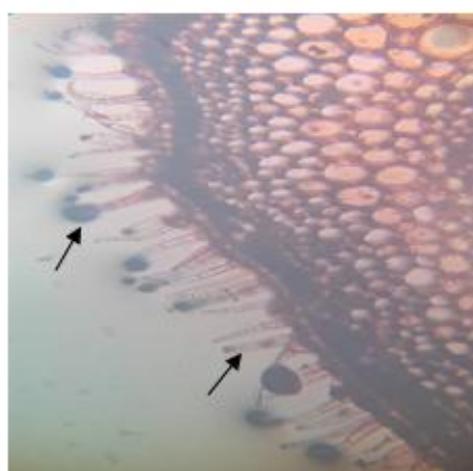
q) Multicellular filiform



r) Unicellular glandular, branched



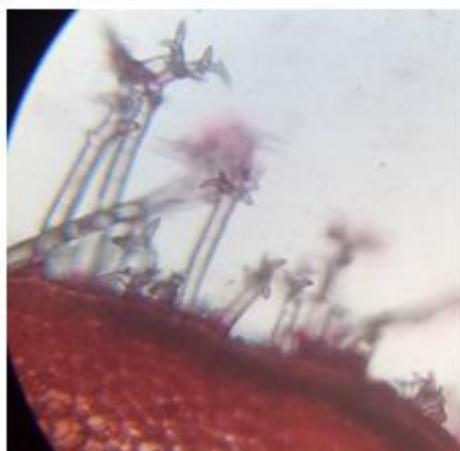
s) Multicellular filiform



t) Multicellular glandular, capitate, uniseriate



u) Multicellular glandular, capitate, uniseriate



v) Multicellular branched, non-glandular

Fig. (a-v):- a) *Abutilon indicum*, b) *Allamanda blanchetii*, c) *Arachis hypogaea*, d) *Cicer arietinum*, e) *Datura stramonium*, f) *Gossypium arboretum*, g) *Hamelia patens*, h) *Helianthus annuus*, i) *Hibiscus rosa-sinensis*, j) *Ixora coccinea*, k) *Jatropha gossypifolia*, l) *Justicia adhatoda*, m) *Lantana camara*, n) *Leucas aspera*, o) *Mimosa*

pubica, p) *Ocimum tenuiflorum*, q) *Parthenium hysterophorus*, r) *Rosa indica*, s) *Ruellia tuberosa*, t) *Solanum lycopersicum*, u) *Tridax procumbens*, v) *Withania somnifera*.

Results and Discussion

In this study trichomes types, morphology has been studied. The present study with the particular types of hair can usually delimit the species genera and even entire family. The distribution of hair is very complex in nature because different parts of the same species have different of hairs (Arunprakash S, *et al.*, 2014). This study has useful to describe the different plant hairs or trichomes, because they generally occurred on different plant parts. The highest number of trichomes has been reported in *J.gossypifolia*, *S. lycopersicum* L., *Gossypium sp.*, and *Tridax procumbens* L. containing 3 types of hairs. Our result is similar with (Arunprakash S, *et al.*, 2014). Trichomes are widely found on the aerial parts of a range of plants e.g. stem, leaf region has majority of trichomes present on it.

The present study gives the information about 11 families shown in table no.02. Total information shows that the distribution of 22 plants in 11 families from this information Asteraceae, Malvaceae, and Solanaceae family has been contained 03 plants each as well as family Apocynaceae, Rosaceae, Verbenaceae and Euphorbiaceae contains 1 plants each while Acantheceae, Lamiaceae, and Rubiaceae has been contained 02 plants each. In table no.03 and 04 types of trichomes found in studied plants species has been shown information about presence and absence of particular types of trichome in studied plant species. It has been clear that presence of unicellular type of trichome has been higher number followed by unicellular filiform trichomes shown total number of 05 trichomes. After that number of unicellular glandular trichome is 04 and unicellular sessile type of trichome has been shown total number of 03 trichomes. Followed that unicellular branched has been contained 03 and unicellular serrate and papillate has been shown 1 total number of trichomes in each.

It has been shown that, multicellular filiform type of trichome contained higher no. i.e. 06 followed that multicellular glandular and multicellular uniserrate has been shown no. 03 each. Whereas multicellular capitate has been shown total no. of trichomes 02 while multicellular branched has been shown only total no. of trichome 01 in distribution.

While multicellular sessile, multicellular conical, multicellular serrate, and multicellular papillate type of trichomes are absent.

Conclusions

The present study has been carried out with characterization of trichomes (hairs) of different vegetative parts of plants. trichomes study can be treated as diagnostic features of family different types of plants such as leaves, stem, petiole which has been used in systematic consideration uniformity within a plant group, hence are used in classification and identification of plants. Thus they have Taxonomic and Phylogenetic importance.

According to plants growing in different habitat to improve the environmental adaptability and yield of the plans, we can promote or inhabit the trichomes formation by altering the certain physiological characteristic of trichomes for different plants in the future. So it deduced from this work more comprehensive research is necessary for their further elaboration.

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The Societal Benefits and Scientific Approach to the OSF and PFZ Forecast in Catch Per Unit Efforts (CPUE) along the Coast of Ratnagiri District, Maharashtra, India.

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ABSTRACT: The OSF and PFZ is correlate to the fishing activities and after fishing activities and these information get benefits to the users. A reliable and timely forecast on the Potential Fishing Zone using satellite derived sea surface temperature and chlorophyll has become an important aspect for the fishermen. The potential fishing zone (PFZ) advisories received from Indian National Centre for Ocean Information Services (INCOIS), Hyderabad. Available information was disseminated to the fishermen community via electronic digital display boards, fax and telephonic messages at the 3 major fish landing centers (Harnai, Mirkarwada and Sakhri-Natye) of Ratnagiri district coast of Maharashtra. Feedback was collected for both the PFZ and Non-PFZ locations and OSF alert location in the prescribed format developed by INCOIS office Hyderabad. This contains name of vessel or boat, date of fishing, time of hauling, latitude and longitude, type of net used, depth of catch, distance from the coast, direction, catch in kg, major catch in kg and major variety. In the present study an attempt has been made to compare fish catch per unit efforts (CPUE) in the areas predicted by Satellite imagery (potential fishing zones PFZ) and with those of non predicted areas (outside potential fishing zones) and the OSF wave direction and height in meter min. & max. and wind speed k/h and direction is observed. An analysis of fish catch data from fishing vessels (within and outside PFZ) revealed that CPUE was higher in notified areas compared to non-notified areas in trawl as well as purse-seine net operations and OSF forecast during 2014-15 and 2015-16. Therefore the accuracy of timely forecasts of PFZ validation is important source of economic gain in fisheries and significantly useful data of OSF.

Keywords: Standardized CPUE, PFZ & OSF Forecast, Validation, Ratnagiri coast and fish catch, wave height, wave direction

Introduction

Availability of food is an important factor which controls fish occurrence, abundance and migration in the sea. The classification of water mass appears to be associated with different biological and physical processes. Sea surface temperature (SST) is one of the important parameters which drive the tropical atmosphere-ocean interaction (Pandey *et al.*, 2008). Several remote sensing techniques has been provide information regarding surface circulation features that effect of define fish habitat (Solanki *et al.*, 2008). Potential fishing zone is a technique of identifying the fish shoals depends upon certain oceanic features of chlorophyll and sea surface temperature (Solanki *et al.*, 2001a & b; Solanki *et al.*, 2003; Pillai, 2005). It is observed that the global wave field is dominated by swell waves with the swell energy. It is observed that the global wave field is dominated by swell waves with the swell energy portion of total wave energy greater than 65% almost everywhere across the World (Semedo *et al.*, 2011). In the wide continental shelf under the swell dominated situation, dissipation of wave energy is mainly by bottom friction in the absence of local wind (Ardhuin *et al.*, 2003).

During the 1980-90 it has been started to use potential fishing zones (PFZ) by using NOAA AVHRR derived SST in India (Solanki *et al.*, 1998, and according to Nath *et al.*, (1991) have used SST image to estimate for fish catch in the Arabian Sea of west coast of India. After this successful efforts, Satellite based Sea Surface Temperature (SST) images are being used as an input for locating potential fishing zones productivity and fish availability for commercial fishing operations (Pillai, 2005, Dwivedi, *et al.*, 2005). A reliable and timely fore cast on the potential fishing zones of fish aggregation have become beneficial to fishing community by reducing search time and efforts involved in catching grounds (Nayak, 2007; CCMB, 2012). The validation experiments of potential fishing zones (PFZ) forecast were carried out by using integration of chlorophyll concentration and SST image; through direct fishing efforts jointly by our laboratory with INCOIS, Hyderabad and about 70% increase catch was reported from suggested areas (Radhakrishna, 2004; Bhaware *et al.*, 2013)

There are many methods have been developed and applied for standardization, catch per unit of effort (CPUE) is an important variable in fisheries sciences, as it provides means to monitor population size trends; relative abundance of species in different habitats and sites; as well as to compare efficiency of different fishing gear (Sahu *et al.*, 2012). Standardizing CPUE including environmental variables is one of the most commonly applied

methods being used as an input data (Song & Wu, 2011). It is also often used as a relative abundance index; assumed to be proportional to stock abundance, in monitoring and assessment of fish stock (FAO, 1998; Sighan *et al.*, 2009). According to Lima *et al.*, (2000) CPUE is especially useful if the relationship between catch and effort is linear through the origin (strict proportionality). It seems a convenient approach, and one that can easily be performed whenever the assumption of similar fishing conditions is fulfilled. A based on our approach can serve as an effective abundance index for stock of fishes. The objective of this study is to develop a standardised CPUE for the fish catches of within and outside of potential fishing zones from Harnai, Mirkarwada and Sakhri-Natye fish landing centres of west coast of Ratnagiri Maharashtra. Ocean wave spectra consist of wind seas generated by local winds and swells of distant storms. Kumar *et al.* (2007) observed that the conditions in the deep water are influenced by swell, whereas in the shallow water, the influence of wind-seas is dominating in most of the study period.

Materials and Methods

The validation experiments of Potential Fishing Zones (PFZ) and Ocean State Forecast (OSF) forecast were carried out by using the PFZ and OSF information received from Indian National Centre for Ocean Information Services (INCOIS), Hyderabad (during 2014-15 and 2015-16 from January, to December except June to August and cloudy weather) for PFZ and thrice in a week (Monday, Wednesday and Friday). The OSF forecast is usually receive in mobile daily and wave rider buoy now cast receive every 5:30 hourly every day. Immediately after receiving these PFZ advisory and every day the OSF information received in their mobile services and these information were used to the fishermen by personal contacts, fax or telephone messages. These information could transfer to the specific vessels, which were selected for to conduct validation exercise in order to obtain concurrent and quantitative feedback on the total catch (species-wise) within and outside PFZ areas. The data on feedback from fishermen consists of type of craft and gear, fish catch, fishing lat. and long., distance from coast, direction and depth of catch, major catch, fish quantity and variety. According to the locality, Fish catch data pertaining to the potential fishing zones (PFZ) advisories were collected from both the boats operated within and outside PFZ in prescribed format developed by INCOIS for carrying out further quantitative analysis immediately upon fishing with experimental validations. The quality, as well as quantity and species-wise identification of fish catch were reconfirmed by personal visit on the landing centres which were drawn earlier by enumerator of the fishermen community. Monthly data of different landing centre were analysed for average CPUE and further calculations were done.

The CPUE were calculated by

$$\text{CPUE (kg/hr)} = \frac{\text{Total weight of fish catch (in kg)}}{\text{Fishing Effort (in hrs)}}$$

Catch and effort data are typically analyzed in the form of catch-per-unit effort (CPUE), which express the quantity of fish caught (in weight) by a given amount of fishing effort. For validations experiments of within and outside potential fishing zones (PFZ) three landing centres were selected, Harnai, Sakhri-Natye (for trawl operating boats) and Mirkarwada (for both trawl and purse-seine operating boats) respectively.

Results

Ratnagiri district is situated on west coast of Maharashtra, India, in which having 3 major fish landing centers (i.e. Harnai, Sakhri-Natye and Mirkarwada). Over 80 Fishermen Co-Operative Societies and one District Fisheries Federation are engaged in fishing activity. The fishing fleet consists of 2,464 mechanized and 1,563 non-mechanized fishing boats and over 67,615 fishers are serving for these fishing industries (Anon, 2007).

Quantification of advantages derived from the usage of Potential Fishing Zone (PFZ) advisories:

Total 102 PFZ forecast advisories were received during the year 2014-15 for fishing and all were used, and 71 results were advantaged. In 2014-15, PFZ advisories were received, in which 66 were used and 59 were advantaged. While in 2015-2016, 73 PFZ forecast advisories were received, 62 used and 52 were advantaged. Therefore on the basis of usage of PFZ forecast advisories and overall success in fishing was 87.36 %. The standardized CPUE has been compared in between each of the two major fishing zones, such as within and outside potential fishing zones (PFZ and outside PFZ) particularly for trawl and purse-seine fishing operations. The catch per unit efforts CPUE shows highest and most favourable oceanographic conditions for fishery

EMERGING TRENDS IN BIODIVERSITY CONSERVATION (ETBC-2019)

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resources accumulation and for fishing operations within in potential fishing zones PFZ. And result indicated that, the catch has been increased by using OSF forecast and within potential fishing zone areas (PFZ) fishing zones (PFZ) were conducted at Harnai fish landing centre (Fig. 1) during the months of April, May, November, December and January and feedback advisory data were collected from the users. Standardized CPUE of fish catch at Harnai was the higher (222.33) in the month of December and lower in April (167.70) within PFZ areas and standardized CPUE of fish catch was than outside potential fishing zone areas (outside PFZ) during the study period.

Standardized CPUE at Harnai, Mirkarwada and Sakhri-Natye fish landing centres, Trawl net catch during the year 2014-15:

The validation experiments of potential fishing zones is very high in the month of October (18.11) followed by April (15.4) from outside the PFZ areas in the Mirkarwada fish landing centre. Standardized CPUE of fish catch from Mirkarwada fish landing centre was higher in the month of October. In the Harnai fish landing centre 8.4 within PFZ and 7.2 outside PFZ in the month of January and Sakhri-Natye fish landing centre 12.5 within PFZ and outside PFZ 10.2 CPUE were observed. Therefore, the fish CPUE is recorded in the PFZ areas is and beneficial as compared to the outside PFZ.

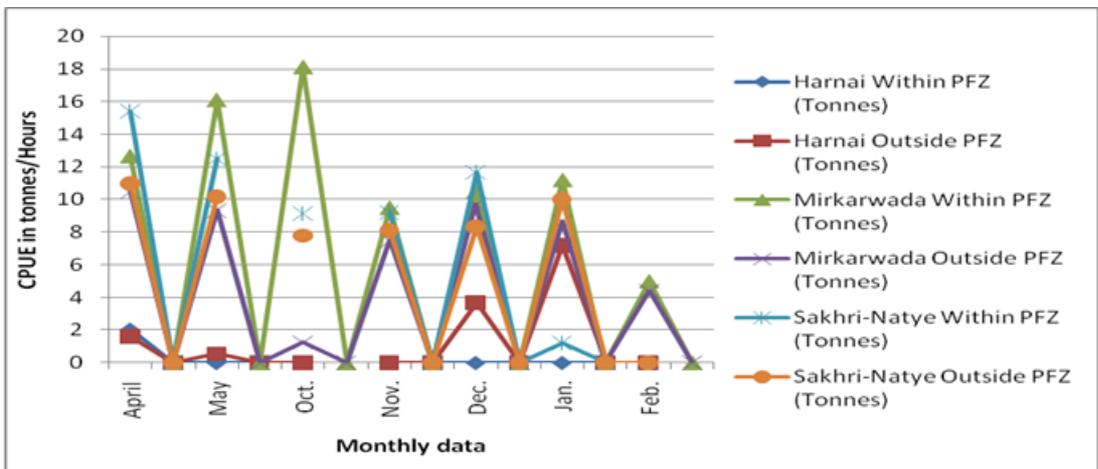


Fig. 1. Standardized CPUE (Tonnes/hr) at Harnai, Mirkarwada, and Sakhri-Natye (FLC), Trawl net catch during 2014-15.

Standardized CPUE at Mirkarwada fish landing centres, Purse-seine net catch 2014-15:

The validation experiments of potential fishing zones is very high in the month of October (12.5) followed by October (9.2) from outside the PFZ areas in the Mirkarwada fish landing centre. Standardized CPUE of fish catch is lowest recorded 5.9 within PFZ and outside PFZ 3.1 in the month of February .

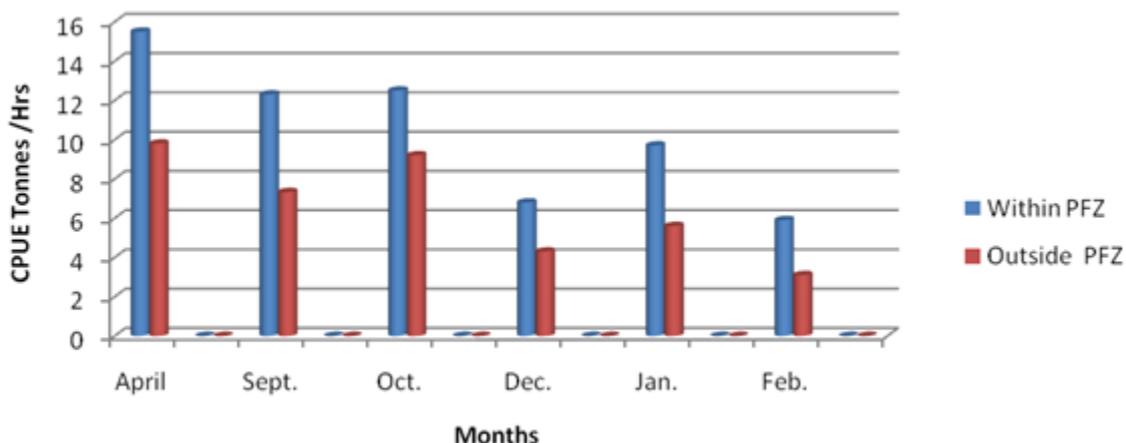


Fig. 2. Standardized CPUE (Tonnes/hr) at Mirkarwada, (FLC), Purse-net catch during 2014-15.

Significant wave height gives an estimate of the total energy, including all spectral peaks. The monthly average significant wave height (Hs), peak time period (Tp), mean wave direction (Dm) and average time period (tavg) at 7 m & 13 m water depth are given. The wave height at 10.13 m water depth is higher and the wave heights are above 2-3 m except during monsoon months. The monthly average Tp ranging from 10.02 to 15.56 s at 15 m water depth and from 7.23 to 13.6 s at 5 m water depth.

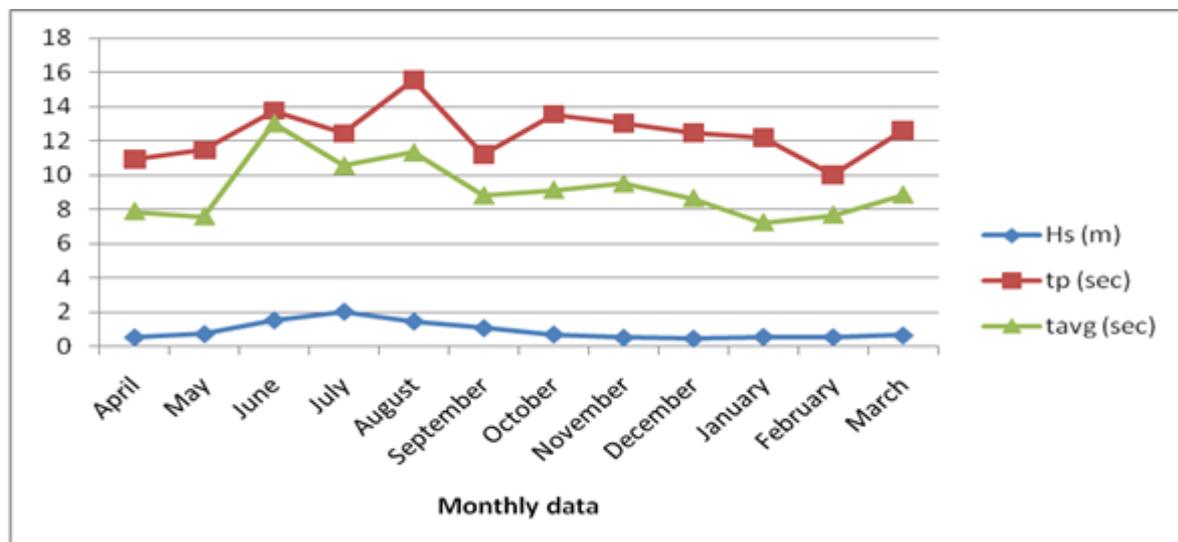


Fig. 3. Mean wave of 1 m water depth of Ratnagiri

Significant Wave Height (Hs)

In the study area highest Hs was during the monsoon period (June-September) and it is about 2 - 4 m due to the occurrence of south west monsoon at the door step of Indian subcontinent. The maximum Hs observed 3rd week of June and it is about 4 m at 15 m water depth. The annual average Hs is 0.45 m and Hs was below 1 m during January to May and from mid of October to December at 11m water depth. When waves comes to near shore (5 m water depth) which undergoes various transformation process, the highest seasonal average Hs was reduced to 1.4 m during monsoon period due to shoaling effect. The annual average Hs is 0.48 m and Hs was below 1 m except the month of June. Hs was highest in the month of July and it is about 2.02 m and there is no data for June month at 3 m depth. The directly fishermen used OSF data and get beneficial about 5,596

numbers from the Mirkarwada fish landing centres and indirectly used the fishermen's OSF information is about 3,154.

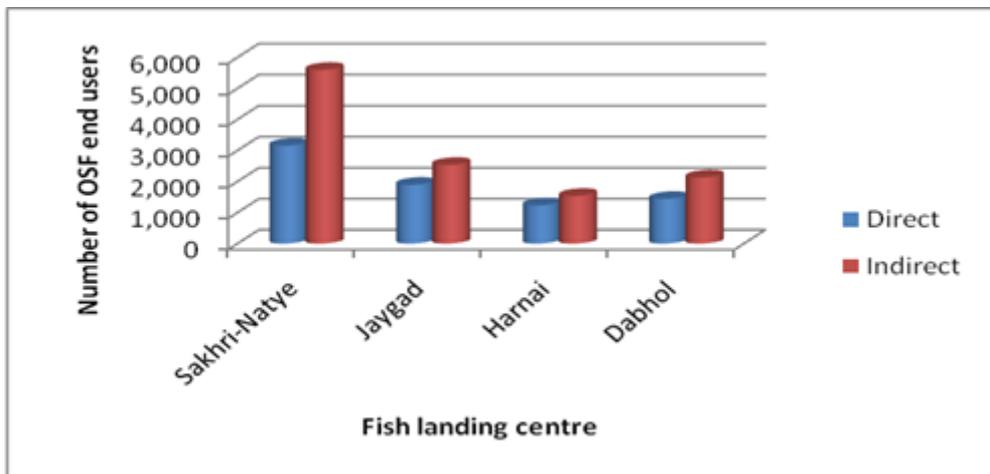


Fig. 4. Numbers of fishermens OSF utilized in Ratnagiri coast

Discussion

The development of fisheries depends upon availability of natural resources, climate, physical resources, adequate finance, suitable and new technology, growth of fishing units, extension of fishing areas, Government policies, the modern technology, growth of fishing units, extension of fishing areas and flow of the technical information to grass-root level (Nayak *et al.*, 2003). With increase in fishing fleets, there is a tremendous pressure on the traditionally known fishing grounds, which may lead to decline in CPUE. Hence, there is a need to divert some fishing efforts in other suitable potential fishing areas, which can be explored using remote sensing techniques. The OSF is monthly used from the April to March and ultimately it observed that, The peak wave period (T_p) indicates that waves are predominantly swell dominated and period is in the range 10 to 15 s. T_p was slightly higher at 3 m water depth compared to 15 m water depth. This may be due to transfer of wave energy from the spectral peak both to lower frequencies, moving the peak frequency to lower values by wave-wave interactions and similar result found) in same study region for few months observation (Amrutha *et al.* 2016). The highest T_{avg} at 7 m water depth is 10.13 s with annual average of 9.1 s whereas at 5 m water depth it is 15.9 s with annual average of 7.7 s. T_{avg} is maximum in the month of October (10.13 s) and minimum in the month of February (7.68 s) at 15 m water depth whereas at 5 m water were observed.

With the launch of Indian Remote sensing Satellite (IRS P4) on May 26, 1999 ocean colour monitor (OCM) data provided information on the basis of chlorophyll concentration and validation of Potential Fishing Zones (PFZ) forecasts are carried out by using integration of chlorophyll concentration and SST image. These advisories are being generated by using the satellite data sets from NOAA AVHRR, IRS-P4 OCM and MODIS AQUA. The SST and chlorophyll-a are derived from the NOAA AVHRR and IRS P4 OCM/MODIS AQUA respectively (Solanki *et al.*, 1998; Solanki *et al.*, 2003). Data distribution is pertaining to the coastal states directly through the fishing efforts jointly by INCOIS, Hyderabad and different institutions on regular basis. This PFZ information is distributed through the fax, telephone, prints and electronic digital display board (EDDB) to the coastal fishermen community immediately after receiving from the INCOIS. The EDDB plays a vital role in providing information in local languages. A reliable and timely forecast of PFZ advisories of fish aggregation are benefitted to the fishermen to reduce their search time for locating fish and saved fuel and effort spent in searching the fishing ground too. It has been proved and validated that, the search time for fish has been reduced by 70 % due to usage of this advisories (Radhakrishna, 2004 & Bhaware, 2013, 2015). The PFZ advisories are more beneficial within the PFZ zones than outside the PFZ zones in pelagic region in Arabian Sea near to the coast of Ratnagiri (Bhaware *et al.*, 2012 & 2015). Exploitation of fishing resources through the integration of ocean colour with sea surface temperature are becomes a more important fishing ground for fishermen community (Dwivedi, *et al.*, 2005 & 2015).

It is also observed that, the CPUE of the fishing depth (30-50 m) zone along the Ratnagiri coast were 100% followed by 80% in 50-100 m depth zone were observed in purse-seine and trawl net operation (CCMB, 2012).

At present increase in total catch CPUE in potential fishing zones PFZ were calculated and compared with mean CPUE of outside potential fishing zones PFZs and about 70% increase was reported from suggested area in 30-100 m depth zones previously reported by Solanki et al, (2003). Also it is important that the fisher folk of Ratnagiri have used 50% advisory and operated their purse-seine and trawl net in potential fishing zones area while total fisher folk of Maharashtra State fishers used only 40% PFZ forecast to extent fishing activity (CCMB, 2012). Thus, majority of active fishermen are using forecast for locating potential fishing grounds and getting substantial and benefits to fishery in the PFZ advisories areas.

To conclude from present study the standardized catch per unit efforts CPUE in purse seine and trawl net calculated and revealed that, i) the CPUE at three landing centres within PFZ is higher than outside PFZ for both the trawls and purse-seine. This indicated that, use of timely forecast PFZ advisories are beneficial for fisher folk to save time and effort are gets higher fish catch. ii) And the purse-seine net fishing percentage are more benefitted than trawl net fishing in potential fishing zones PFZ areas in pelagic fishery.

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Diversity of Aquatic Weeds in Relation to Fish Culture from Siddheshwar Dam, Hingoli District, Maharashtra

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ABSTRACT: In India, inland water in the form of ponds, lakes, and tanks with potentialities of fish culture is approximately 2.34% of total area (7.5 million hectares) of the country. Many of the water reservoirs remain either unused or not properly used for fish culture due to the lack of adequate scientific know-how. Weeds are undesirable and unwanted aquatic plants which are adopted to grow and reproduce under impounded aquatic conditions but are more harmful than beneficial for pond ecology and thus fish culture. Siddheshwar dam constructed on Purna river at Siddheshwar village in the Aundha tahsil, Hingoli district of Maharashtra state, India. Siddheshwar dam serve as an important source of several benefits and facility to the region of Hingoli, Parbhani and Nanded district. Aquatic weeds were collected from the Siddheshwar dam and the species were identified under the microscope and standard flora. Total nineteen species belonging to fifteen families of aquatic weed found in Siddheshwar dam, some are very common which are providing oxygen, food and shelter to fishes and other aquatic organisms. The fish species belonging to Order Cypriniformes was dominant in the dam and most of them are herbivorous or omnivorous in feeding habitat. Certain aquatic plants frequently desirable in fish ponds. Any slackness in controlling their excessive growth diminishes productivity of the water body. Therefore the advantages and disadvantages of aquatic weeds are also discussed in this paper.

Introduction

Water quality is critical public health concern in India. Thus, the provision of safe and adequate water contributes to better health and increased individual productivity. All forms of life are based on the requirement of water. Aquatic plants are essential parts of natural aquatic systems and form the basis of a water body's health and productivity. Invariably aquatic plants become over abundant or unsightly and require control. Aquatic weeds are those unabated plants which grow and complete their life cycle in water and cause harm to aquatic environment directly and to related eco-environment relatively (Lancar and Krake, 2002).

Aquatic plants are essential parts of natural aquatic systems and form the basis of a water body's health and productivity. On the other side, when aquatic plants become over abundant it requires control. Water is one of most important natural resource and in fact basis of all life forms on this planet. Therefore, appropriate O₂ management of water from source to its utilization is necessary to sustain the normal function of life. It is an important part of the natural resource management. The presence of excessive aquatic vegetation influences the management of water in natural waterways; manmade canals and reservoirs which amount to millions of kilometres of such water bodies. They pose serious threat to fish and fisheries. They compete with fish for water, nutrients, light, niche and oxygen and thus reduce the yields. Fish worth millions of rupees are lost every year at the hand of weed menace. Considering the losses caused by aquatic weeds, their management is of utmost importance to improve the availability of water from the source to its end users. This does not only improve availability but also the conveyance efficiency. Growth of aquatic weeds interferes with the storage and delivery systems of irrigation water, maintenance of canals, drains, barrages, lakes, ponds etc. These systems often get choked with the weeds and cause environmental pollution. On low lying areas, adjoining irrigation and drainage channels, soil salinity and alkalinity problems do arise Subhendu Datta (2014).

Aquatic weeds referred to as macrophytes constitute an important component of an aquatic ecosystem. The macrophytes are classified broadly into six groups based upon their size, shape and growth habits. Following groups are planktonic algae, filamentous algae, submersed weeds, emerged weeds, marginal weeds and floating weeds (Mandel, 2007). Aquatic weeds hinder navigation, choking rivers, irrigation channels, dams etc., impede drainage and interfere swimming recreation on water bodies. Their diversity and biomass influence primary productivity and complexities of tropic states (Cook, 1996). The fresh water resources are dynamic in nature of physico-chemical status due to environmental and anthropogenic pressure. An ecologically well balanced ecosystem supports fairly wide variety of Macrophytes but excessive growth of Macrophytes caused serious problems for water quality and pisciculture (Murphy, 1988).

Material and Methods

Siddheshwar dam, is an earthfil dam. Constructed on Purna river at Siddheshwar village in the Aundha Taluka, Hingoli district, in the state of Maharashtra in India. The river Purna, a tributary of Godavari river in the of Aurangabad district and after a winding course of about 250 miles, it joins Godavari below Purna Railway Junction. Siddheshwar dam serve as an important source of several benefits and facilities to the region of Hingoli district and Nanded district. This has been selected for carrying out the earthen type of dam. It is situated at Northern part of Marathwada region of Maharashtra. The official name of this dam is Siddheshwar Dam Do3206. The location of dam is at 1935'-19040' N latitude 7605'-770E longitude.

The present study was carried out during January to December 2016. The aquatic weeds are collected from the Siddheshwar dam. This collected material is washed with the water and dried in the paper for few days. The dried plants are stucked to prepared file and the herbarium is prepared. The algal aquatic weeds are stored in formalin for long time that they cannot spoil. The species were identified under the microscope and standard flora. The fish species were identified by using Days volume Day (1878), and Talwar & Jhingran (1991).

Results and Discussion

Total nineteen species belonging to fifteen families of aquatic weed found in Siddheshwar dam (Table 1.), some are very common which includes *Spirogyra*, *Cladophora*, *Azolla*, *Lemna*, *Potamogeton*, *Scirpus*, *Anabaena*, *Hydrilla*, *Typha*, *Ipomea*, *Panicum* and *Pharagmites* are providing oxygen, food and shelter to aquatic organisms (Plate 1.). Controlled growth of aquatic vegetation in fish ponds is usually beneficial to fishes. It helps in maintenance of healthy pond life and ecophysiology of the pond. Some of the submerged weeds are good oxygen generators. Joshi (2012) observed that in dams of Yevtmal district *Najas minor*, *Chara zeylennica*, *Spirogyra* spp., *Potamogeton diversifolius* were majorly found in most of the dams. *Nelumbo nucifer* and *Azolla imbricate* were very rarely observed in one or two of the dams. Many of these weeds survive well in the new environments and grow at a fast rate i.e. they compete with native vegetation which can lead to ecological shifts and also affect the quality of water (Uka *et. al.* 2009).

Weeds if present in limited number then they are beneficial for fish culture, as they absorb inorganic components from the soil, water or atmosphere and bring them into the food chains of the pond ecosystem. Adequate growth of weeds help the fish by forming necessary shelter during prolonged duration of sunshine. The marginal weeds are also beneficial in checking the erosion in dam exposed to wind and wind action, thus reducing the turbidity. Weeds have favourable effects on the biological purification of water and many fishes need them to deposit their eggs.

Aquatic weeds affect on aquatic ecosystem and pisciculture activity in several ways such as it affects the quality of water, increase the organic matter content of water, hindrance for water flow, water clogging, pose pollution and health problems also effect on fish production. Therefore control of aquatic weeds by manual, mechanical, chemical and biological method were needed time to time.

Present study confirms the occurrence of 37 fish species (Table 2) belonging to 19 genera, 8 families and 8 orders. Order Cypriniformes was dominant with 24 species followed by Order Siluriformes with 5 species, Order Channiformes with 4 species and Order Clupeiformes with 2 species and Order Mastacembeliformes & Perciformis by single species (Salve and Sirsat, 2018).

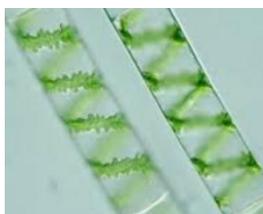
Table 1: Diversity of aquatic weeds of Siddheshwar dam in Hingoli district, Maharashtra.

Sr. No.	Family	Scientific Name	Types of weed
	Chlorophyceae	<i>Spirogyra</i> spp.	Slimy green algae
2.	Cladophoraceae	<i>Cladophora</i> spp.	Filamentous algae
3.	Salviniaceae	<i>Azolla imbricate</i>	Floating hydrophytes
4.	Lemnaceae	<i>Lemna minor</i>	Floating hydrophytes
5.	Potamogetonaceae	<i>Potamogeton diversifolius</i>	Rooted floating leaf
6.	Potamogetonaceae	<i>Potamogeton Crispus</i> L.	Rooted floating leaf
7.	Cyperaceae	<i>Scirpus articulatus</i>	Rooted emergent
8.	Cyperaceae	<i>Eleocharis plantoginea</i>	Rooted emergent
9.	Polygonaceae	<i>Polygonum amphibium</i> L.	Rooted emergent
10.	Nostocaceae	<i>Anabaena</i> spp.	Submerged species
11.	Hydrocharitaceae	<i>Elodea Canadensis</i>	Submerged species

12.	Characeae	<i>Chara zeylennica</i>	Submerged species
13.	Hydrocharitaceae	<i>Vallisneria spiralis</i>	Submerged species
14.	Najadaceae	<i>Najas minor</i>	Rooted submerged
15.	Hydrocharitaceae	<i>Hydrilla verticillata</i>	Rooted submersed
16.	Convolvulaceae	<i>Ipomoea aquatica</i>	Rooted hydrophytes
17.	Typhaceae	<i>Typha spp.</i>	Marginal s species
18.	Paniceae	<i>Panicum purpurascens</i>	Amphibious m.species
19.	Graminaea	<i>Pharagmites communis</i>	Amphibious m.species

Plate No. 1: Common weed species from Siddheshwar dam in Hingoli district.

Spirogyra



Cladophora



Azolla



Lemna



Potamogeton



Scirpus



Anabaena



Hydrilla



Typha



Ipomea



Panicum



Pharagmites



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Table 2 : Ichthyofauna of Siddheshwar dam in Hingoli district, Maharashtra*.

Order	Family	Species
Order-I: Clupeiformes Suborder: Notopteroidei	Family –I Notopteridae	1) <i>Notopterus Notopterusi</i> (Palls) 2) <i>Notopterus chitala</i> (Ham.)
Order-II: Cypriniformes Suborder: Cyprinoidei	Family –II Cyprinidae	3) <i>Chela phulo</i> (Ham.) 4) <i>Chela saldoni</i> (Day) 5) <i>Cyprinus carpio</i> (Linn) 6) <i>Catla catla</i> (Ham.) 7) <i>Cirrhinus mrigala</i> (Ham.) 8) <i>Cirrhinus reba</i> (Ham.) 9) <i>Discognathus lamta</i> (Ham.) 10) <i>Discognathus modestus</i> (Hackel.) 11) <i>Labeo rohita</i> (Ham.) 12) <i>Labeo calbasu</i> (Ham.) 13) <i>Labeo boggut</i> (Ham.) 14) <i>Osteobrama cotio</i> (Ham.) 15) <i>Puntius amphibias</i> (Valeneiennes) 16) <i>Puntius chola</i> (Ham.) 17) <i>Puntius jerdoni</i> (Day.) 18) <i>Puntius sarana sarana</i> (Ham.) 19) <i>Puntius ticto ticto</i> (Ham.) 20) <i>Puntius sophore</i> (Ham.) 21) <i>Thynnichthys sandkhol</i> (Skyes) 22) <i>Rasbora daniconius</i> (Ham.)
	Family- III: Cobitidae	23) <i>Lepidocephalichthyes guntea</i> (Ham.) 24) <i>Nemacheilus botia</i> (Ham.) 25) <i>Nemacheilus aureus</i> (Ham.) 26) <i>Nemacheilus beavani</i> (Ham.)
Order:-III: Siluriformes	Family- IV: Bagridae	27) <i>Mystus cavasius</i> (Ham.) 28) <i>Mystus seenghala</i> (Skyes.) 29) <i>Mystus vittatus</i> (Bloch.)
	Family- V: Siluridae	30) <i>Wallago attu</i> (Bloch. & Schneider.) 31) <i>Ompak bimaculatus</i> (Bloch.)
Order:-IV: Channiformes	Family- VI: Channidae	32) <i>Channa gaucha</i> (Ham.) 33) <i>Channa marulius</i> (Ham.) 34) <i>Channa punctatus</i> (Bloch.) 35) <i>Channa stratus</i> (Bloch)
Order:-V: Mastacembeliformes	Family- VII: Mastacembelidae	36) <i>Mastacembelus armatus</i> (Lacepede.)
Order:-VI: Perciformes	Family- VIII: Gobiidae	37) <i>Glassogobius giuris</i> (Ham.)

* Cited from Ichthyofauna of Hingoli District, Maharashtra (Salve and Sirsat, 2018)

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Effect of Cisplatin on Glycogen Contents in Freshwater Bivalve, *Corbicula Striatella* (Deshayes 1854)

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ABSTRACT: Biochemical estimation of cisplatin induced nephrotoxicity well known side effects in freshwater bivalve *Corbicula Striatella* were exposed to acute dose of cisplatin one of the ingredients of anticancer drug (1.884 PPM) acute treatment of 24 and 96 hours and chronic treatment 7, 14 and 21 days. The various tissues such as the mantle, gills, foot, ovary, testis, digestive glands and whole body of the bivalves were separated, dried in the oven and their glycogen contents were estimated. Except gills, cisplatin reduced the glycogen contents from most of the tissues of *corbicula striatella* overall reduction in the glycogen depot was observed. The most affected tissue in which the great depletion observed was digestive glands.

Keywords: Glycogen, cisplatin, *corbicula striatella*

Introduction

Cisplatin are the anticancer drug induced nephrotoxicity is well-known side effect which is excess dose are harmful or injurious molluscs. The evaluation of LC50 concentrations of anticancer drugs or toxicant is the first step before carrying further studies on physiological changes in animals. Cisplatin, cis-diamminedichloroplatinum II (Cis- DDP), Platinum containing co-ordination complex are effective antitumour agents utilized in the treatment of a wide variety of malignancies but antibiotics and anticancer drugs are affect the bivalve or increase the death rate because the depleted the physiological ions and glycogen and other content.

Materials and Methods

The cleaned animals were then kept for depuration for 12hrs in laboratory conditions under constant aeration. For biochemical analysis, animals were dissected and soft body tissues like matle, gill, foot, ovary, testis, wholebody, and digestive gland, were removed. 100mg of each wet tissues were taken for biochemical analysis. Glycogen was determined by the anthron reagent Standard deviations were calculated during variations of of chronic as well as acute dose of exposure in *Corbicula Striatella*.

a) Acute exposure to Cisplatin

The healthy bivalves, *Corbicula striatella* were exposed to acute treatment (LC50/2) of Cisplatin (1.884 PPM).

b) Chronic exposure to Cisplatin

The acclimatized *Corbicula striatella* were exposed to (LC50/10) concentration of cisplatin was (1.884 PPM) up to 21 days. During exposure periods, no special food was provided and the water with required concentration of cisplatin was changed daily in the experimental set and also from control. Control set was provided with dechlorinated water only without addition of any antibiotics. After 24 and 96 hours of acute and after 7, 14and 21 days of chronic exposure, the mantle, gill, foot, testis, ovary, digestive gland and the whole body was isolated blotted to remove excess water and dried in oven at 80 OC till constant weight was obtained. All tissues were ground separately into fine powdered form and glycogen contents were estimated. Glycogen was estimated by Anthrone reagent method as given by Zandee 1972.

Glucose was used as a standard and the amount of glycogen was calculated by multiplying the glucose value by the factor 0.927. Determinations in triplicate were performed on one homogeneous sample of glycogen as well. The variations in the values for glycogen from different tissues (standard deviations as denoted in Table was proved statistically by computing a mean square for each part of the table by pooling the standard deviations. Significant difference in glycogen contents were computed at 0.001, 0.01& 0.05 level.

Discussion

In bivalves, are filter feeder and habitat under aquatic mode of life easily available at laboratory under strictly control laboratory conditions the bivalve acute and chronic exposure are completed then ready for biochemical estimation. (Sinderman 1996; Oliver et.al., 2001). Excess anticancer drugs are harmful to reduction glycogen content and disease expression in internal mechanisms (Fisher 2000). Cell proliferation is critical to repair processes following damage caused by toxic and pathogenic agents and in carcinogenesis (Butterworth 1991). Glycogen specifically expressed during cell proliferation, especially in mammals, have been well studied because of their roles in the control of cell division and inhibitory impacts by drugs (Baez 1996). The decrease in glycogen might be due to great breakdown of glycogen in the digestive gland subjected to glycogenolytic activity reduces the aerobic metabolism due to pollutants. 5- fluorouracil drugs. (Kabeer et al., 1977). The results obtained in the present investigations response to the stress; however, no literature is available on such action of antibiotics on invertebrates. *L. corrianus* upon exposure to cisplatin (acute & chronic) showed the decrease in the level of glycogen except gill.

The body reserves from different tissues of *Corbicula Striatella* are channelized from one organ to other as per their requirement for energy or synthesis of certain compounds. The artificial pearl culture is progressing very fastly to tackle a problem of sale demand ratio. During post-operative care bivalves used to expos to certain antibiotics. During which there are high chances of bivalve mortality.

Results

Table indicates changes in glycogen level of different tissues of *Corbicula Striatella*. On acute and chronic exposure to cisplatin. In the glycogen contents were reduced in foot, ovary, testis and digestive gland except gills. Gills showed the increase in glycogen content after acute and chronic exposures. The ovary showed high glycogen lytic activity (34.74 %) after acute treatment. The chronic exposures lead towards the high depletion in digestive gland (47.69 %), ovary (40.0%) the whole body (31.56 %) and testis (21.16%). there was initial increase in glycogen contents in mantle and gills after acute treatment but decrease after chronic treatment. The maximum glycogen level depletion occurred in ovary followed by testis and digestive gland. In ovary the content reduced after 21 days exposure was 67.39 % while the whole body, testis and digestive gland showed 59.99, 52.66 and 48.52% decrease respectively. Changes in glycogen levels in different tissues after exposure to cisplatin indicate metabolic changes and channelization of glycogen to different tissues. Digestive gland being a site of detoxification of toxicants, showed maximum depletion of glycogen. On the contrary the probable reason to increase glycogen content in mantle and gill initially, due to response against the external stimuli posed by the water rich in cisplatin. The change in biochemical composition is an indicator of stress of chemical or physical nature in the surrounding which mainly affects glycogen contents.

Conclusion

The glycogen are the tissue repair and construction of the cell component. In Mollusca high glycogen demand of gonadal tissue are found in all over tissues in whole seasons because gonads are highly valuable tissues of growth, reproduction and development of bivalves but overall observation in this experiment acute dose is minimum useful for treatment of body but some side effects in physiological condition and chronic dose are highly serious due to the depletion of glycogen level.

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Observation Table

Table Impact of cisplatin on glycogen content (mg/100mg of powder) of *corbicula striatella* after acute and chronic exposure.

Tissue	24 hrs		96 hrs		7 Days		14 Days		21 days	
	Control	Cisplatin	Control	Cisplatin	Control	Cisplatin	Control	Cisplatin	Control	Cisplatin
M	12.354±0.81 1	10.554±0.65 3 -16.273***	12.256±0.74 8	10.699±0.463 -11.1152*	11.668±0.95 0	6.298±0.511 -51.249***	11.589±0.653	9.878±0.986 -21.8190**	10.561±0.91 5	9.816±0.827 -7.7925*
G	9.518±0.760	10.849±0.87 9 +15.625**	9.5100±0.34 4	11.270±0.41. 5 +20.690	8.9160±0.48 7	8.761±439 +7.855**	7.8620±0.831 9	8.769±0.945 8 +13.220	6.8837±0.14 2	8.0327±0.19 0 +19.529
F	7.4752±0.26 1	5.417±0.178 -31.821***	7.486±0.240	7.401±0.237 -1.2341*	6.468±0.106	6.149±0.166 -5.848**	5.845±0.146	5.210±0.390 -13.107*	5.004±0.585	4.19±0.309 -20.190*
O	13.466±0.33 2	10.813±0.32 0 -21.282***	13.347±0.70 4	9.057±0.499 -34.742***	15.976±0.04 3	13.952±0.34 4 -13.515***	15.886±0.696	13.320±1.04 5 -17.2348**	13.992±1.30 7	8.795±0.190 -40.000**
T	18.186±0.26 1	16.78±0.629 -8.1639*	18.689±0.24 0	13.714±1.246 -28.1247**	16.101±1.06 9	15.167±0.73 0 -6.1843NS	15.151±1.426	13.300±0.58 -13.083*	13.182±1.85 2	10.556±0.43 9 -21.562*
WB	12.327±0.58 2	10.25±0.285 -18.270**	11.150±0.76 0	8.404±0.237 -27.051**	11.026±0.58 2	10.169±0.28 5 -8.538*	10.052±0.000	7.488±0.166 3 -28.320**	6.2786±0.97 4	4.612±0.124 -31.569*
DG	10.657±0.62 9	9.746±0.570 -9.4335**	10.560±0.82 0	8.482±0.641 -21.7394**	10.699±0.62 9	9.363±0.606 -13.773***	9.656±0.772	6.626±0.558 -35000***	5.002±0.475	3.093±0.027 -47.692**

M= Mantle;G=Gill;F=Foot;O=Ovary;T=Testis;WB=Whole body;DG=Digestive gland. Values are expressed as mg/100mg dry weight of tissues. ± indicates standard deviation of three independent replications. +or - indicates % variation over control. Significance: * P < 0.05; ** P < 0.01; *** P 0.001; NS = Non-significant

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Taxonomic Algal Diversity Orders Volvocales, Tetrasporales, Euglenales, Chryomonadales and Peridinales in Dimbhe dam from Ambegaon Tehsil of Pune District (Maharashtra)

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ABSTRACT: The Ambegaon tehsil in Pune District situated in between 19°7'0" Northern 73°44'0" Eastern latitude on the northern part of Deccan Plateau and composed of undulating hills. Ambegaon tehsil covers the area from Bhimashankar to Lakhanpur. This tehsil has survived with the blessings of Kulguru Shree Khanderaiya of Bhimashankar. Agriculture is the main occupation of this region. Adivasi Tribes found in large number in this region. Attempts have been undertaken to bring out the Algal flora of this region. Periodical collections of algae from the study area were done from April 2014 to October 2015 at Dams as well as Rivers, Lake's, Puddles, Pulls etc. from Ambegaon Tehsil. The 47 species, 04 varieties belonging to 15 genera of 09 families from 05 orders of 04 classes from 04 divisions. Family Euglenaceae includes 04 genera, 26 species and 03 varieties while family Ceratiaceae and Haematococcaceae include only 1 genus and 1 species; Euglena is more densely occur in Ambegaon tehsil.

Keywords: Pune, Ambegaon, Euglena, Bhimashankar, Peridinales, Haematococcus

Introduction

Planktonic algal (sample) collection was made by using plankton net of blotting silk cloth 25 meshes/linear inch and analyzed qualitatively. Phytoplanktons were collected by using phytoplankton net from surface waters of impoundments. Collected samples were investigated from September 2017 to October 2018. The present investigation is undertaken with keep in mind that to study the algal population from Dimbhe Dam & its surrounds stations of study area.

Materials and Methods

The collected algal samples were preserved in a mixture of 50 ml of 95% ethyl alcohol, 5 ml of glacial acetic acid, 10 ml of 40% commercial formalin and 35 ml of distilled water.

The specimens are observed under microscope for 10X, 40X, 100X and Photographs were taken with the help digital camera under appropriate magnifications. The Vaucher specimens have been deposited at Dept. of Botany, Hon. Baladaheb Jadhav College, Ale, Tal. Junnar, Dist. Pune.

Periodical collections of algae from the study area were done from the Dams as well as Rivers, Lake's, Puddles, Pulls etc. from Ambegaon Tehsil. Sampling stations were carried away. The samples were bringing to laboratory for identification; Identification of specimens was mostly based on the keys given in standard monographs & literatures like Desikachari (1959), Randhawa (1959), Venkatraman (1961), Prescott (1951), Ramnathan (1964), Bourrilly (1970), Philipose (1967), Gonzalves (1981), Iyengar and Desikachari (1981), Desikachari et al (1990), Anand (1998) and Sarode and Kamat (1984).

List of Algal Specimens

Sr. No.	Name of Algal Specimen
1	<i>Volvox aureus</i> Ehrenberg
2	<i>Volvox globator</i> Linnem. Ehrb.
3	<i>Gonium pectorale</i> Muller
4	<i>Gonium sociale</i> (Duj.) Warming in Bot.
5	<i>Pandorinamorum</i> (Muller) Bory
6	<i>Eudorinaelegans</i> Ehrenberg
7	<i>Chlamydomonas globosa</i> Snow
8	<i>Chlamydomonas polypyrenoideum</i> Prescott

9	<i>Chlamydomonassphagnicola</i> Fritsch and Takeda
10	<i>Sphaerellopsisiyengarii</i> Balakrishnan
11	<i>Haematococcuslacustris</i> (Girod) Rostafinski
12	<i>Gloeocystisampla</i> (Kuetz) Lagerheim
13	<i>Sphaerocystisschroeteri</i> Chodat
14	<i>Euglena acus</i> Ehrenberg
15	<i>Euglena acus</i> Ehrenberg v. <i>rigida</i> Huebner
16	<i>Euglena geniculata</i> Dujardin
17	<i>Euglena gracilis</i> Klebs
18	<i>Euglena limnophila</i> Lemm.
19	<i>Euglena minuta</i> Prescott
20	<i>Euglena oblonga</i> Schmitz
21	<i>Euglena oxyuris</i> Schmarda
22	<i>Euglena polymorpha</i> Dangeard
23	<i>Euglena proxima</i> Dangeard
24	<i>Euglena rostrifera</i> L.P. Josnson
25	<i>Euglena sanguinea</i> Ehrenberg
26	<i>Euglena satelles</i> Brast. Spect
27	<i>Euglena spiroides</i> Lemmermann
28	<i>Euglena tuba</i> H. J. Carter
29	<i>Lepocinclis fusiformis</i> (Carter) Lemmermann
30	<i>Lepocenalis texta</i> (Duj.) Lemm
31	<i>Phacus curvicauda</i> Swireenko
32	<i>Phacu shelicoides</i> Pochmann
33	<i>Phacus lismorensis</i> Playfiar
34	<i>Phacus longicauda</i> (Ehrens.) Dujardin
35	<i>Phacus longicauda</i> (Ehr.)Dur.v. <i>insecta</i> Hub Pestaio
36	<i>Phacus pulcher</i> Roll
37	<i>Phacusranula</i> Pochm
38	<i>Phacus swirenkoi</i> Skvortzow
39	<i>Phacus tortus</i> (Lemm) Skvortzow
40	<i>Trarhelomonas dubia</i> (Swir.)Deflandre
41	<i>Trarhelomonas intermedia</i> Dangeard
42	<i>Trachelomonas rotunda</i> Swireenko
43	<i>Trachelomonas volvocina</i> Ehr.v. <i>punctate</i> Playfair
44	<i>Mallomonas acaroides</i> v. <i>maskovensis</i> (Wermel) Krieger
45	<i>Mallomonas tonsurata</i> Teiling
46	<i>Glenodinium borgei</i> (Lemm.) Schiller
47	<i>Glenodinium pulvispculus</i> (Ehrens) Stein
48	<i>Glenodinium quadridens</i> (Stein) Schiller
49	<i>Peridinium cinctum</i> (Muell.) Ehrenberg Slein
50	<i>Peridinium pusillum</i> (Penard) Lemmermann
51	<i>Ceratium hirundinella</i> (O.F. Muell.) Dujardin

Summary and Conclusion

Since the dawn of civilization, water has been the most important raw material for civilization. It is one of the vital sources of all kinds of life on the earth. Economically, culturally and biologically water is most useful natural resource on the earth. We use water for drinking, bathing, cooking, cooling, irrigation, transportation, energy power and recreation. Thus, water is nature's gift to the living world including human race. Our biosphere consists of 71 % of water out of which fresh water environment occupied only 2.6 %. For the usable purpose only 0.62 % water from lakes, streams, rivers and other resources are available for the living organisms.

EMERGING TRENDS IN BIODIVERSITY CONSERVATION (ETBC-2019)

Organized by Department of Botany, K.J. Somaiya College of Arts, Commerce and Science, Kopergaon

In India most of the cities, towns, villages and industries are situated at the bank of rivers and lakes. Due to uncontrolled population, the huge quantity of untreated sewage is being added everyday in these different water reservoirs. Besides these, industrial wastes, residues of insecticides, pesticides, excess agricultural fertilizers also added in these fresh water eco-systems causing pollution and creates health hazards.

Present study is on the taxonomic data of algal species were collected from Dimbhe Dam, It is located on Ghod River at Dimbhe 11 kms away from Ghodegaon in Ambegaon Tehsil. Water samples were collected periodically from above this sampling station. For qualitative analysis, water samples were collected separately in the bottles. Collections were done from streams, rivers, ponds, puddles, and impoundments during and after monsoon season from Ambegaon Tehsil of Pune District. Algae of different habitats were collected from these localities such as - planktonic, benthic, epiphytic and from epiphyllous .

Quantitative estimation was done for phytoplankton by Lackey's drop method (Lackey, 1938). Algal identification was carried out by using standard literature and monographs. Microphotographs of algal plants encountered during investigation period were taken. I have collected 51 algal specimens. The 47 species, 04 varieties belonging to 15 genera of 09 families from 05 orders of 04 classes from 04 divisions .

Conclusions

- ❖ This research work helps us to know type of algal flora of the study area.
- ❖ The data gathered serves as base line data for planning utilization and conservation strategies of algae.
- ❖ Phytoplankton studies helps us to know primary producers (Qualitatively and quantitatively) of the study area.
- ❖ This research work may help all the phycological students to study the algal vegetation in Ambegaon.

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Taxonomic Algal Diversity of Orders Chaetophorales, Cladophorales, Oedogoniales, Charales from Junnar and Ambegaon Tehsils of Pune District (Maharashtra)

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ABSTRACT: The Junnar tehsil in Pune District is situated between 19°11'59" Northern 73°52'47" Eastern latitude on the northern part of Deccan Plateau & composed of undulating hills. Junnar tehsil is famous for its wells and Dams. The famous and historical fort of Shivneri where Shivaji Maharaj was born is in this region. There is also a Satellite Center in Arvi. The Ambegaon tehsil in Pune District situated in between 19°7'0" Northern 73°44'0" Eastern latitude on the northern part of Deccan Plateau and composed of undulating hills. Ambegaon tehsil covers the area from Bhimashankar to Lakhanpur. This tehsil has survived with the blessings of Kulguru Shree Khanderaiya of Bhimashankar. Agriculture is the main occupation of this region. Adivasi Tribes found in large number in this region. Periodical collections of algae from the study area were done from April 2014 to October 2015 at Dams as well as Rivers, Lake's, Puddles, Pulls etc. from Junnar and Ambegaon Tehsils.

Keywords: Chaetophorales, Cladophorales, Oedogoniales, Charales, Junnar, Ambegaon, Pune, Maharashtra.

Introduction

Filamentous algae were collected from mass growths by hand. Sub-aerial algae growing attached to tree barks, on damp walls or other such substrata were collected by scraping with a scalpel and then picked up with the help of a forceps. Hand collected samples were investigated from April 2014 to October 2015. The present investigation is undertaken with keep in mind that to study the algal population from selected stations of study area.

Attempts have been undertaken to bring out the Algal flora of this region. Collections of freshwater algae were done from streams, rivers, ponds, puddles, and impoundments during and after monsoon season from Junnar and Ambegaon tehsils of Pune District. Algae of different habitats were collected from these localities such as - planktonic, benthic, epiphytic, terrestrial, epiphyllous and from tree-trunk. Quantitative Analysis of phytoplanktons was done of the following impoundments - Manikdoha Dam, Yedgaon Dam, Dimbhe Dam, Pimpalgaon joga Dam.

Materials and Methods

The samples were preserved in a mixture of 50 ml of 95% ethyl alcohol, 5 ml of glacial acetic acid, 10 ml of 40% commercial formalin and 35 ml of water. The specimens are observed under microscope for 10X, 40X, 100X and Photographs were taken with the help digital camera under appropriate magnifications. Identification of specimens was mostly based on the keys given in standard monographs & literatures. The Voucher specimens have been deposited at Dept. of Botany, Hon. Baladaheb Jadhav College, Ale, Tal. Junnar, Dist. Pune.

Periodical collections of algae from the study area were done from the Dams as well as Rivers, Lake's, Puddles, Pulls etc. from Junnar Tehsil. Sampling stations were carried away. The samples were bringing to laboratory for identification; Identification was done with the help of Indian monographs and other standard literature like Desikachari (1959), Randhawa (1959), Venkatraman (1961), Prescott (1951), Ramnathan (1964), Bourrilly (1970), Philipose (1967), Gonzalvies (1981), Iyengar and Desikachari (1981), Desikachari *et al* (1990), Anand (1998) and Sarode and Kamat (1984). The collected algal forms had been preserved in 4% formalin.

Algal samples were collected from various freshwater biotopes *viz.* ditches, puddles, pools, ponds, reservoirs, waterfalls, streams, rivers, paddy fields, moist soil, swamps and marshes of Study area. Periodical collections of algae from the study area were done. Identification was done with help of Indian monographs on India algae and other standard literature.

I have collected 25 algal specimens in which 22 species, 02 varieties 1 forma. belonging to 11 genera of 05 families from 04 orders of 02 classes in 01 division. Family Oedogoniaceae includes 02 genera 06 species 01

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Variety and 01 forma, while Family Coleochaetaceae includes 01 genera and 01 species, Oedogonium is more densely occur in Ambegaon and Junnar tehsils.

List of Algal Specimens

Sr. No.	Name of Algal Specimen
1	<i>Stigeoclonium attenuatum</i> (Hazen) Collins
2	<i>Stigeoclonium nanum</i> Kuetzing
3	<i>Stigeoclonium polymorphum</i> (Franke) Heering
4	<i>Chaetophora elegans</i> (Roth) C. A. Agardh
5	<i>Aphanochaete repens</i> A. Braun
6	<i>Coelochaete nitellarum</i> Jost
7	<i>Oedogonium brunelii</i> Gonz. and Jain.
8	<i>Oedogonium curtum</i> Wittrock
9	<i>Oedogonium epiphyticum</i> Trans. and Tiff
10	<i>Oedogonium kunmingenae</i> Zhu.
11	<i>Bulbochaete kosmoceps</i> Skuja
12	<i>Bulbochaete setigera</i> (Roth) C. Agardh
13	<i>Pithophora mooreana</i> Collins
14	<i>Pithophora oedogonia</i> (Mont.) Wittrock
15	<i>Pithophora varia</i> Wille
16	<i>Rhizoclonium crassipellitum</i> West and West
17	<i>Rhizoclonium fontanum</i> Kuetzing
18	<i>Rhizoclonium hookeri</i> Kuetzing
19	<i>Chara canescens</i> Desvaux and Loiseleur Deslongschamps
20	<i>Chara coralline</i> Wildenow in Mem. AC. Roy.
21	<i>Nitella furcata</i> (Roxb. and Bruzelius) Agardh
22	<i>Nitella hyalina</i> (De Cond.) Agardh.
23	<i>Cladophora fracta</i> (Dillw.) Kuetzing v. <i>lacustris</i> (Kuetz.) Brand ex Heering
24	<i>Bulbochaete alabamensis</i> Transand Brownv. <i>belgaumense</i> Gonz. and Sonn.
25	<i>Oedogonium tinuissimum</i> Hansg. Notarisia, Hirn. f. <i>indicum</i> Gonz. and Jain

Summary and Conclusions

Since the dawn of civilization, water has been the most important raw material for civilization. It is one of the vital sources of all kinds of life on the earth. Economically, culturally and biologically water is most useful natural resource on the earth. We use water for drinking, bathing, cooking, cooling, irrigation, transportation, energy power and recreation. Thus, water is nature's gift to the living world including human race. Our biosphere consists of 71 % of water out of which fresh water environment occupied only 2.6 %. For the usable purpose only 0.62 % water from lakes, streams, rivers and other resources are available for the living organisms.

In India most of the cities, towns, villages and industries are situated at the bank of rivers and lakes. Due to uncontrolled population, the huge quantity of untreated sewage is being added everyday in these different water reservoirs. Besides these, industrial wastes, residues of insecticides, pesticides, excess agricultural fertilizers also added in these fresh water eco-systems causing pollution and creates health hazards.

Present study is on the taxonomic data of algal species were collected from

Station S1: Dimbhe Dam, It is located on Ghod River at Dimbhe 11 kms away from Ghodegaon in Ambegaon Tehsil.

Station S2: Manikdoh Dam, It is located on Kukadi River at Manikdoh 7 kms away from Junnar in Junnar Tehsil.

Station S3: Pimpalgaon Joge Dam, It is located on Pushpavati (Aar) River near Joge, at Nagar-Kalyan Highway, 25 kms away from Alephata & 10 kms away from Junnar in Junnar Tehsil.

Station S4: Wadaj Dam, It is located on Meena River at Wadaj 5 kms away from Junnar in Junnar Tehsil

STATION S5: Yedgaon Dam, It is located on Kukadi River at Yedgaon 10 kms away from Alephata in Junnar Tehsil.

Water samples were collected periodically from above five sampling stations. For qualitative analysis, water samples were collected separately in the bottles. Collections were done from streams, rivers, ponds, puddles, and impoundments during and after monsoon season from Junnar and Ambegaon Tehsils of Pune District. Algae of different habitats were collected from these localities such as - planktonic, benthic, epiphytic, terrestrial, epiphyllous and from tree-trunk.

I investigated 5 impoundments (in this study area) and it's nearby water bodies out of these Manikdoh Dam shows more diversity of algal plants. While Pimpalgaon Joge Dam shows less number of algal plant diversity.

Conclusions

- ❖ This research work helps us to know type of algal flora of the study area.
- ❖ The data gathered serves as base line data for planning utilization and conservation strategies of algae.
- ❖ Phytoplankton studies helps us to know primary producers (Qualitatively and quantitatively) of the study area.
- ❖ This research work may help all the phycological students to study the algal vegetation in Junnar and Ambegaon.

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Some Ethno-Veterinary Plants from Toranmal Plateau, Nandurbar District, Maharashtra, India

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ABSTRACT: A survey has done on veterinary medicinal plants of Toranmal Plateau of Nandurbar district, Maharashtra, India. When data was collected, attention given to the specific diseases of animal, because domestic animals are valuable to the tribal people. Some common diseases like bone fracture, stomach ache, wounds, lactation, loose motion, maggotted wounds, retention of placenta etc. are very common. About 46 plant species are found to be used by tribal people in the Toranmal plateau.

Keywords: Ethno- veterinary, Toranmal plateau.

Study Area

Toranmal plateau is a part of Nandurbar which is the newly constituted district in the state of Maharashtra. As much as 65% of the population of the district is tribal. Satpuda Mountain is a range of hills in central India. The range rises in eastern Gujarat state near the Arabian Sea coast, running east through the border of Maharashtra and Madhya Pradesh to the east till Chhattisgarh. Satpuda Range, range of hills, part of the Deccan plateau, western India. The hills stretch for some 560 miles (900 km) across the widest part of peninsular India, through Maharashtra and Madhya Pradesh states. The district can be divided into hilly tracts and undulating plain areas. The hillocks of Satpuda are flat-topped and plain. Highest elevation is recorded at Toranmal hills rising up to 3373 ft. with a lake on its top. Very small part of Narmada basin is towards the west. The name of Satpuda is given because of the seven folds forms the watershed between Narmada (north) Tapi (south) rivers.

Toranmal Plateau is one of the important plateaus in mid Satpuda in northern Maharashtra. This plateau forms a table land and summit covering about 41 Sq.Km. area at 1155 meter altitude (AMSL). It lies in western Satpuda Mountain which is a horst block between Narmada graban on north and Tapi in the south. Because of its scenic beauty it has a long historical background. Formerly, it is believed to be capital of King Yuvanashav during Mahabharata period. The total plateau summit area covers 41 Sq. Km. and extend between 21o 54' North to 21o 61' latitude and 74o 26' to 74o 34' East longitude. This is one of the best hill stations and famous tourist resort in North Western Maharashtra, 55 Km. from Shahada Tahsil and 90 Km North of Nandurbar district (Anonymous, 2010).

Toranmal plateau is confined by the escarpment from all sides that can be grouped as northern, southern, eastern and western escarpment, forming an inseparable land of the plateau.

Nandurbar district comprises of major portion of Satpura ranges. The Satpuda is a broad belt of mountainous land stretching east west in a wall like manner on the northern side of the river Tapi. Satpuda Mountain forms about seven major folds with an average height of 600 m above sea level and slope down steeply towards river Narmada in North. Two of these ranges of hills unite at Toranmal and enclose an irregular tableland of about 50 km long and 25 km broad. The plateau with hill station known as Toranmal has a temple called the Torana Temple (as Goddess of tribals) and Toranmal village. The landscape has two lakes-the Yashwant Lake which spans about 1.59 km² and has a maximum depth of 27 meters. and the Lotus Lake which derives its name from the fact that it is always covered with lotus flowers. several streams of which two main streams are Sitakhai and Kalapani; The waterfalls (e.g. Sitakhai and Kalapani) are the associated landforms of the escarpments. They also create varieties of landforms like depressions, caves, outlier hills, etc. Northern part of this area occupies dry deciduous type of forest while, the southern fertile plains towards river Tapi is predominantly agricultural. Toranmal fall in the Shahada Taluka of the district.

Population

The prominent tribes inhabiting Toranmal includes the Pawaras, Bhils, Gamits, Gavits, Kokanis, Mavachis, Pasvis, Tadavi, Valvis and vasaves are the various ethnic group have their own dialect viz Pavari, Mavchi, Bhili, Kokani etc. The tribals have the knowledge of medicinal and another uses of plants growing in the forests. Tribal

medicine men called Vaidu, Bhagat, Bawa, Vaidu, Maharaj, specifically know the exact preparation of the medicine and diagnosis of the diseases. Pawara and Bhil are the most dominant tribes in the area.

Aims of Study

Survey of the different localities within the area for gathering information, collection of plant specimens, identification and documentation of plants used for medicine, veterinary etc.

- ❖ To study the impact of tribal culture on vegetation, this includes primitive agricultural and forestry operations to preserve genetic resources of useful plants for developing crops.
- ❖ Collection and conservation of plants used by tribals with special reference to wild relatives of cultivated plants.
- ❖ Literature survey of screening for pharmacological aspects of plants for investigation of active principles of the plant parts or plants used in medicine, pesticide and fish poison, etc.
- ❖ Inventorisation of the wild edibles like fruits, roots tubers, seeds, etc.
- ❖ To document the ethnobotanical data from existing literature and from actual field work and a comparison to be made to find the uses less known and plant parts used for similar uses reported earlier.

Methodology

The data presented here is based on personal interviews and observations of informants. The indigenous knowledge of local people regarding plants was gathered by intensive ethnobotanical explorations. The area visited annually for 4-5 times during the 2013 to 2015 for covering different villages and hamlets of study area and each visit lasted for about 5-6 days. During the field investigation, for plant collection and documentation of data, the informant accompanied the author/s. Sometimes more than one informant was included in the team. Each use of the plant has been confirmed and verified during different visits to different localities in the region and even with the same informants on different occasions. The uses were considered valid if at least 2 informants had similar remarks about the uses of the plant. During the field work 2-3 voucher specimens of each useful plant and plant part used in medicine were collected and numbered. The voucher specimens were made mostly at flowering or fruiting stage according to the standard methods (Jain & Rao, 1976). Their description, uses and other details were recorded in the field book and in ethnobotany data sheets, which is based on Jain (1995). Collected plant specimens were identified with the help of keys to families, genera and species provided in standard floras Patil, (2003), Cooke (1958), Sharma *et al.* (1996), Singh *et al.* (2000 & 2001), etc.

Results

Total 46 angiosperm species of 32 families used for treating different diseases of domestic animals have been recorded. Out of the 53 uses are recorded from the region 8 are of wounds; 4 lactation, 4 constipation, 4 intestinal worm, 4 foot and mouth diseases, 3 swelling of legs, 2 for loose motion, 5 wound maggots, and other purpose like eye infection, bone fracture, scabies dyspepsia, etc. Maximum number of species used for treating wound diseases are from family Fabaceae which is followed by Malvaceae, Solanaceae, Euphorbiaceae, Asteraceae,

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Enumeration

1. *Argemone mexicana* L. PAPAVERACEAE 'Piwaladhotra'. Distribution: Common in waste lands; Sitakhai, Toranmal
Uses: Swelling of legs: Half liter of whole plant extract given once a day for 5-6 days.
2. *Abutilon indicum* (L.) MALVACEAE 'Mudra' Distrib.: Common in field edges & waste places; Leghapani.
Uses: Stomach ache: Half liter extract leaves given twice a day for two days to cattle.
3. *Hibiscus rosa-sinensis* L. MALVACEAE 'Jasvand'. Distrib: Cultivated as an ornamental plant; Caves area, Toranmal.
Uses: Wounds: paste of leaves applied externally for healing cattle wound.
4. *Citrus aurantifolia* RUTACEAE 'Limbu'. Distrib. : Cultivated, field edges and villages; Khadaki
Uses: Eye infection in cattle: Few drops leaf juice instilled in eyes.

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5. *Balanites aegyptiaca* (L.) BALANITACEAE 'Hingu' Distrib.: Common in waste lands, road sides and in open forests; Caves area, Toranmal. Uses: Intestinal worms: 50 ml juice of single fruit given orally once a day for three days to cattle.
6. *Azadirachta indica* A. MELIACEAE 'Lim bada' Distrib. : Common in villages along road sides; Near Lake area, Toranmal.
Uses: Intestinal worms: Half liter extract of inner stem bark given twice a day for two days to cattle.
7. *Maytenus senegalensis* (Lam.) CELASTRACEAE 'Yenkal'. Distrib: Occasional, near Check Dam area. Toranmal.
Uses; Indigestion: Half liter of leaf extract is given twice a day for two days.
8. *Ziziphus oenoplia* (L.) RHAMNACEAE 'Bor'. Distrib.: Common in forests and field bunds; Near Lake area, Toranmal.
Uses: Throat infection: 250 ml juice of 100 gm stem bark with 3 gm black pepper powder given orally twice a day for 3 days to cattle.
9. *Cissus quadrangularis* L. VITACEAE 'Kandvel'. Distrib.: Occasional in field edges and villages; Leghapani.
Uses: Cough of cattle: half liter of whole plant extract given once a day for 4-5 days.
10. *Semecarpus anacardium* L. ANACARDIACEAE 'Bibba' Distrib.: Common in dry deciduous forests; on the way from leghapani to Toranmal.
Uses: Foot and mouth disease: half litre of stem bark extract given thrice a day for two days
11. *Erythrina stricta* Roxb FABACEAE 'Pangara'. Distrib. : Occasional, Satpayri forests
Uses; Conjunctivitis: Few drops of leaf juice is instilled in eyes twice a day for 2 days.
12. *Erythrina variegata* L. FABACEAE 'Pangara'. Distrib.: Common near villages; Sitakhai.
Uses: Wound maggots: Paste of inner bark is applied to kill the wound maggots and for healing of wounds.
13. *Tephrosia villosa* (L.) FABACEAE 'Unhali' Distrib. : Occasional along the roadside, Sitakhai road .
Uses: Wound: Leaf powder mixed with coconut oil is applied over wounds for 4-5 days.
14. *Cassia auriculata* L. FABACEAE 'Tarvad' Distrib. : Frequent in open forest and hill slopes; Bottom steps, Satpayari.
Uses: Tonic: Leaves and tender shoots are given as a fodder twice a day for 7 days to cattle.
15. *Cassia fistula* L. FABACEAE 'Bahava'. Distrib. : Occasional in forest edges & road sides; Toranmal.
Uses: Removal of Placenta in cattle: Half liter of stem bark extract given.
16. *Acacia chundra* Roxb MIMOSACEAE 'Khair'. Distrib.: Common in dry deciduous forest; Toranmal .
Uses: Swelling in legs: One liter juice of handful of stem bark given orally twice a day for 3 days to cattle
17. *Acacia farnesiana* (L.) MIMOSACEAE 'Deobabhu'. Distrib.: Common in wastelands; around Yashawant Lake.
Uses: Wounds: Leaf paste is applied to cattle
18. *Quisqualis indica* L. COMBRETACEAE 'Rangoon-vel'. Distrib.: Planted, as an ornamental plant, Toranmal.
Uses: Intestinal worms: 10-15gm of seed paste mixed in water given to cattle once a day for 2-3 days.
19. *Terminalia bellirica* (Gaertn.) COMBRETACEAE 'Behada' .Distrib.: Occasional in forests and in villages; Leghapani.
Uses: Loose motions: Half liter extract of stem bark is given twice a day until cure.
20. *Eucalyptus globulus* Labill MYRTACEAE 'Nilagiri' .Distrib. : Common around villages; Khadaki.
Uses: Weakness: 30-40ml extract of fresh leaves, with pinch of salt taken once a day for 7-8 days.
21. *Careya arborea* Roxb LECYTHIDACEAE 'Kumbhi' Distrib: Occasional in dry deciduous forests; Legapani.
Uses: Stomach ache: Half liter extract of fresh stem bark given orally once a day until cure.
22. *Lagenaria siceraria* (Mol.) CUCURBITACEAE. 'Dudhi bhopala'. Distrib. : Cultivated and escape; Khadaki.
Uses: 1. Constipation: Unripe green fruits are given along with fodder for 5-6 days. 2. Foot and Mouth disease of cattle: Green unripe fruits are given as fodder for 7-8 days.
23. *Centella asiatica* (L.) APIACEAE 'Brahmi'. Distrib.: Occasional; Caves area, Toranmal
Uses: Lactation: Leaves when used as fodder increase the secretion of milk in cows.
24. *Nerium indicum* Mill APOCYNACEAE 'Kanher' Distrib.: Common in temples, Toranmal
Uses: Wound maggots: Leaf ash mixed with oil applied externally on wounds until cure.
25. *Wrightia tinctoria* R. APOCYNACEAE 'Kalakuda' .Distrib.: Common in dry deciduous forests; Near Lake area, Toranmal.
Uses: To improve Lactation: Pods are given along with fodder for 10-15 days.
26. *Calotropis gigantea* (L.) ASCLEPIADACEAE 'Rui' Distrib.: Common in wastelands, villages & road sides; Near Lake area, Toranmal.

- Uses: Wound maggots: Latex applied over wounds for a week,
27. *Cryptostegia grandiflora* (Roxb.) PERIPLOCACEAE. 'Kavali' Dist : Common in forests; Kalapani
Uses: Wounds: Ash of burned leaves mixed in coconut oil and applied on wounds.
28. *Enicostema axillare* (Lam.) GENTIANACEAE 'Nai'. Distrib: Frequent in open moist situations amidst grasses. Sunset point. Toranmal.
Uses: Constipation in cattle: about half liter of plant extract given twice a day for 7-8 days.
29. *Cordia dichotoma* Forst. BORAGINACEAE 'Bhokar' Distrib.: Common in forests, villages and road sides; Toranmal.
Uses: Joint swelling: One liter juice of 200gm stem bark given orally once a day until cure to cattle
30. *Datura metel* L. SOLANACEAE 'Kala-Dhotra' Distrib.: Common in waste lands; Toranmal.
Uses: Wound maggots: Fruit paste is applied over wounds to kill maggots.
31. *Nicotiana tabacum* L. . SOLANACEAE 'Tambakhu'Distrib. : Occasional, Cultivated for leaves in Khadaki.
Uses: Wound maggots: Leaves with bark of *Annona squamosa*, crushed and applied externally until cure.
32. *Solanum virginianum* L SOLANACEAE 'Kateringani' Distrib: Common in wasteland weed; Near Lotus lake
Uses: Foot and mouth disease: Handful of ripened fruits given orally twice to buffaloes and cows.
33. *Andrographis paniculata* (Burm. f.) ACANTHACEA. 'Kiryat'. Distrib.: Common in forests & hill slopes; Toranmal.
Uses: 1. Intestinal worms: Half liter of leaf extract is given once a day for three days to cattle.2. Foot and mouth disease: water extract of leaves given orally once a day for three days to cattle.3.Scabies: Leaf paste is applied externally till cure.
34. *Eranthemum roseum* (Vahl) ACANTHACEA. 'Dasamuli' Distrib. : Common in forest undergrowth, Satpayari, Toranmal.
Uses: To improve lactation in cattle: Whole plant along with roots washed with water and given as fodder to milking cattle to improve lactation.
35. *Clerodendrum serratum* (L.) VERBENACEAE . 'Bharangi'. Distrib.: Common on hill slopes. Satpayari
Uses: Constipation in goats: Leaves are given along with fodder for 2-3 days.
36. *Lantana camara* L. VERBENACEAE 'Ghaneri'. Distrib. : Common is waste places, Toranmal,
Uses: Swelling: Leaf paste with equal proportion of turmeric powder mixed in warmed coconut oil and applied.
37. *Alternanthera tenella* Coll AMARANTHACEAE 'Reshimkata'.Distrib: Common in open and waste places, Near yashawant lake, Toranmal.
Uses: Lactation: Plant given to cattle to improve lactation.
38. *Aristolochia bracteolata* Lam. ARISTOLOCHIACEAE 'Gandhati' Distrib.: Scattered weed in agrifields, Khadaki.
Uses: Dyspepsia: 250 ml juice of 100gm fresh leaves given orally thrice a day for one day.
39. *Dendrophthoe falcata* (L.f.) LORANTHACEAE 'Bandgul' Distrib. : Common parasite found on trees, Leghapani
Uses: Swellings of legs: Leaf paste applied for swellings.
40. *Acalypha indica* L. EUPHORBIACEAE 'Khokali'.Distrib. : Common along road sides; Leghapani
Uses: Wounds: Leaf paste applied for healing wounds of cattle.
41. *Ricinus communis* L. EUPHORBIACEAE 'Erend'. Distrib.: Cultivated along field bunds; Kalapani
Uses: Constipation in calf: Seed extract 100-150 ml given one a day for 2-3 days to calf.
42. *Ficus hispida* L.f MORACEAE 'Wadiumbar'.Distrib.:Common near temples and pond bunds; Leghapanai.
Uses:Constipation: Half liter water extract of handful unripe fruits given once.
43. *Vanda tessellata* (Roxb.) ORCHIDACEAE 'Marad'. Distrib.: Occasional in all forests on different tree species; Leghapani.
Uses: Joint pain and swelling in legs: Handful whole plant crushed and with cooking oil and given orally twice a day for three days to cattle.
44. *Curcuma longa* L. ZINGIBERACEAE 'Halad'. Distrib. : Cultivated; Kalapani
Uses: Wounds: Rhizome powder with coconut oil applied externally on wounds.
45. *Cocus nucifera* L. ARACACEAE 'Naral' Distrib. : Cultivated on field edges; Kalapani
Uses: Wounds: ash of fruit fiber applied externally until cure.
46. *Dendrocalamus strictus* Roxb POACEAE 'Velu'. Distrib.: Occasional in forest edges; Sitakhai.
Uses: Bone fracture: Fractured part bandaged by using bamboo strips and jute thread and cotton cloth.

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The Efficiency of Arbuscular Mycorrhiza on Augmentation, Expansion, and Yield of Garlic (*Allium sativum* L.)

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ABSTRACT: Arbuscular mycorrhizal fungi play a crucial role in the uptake of water and nutrients from the soil. Garlic (*Allium sativum* L.) plants need plenty of fertilizer for their growth and it is a sensitive plant to drought. The intend of the research study is to how the mycorrhizal fungi are beneficial for the growth, development, and yield of garlic. The connection between garlic and AMF benefited more powerfully. Garlic crop is cultivated in winter season. Inoculation of *Glomus domenicii* spore in the field showing a better result. Parameters like root length, leaf length and number of leaves as well as diameter of the bulb, weight bulb etc. per plant were calculated. It was observed that the nonmycorrhizal plant showed a reduction in root length, leaf length and number of leaves whereas mycorrhizal plant showed enhance in root length, leaf length and number of leaves. Regarding productivity of garlic mycorrhizal plant showed less in diameter and weight of bulb, whereas mycorrhizal plant showed an increase in diameter and weight of bulb in both seasons. There is a better yield of Garlic after inoculation of mycorrhizal spore *Glomus domenicii*.

Keywords: Arbuscular mycorrhizal fungi, Inoculation, Garlic, productivity, Interactions.

Introduction

AM fungi are associated with roots of nearly 95% the terrestrial plant species. It is a symbiotic association between soil fungi and fine plant roots. AM fungi symbioses with roots, contribute to improving nutrient as well as mineral uptake so they referred as phosphorus gathering fungi. The fungus receives carbohydrates and growth factors from the plant, which in turn receives nutrient absorption. AMF enlarge the soil volume from which nutrients can be taken up, via an extensive mycelium network, enabling host plants to access more resources [1]. AM fungi increase the ability of plants to absorb water, nitrogen, and minerals by increasing the effective absorbing surface area of root systems. The AM fungi can protect the plant against abiotic (drought) stress, and improve soil aggregation [2-3]. It is observed that when mycorrhizae inoculated to crops, there is an increase in root proliferation and reduction of fertilizer input [4-5]. AMF inoculation increases the uptake of phosphorus and other nutrients which enhanced the growth and yield of crops [6]. Garlic (*Allium sativum* L.) is an important vegetable crop belonging to family Liliaceae. It is an annual herb with aromatic fleshy underground bulb; leaves are linear, cylindrical and fleshy. Garlic, onion is one of the important bulb crops it has a sparse routing system without root hairs which makes the crop dependent for water and nutrient acquisition on arbuscular mycorrhizal fungi [7-8]. China, India and Bangladesh are the world's leaders in garlic production. The Maharashtra, Andhra Pradesh, Uttar Pradesh, Karnataka, Bihar etc. are the leading garlic growing states of India. The common varieties grown in Maharashtra are Agrifound white (G-41), Yamuna Safed-2(G-50), Yamuna Safed-3(G-282) etc. Garlic is a rich source of carbohydrate, Protein & Phosphorous. Garlic contains about 62.8% Water, 6.3% protein, 0.1% Fat, 29% carbohydrate including 3.9% Sucrose, phosphate salt & small amount of vitamin-like thymine, riboflavin, niacin & ascorbic acid.

The experiment was done in the year 2017-18. In the winter season, the crop is growing from November to January and it will be ready for harvesting from March to May. The garlic crop and both seasons were considered for root length, leaf length, number of leaves, the diameter of bulb and weight of bulb in the said period.

Materials and Methods

In the present study, six localities from Yeola and Chandawad taluka of Nashik district, Maharashtra (India) were selected for analyzing soil samples in January-2017 for winter season. The correlation between AM fungi and garlic (*Allium sativum* L.) plants was also studied by using control method after referring to relevant literature.

Collection of soil and root samples

Soil samples were collected from selected rhizosphere and non-rhizosphere sites (Visapur, Ambewadi, Vaki, and Talegaon) at an interval of 30 days. Each plot sampled for analysis was measured around 1 acre. These soil samples were collected in winter seasons in the year of 2017. Nearly 350-500gm of soil was collected from each locality and soil samples were transferred into fine polythene bags, brought to the laboratory and stored in a refrigerator at 5°C until further use. The collection of root samples was done from selected localities. Feeder roots were collected from the rhizosphere zone of the garlic plants by obtaining samples from a depth of about 10-15 cm. Root samples were collected at an interval of 30 days. They were collected in sterile polythene bags and brought to the laboratory for processing as well as for analysis of root colonization.

Preparation of pure culture

The soil samples of garlic plants were collected from selected localities and brought to the laboratory in clean, appropriate polythene bags. Tap water was taken in a beaker of 1000 ml capacity and the air-dried soil sample was mixed to it. Using a glass rod, soil water mixture was vigorously stirred. After allowing the heavier soil particles to settle the suspension containing soil, root, and fungal hyphae was very slowly allowed to pass through a set of 500, 240, 170, 150, 100 and 72 µm sized sieves. The extracts were washed and transferred from sieves to Whatman filter paper No. 1. Using compound and binocular microscope. AM fungal spores, sporocarps, and AM fungal aggregates were picked up by means of a needle [10]. In a Petri-plate, seeds of jowar were placed upon moist filter paper as the same assisted in timely termination of the seed. When roots were about 3-4cm in length, the isolated spores were surface sterilized using 1% streptomycin solution. The roots of germinated jowar seeds were sterilized using alcohol. Surface sterilized spores (*Glomus domenicum*) were studded on jowar seedling roots. These seedlings were transferred in pots containing sterilized soil in a green house, after one to two days of inoculation. Pots were watered regularly as per requirement. After 45-50 days, the roots were analyzed for mycorrhizal infection [11]. They were also analyzed for root colonization [12]. On observing AMF colonization, the supply of water was stopped and shoots were cut off at soil level. These pots with roots were allowed to dry, after which, they were cut using a chopper. For the multiplication of individual species, these roots along with rhizosphere soil could be used.

Results and Discussion

The outcome of AM fungi on growth response of garlic

The outcome of AM fungi on growth response of garlic was studied during winter season after 60 and 90 days. The growth parameters like root length, leaf length, and a number of leaves per plant were recorded in control mycorrhizal plants. The length of root after 60 days was 3.67cm in control plant whereas it was measured 5.35 cm in the mycorrhizal plant. After 90 days the length of root recorded was 6.24 cm in control plant whereas it was recorded 14.11cm in the mycorrhizal plant. The length of leaf recorded after 60 days was 22.00 cm in control plant whereas it was 25.50cm in the mycorrhizal plant. After 90 days the length of leaf recorded was 28.55 cm in control plant whereas it was recorded 36.00 cm in the mycorrhizal plant. The number of leaves recorded after 60 days was 13 in mycorrhizal plant whereas it was 11 in control plant. After 90 days the number of leaves recorded was 12 in control plant whereas it was recorded 15 in the mycorrhizal plant. The mycorrhizal plants showed better growth after 60 and 90 days as compared to a control plant. The results were significant at $\alpha \leq 0.05$ level.

Table 1: Effect of AM fungi on growth response of garlic during winter season

Season	No. of days	Plants	Root length(cm)	Length of leaf(cm)	No. of leaves /plant
Winter	60 days	Control	03.67 ±1.15	22.00 ±2.31	11 ±1.83
		Mycorrhizal	05.35 ±1.18	25.50 ± 2.48	13 ±1.83
	90 days	Control	06.24 ±1.17	28.55 ±2.34	12 ±1.83
		Mycorrhizal	14.11 ±1.19	36.00 ±2.31	15 ±1.83

It is observed that, in the winter season of the garlic plant, three parameters were studied for 60 and 90 days. At the time interval of 60 days, root length, leaf length and the number of leaves increased in mycorrhizal plants whereas it decreased in nonmycorrhizal plants [13-14]. The fungal mycelium in the soil can absorb nutrients so that they increase the efficiency. Colonization on P nutrition are often large and have an effect on plant

symbiosis on the other nutrients are masked. For the 90 days time interval the root length, leaf length and the number of leaves increased in mycorrhizal plants whereas it decreased in nonmycorrhizal plants. Significantly increased mycorrhiza formation over that caused by the level of native AM fungi present at the particular site. At the time of harvest, all inoculated garlic showed higher values of bulb diameter, fresh weight, shoot P content and bulb yield than uninoculated plants [15].

The outcome of AM fungi on growth and yield response of garlic in winter seasons

The outcome of AM fungi on growth and yield of garlic bulb was studied during winter season after 75 and 105 days. The diameter of the garlic bulb and weight of garlic bulb was recorded in control and mycorrhizal plants. The diameter of garlic bulb recorded after 75 days was 20.40 cm in control plant whereas it was 22.00 cm in the mycorrhizal plant. After 105 days the diameter of garlic bulb recorded was 23.60 cm control plant whereas it was recorded 26.20 cm in the mycorrhizal plant. The weight of garlic bulb recorded after 75 days was 78.10 gm in control plant whereas it was 82.70 gm in the mycorrhizal plant. After 105 days the weight of garlic bulb recorded was 82.30 gm in control plant whereas it was recorded 95.50 gm in the mycorrhizal plant. The mycorrhizal plant showed better results than the control plant after 75 and 105 days. The results were significant at $p \leq 0.05$ level.

Table 2: Effect of AM fungi on growth and yield of garlic during winter season

Season	No. of days	Plants	The diameter of the bulb (cm)	The weight of bulb (gm)
Winter	75 days	Control	20.40 ± 1.88	78.10 ± 1.83
		Mycorrhizal	22.00 ± 1.83	82.70 ± 2.01
	105 days	Control	23.60 ± 1.92	82.30 ± 1.90
		Mycorrhizal	26.20 ± 2.01	95.50 ± 1.83

Effect of AM fungi on growth and yield of garlic plant in winter

The effect of AM fungi on growth and productivity of garlic was studied under field condition. The parameters like the diameter of bulb and weight of bulb etc. were observed and studied in control and experimental conditioned garlic plants. Data were collected at the interval of 75 days, 105 days, up to four months. Data showed increased in biomass and yield of garlic under field condition [16]. According to [17] inoculation with AM fungi, especially indigenous types comparable to N, P fertilizer application in enhancing garlic growth and thus could provide a sustainable and environmentally safer option. The various growth biometrics such as plant height, number of leaf sheaths at 30 and 60 days control plant of garlic. It is concluded that from the above experiment that the mycorrhizal plants showed the better length of root and leaf as compared to nonmycorrhizal plants after 60 and 90 days respectively. The plants like garlic, soybeans, onion etc. are less susceptible to nematode. The number of leaves per plant was recorded maximum in mycorrhizal plants than nonmycorrhizal plants. The results were similar in the winter season at all the four selected localities. The effect of AM fungi on growth and productivity of garlic was studied under field conditions. The mycorrhizal plants mycorrhizal [18, 19] showed more diameter and higher weight of garlic bulbs than non mycorrhizal plants after 75 and 105 days.

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Study of Pollen Morphology and Preparation, Identification Key of Pollen Grain of Various Family Members at S.S.G.M College Campus

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ABSTRACT: The presented work is the study of pollen morphology of SSGM Collage campus angiospermic plants. 13 family and 20 species and prepared their identification key of pollen grain, studied the pollen variability of family observed. Species of family Fabaceae is more than the other five species. and Malvaceae two species, Euphorbiaceae two species, Myrtaceae two species observed great variability in the pollen of Fabaceae. One species of Lamiaceae, one species of Asteraceae., one species of Rosaceae., and two species of Malvaceae., one species of Cucurbitaceae, one species of Moringaceae., one species of Convolvulaceae., and one species of Anacardaceae. Therefore it is essential to examine a large no. of pollen grain from family to obtain complete knowledge of that family. The preserved material was prepared by acetolysis method according to Erdtman (1960) for light microscope. The pollen morphology varies among different plant species; occur in varying shape and forms.

Keywords: Pollen grain, acetolysis, SSGM campus Morphology

Introduction

Study of pollen morphological features is called palynology. First studies by Willam and Hyde (1960) Honeybees and flowering plant have considered as an example for co-evolution and mutualism. Honeybees need flowering plant for nectar and pollen source of food and flowering plant. Species belonging to family Asteraceae pollen are spinolous, spherical in shape. The different species in Fabaceae has great morphological diversity. They also have variation in symmetry, position and distribution of aperture, exine structure and sculpture of a pollen wall. The pollen grain of plant family Malvaceae is echinate. Species of family Myrtaceae pollens are colporate and prorate. Earlier several studies on pollen morphology have been done worldwide (Raj-1969, Sowunmi 1973 Tomb et. al 1974, Nair and Kapoor 1974, Gillandchinnappa, 1982) has done palynological investigation to forest trees in relation to forest history and natural mixture of trees species on the basis of their pollen profile, Noor et. al (2004) has done the palynological studies of cultivated plants of Pakistan. The pollen grain in a plant is part of used to transport of the male gamete to the female part of the flower. There are different types of pollen grain fertile and sterile. Only the fertile pollen provides good yield, the identification of grain using morphological character. This operation can be done by using two approaches based on intensity and size variation. The proposed work mainly focused on the identification of fertile one appears larger than the sterile. The fertilization the central cytological part is the main source. An inner and outer exine is other part act as wall for the pollen grain.

Materials and Methods

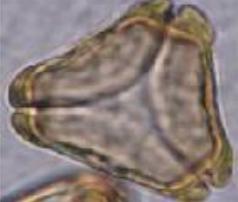
Field studies

In the present investigation, the pollen morphology of 20 plant species from the different family has been identified and studied during January to March. A field survey in campus was conducted year to year. The sample directly collected from mature flower buds. The mature pollen grain of the identified by plant species are collected and preserved in 70 percent alcohol for further investigation.

Preparation of pollen slide

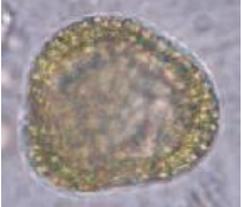
The preserved material was prepared by acetolysis method according to Erdtman (1960) for light microscope. Which involves the introduction of acetolysed mixture comprising acetic anhydride with concentrated sulphuric acid 9:1. The tubes were immersed in boiling water bath for 3-5 min, centrifuged and decanted. Residue was wash with water and decanted, about few drops of glycerin was added and mounted on slide. The prepared slide was studied under microscope for morphological studies under light.

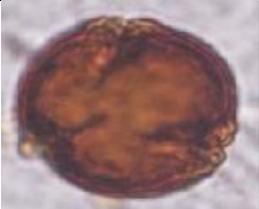
Observation Table

Sr no	Pollen type	Plant name and family name.	Morphology.	Forage source.
1		<i>Acacia sp.</i> (Fabaceae)	Polyad type, individual cell sub-globose, in periphery and square in center, polyads are not in the form of pollinia (grain group 16)	Tree
2		<i>Adathoda vasica</i> (Acanthaceae)	Monoporate, oblate, radial, symmetry	Shrub
3		<i>Butea monosperma</i> (Fabaceae)	Colpate, prolate, oblate, spheroid, obscure pattern, bilateral symmetry.	Tree
4		<i>Caespinia pulcherrima</i> (Fabaceae)	3-colpate, suboblate shape, bilateral symmetry.	Tree
5		<i>Calliandra linearis</i> (Myrtaceae)	Colpate, prolate, oblate, obscure, bilateral symmetry.	Tree
6		<i>Croton sp.</i> (Euphorbiaceae)	Retipitate, inaperturate, radial symmetry, clavate xine.	Shrub
7		<i>Eucalyptus globosa</i> (Myrtaceae)	Colpate, prolate, oblate, spheroid, obscure pattern, parasyncoplate.	Tree

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8		<i>Euphorbia pulcherrima</i> (Euphobiaceae)	3-colporate, spheroid shape, furrows Indistinct, reticulate, bilateral Symmetry.	Tree
9		<i>Hibiscus sp.</i> (Malvaceae)	Pantoporate pores, echinate, Radial symmetry.	Shrub
100		<i>Ipomoea indica</i> (Convolvulaceae)	Pantoporate pores, Echinate, radial symmetry.	Shrub
11		<i>Cucurbitapepo</i> (Cucurbitaceae)	Porate, exine is reticulate or Retipilate, radial symmetry	Shrub
12		<i>Jasminum sp.</i> (Oleaceae)	Sub oblate, or oblate spherical, Furrows radial symmetry.	shrub
13		<i>Mimosa pudica</i> (Fabaceae)	Tetrad, tetragonal psilate, Radial symmetry.	herb
14		<i>Mangifera indica</i> (Anacardiaceae)	Colporate, prolate, striatoreticulate, Bilateral symmetry	Tree
15		<i>Pavonia sp.</i> (Malvaceae)	Pantoporate, spheroid, exine echinate Spinolous, radial symmetry.	herb

16		Rosa canina (Rosaceae)	3-colporate, spherical shape or, prolate Spheroid exine is intectate, surface psilate, bilateral symmetry.	shrub
17		Tridax procumbens (Asteraceae)	Porate, spinolous, spheroid shape Radial symmetry.	herb
18		Moringa oleifera (Moringaceae)	Ptychotreme, psilate exine, Oncus, periporate, radial Symmetry.	tree
19		Ocimum sp. (Lamiaceae)	6-colporate, sub-oblate, reticulate, radial symmetry.	herb
20		Pongamia pinnata (Fabaceae)	Prolate spheroid pores Indistinct.	tree

Key for identification of pollen type

- 1. Pollen Colporate.
 - 2. Pollen Spheroid
 - 3. Pollen structure reticulate ornamentation
 - 4. Pollen furrows
 -*Butea monosperma*
 -*Euphorbia pulcherima*
 - 3. Pollen not show reticulate ornamentation
 - 5. Surface pistilate
 -*Rosa canina*
 -*Mangifera indica*
 - 2. Pollen Oblate
 - 6. Shape oblate
 - 7. Pattern parasyn-colporate
 -*Eucalyptus globus*
 -*Callindra linearis*
 - 7. Pattern not as above
 - 6. Shape sub- oblate
 - 8. pollen 6 colporate
 -*Ocimum sp.*
 -*Ceasalpinia pulcherima*
 - 1. Pollen other than colporate.
 - 9. Pollen Distinct

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| | |
|---------------------------------|--------------------------------|
| 10. Pollen with radial symmetry | |
| 11. Pollen furrows | <i>Jasminum sp.</i> |
| 11. Pollen not furrows | |
| 12. Pollen echinate | |
| 13. Pollen Pentaporate | |
| 14. Pore 20-27 | |
| 15. pollen size large | <i>Hibiscus sp.</i> \ |
| 15. pollen size small | <i>Pavonia sp.</i> |
| 14. Pore 70-75 | <i>Ipomoea indica</i> |
| 13. Pollen Muliporate | <i>Tridax procumbens</i> |
| 12. Pollen not echinate | |
| 16. Monoporate Pollen grain | <i>Adathoda vasica</i> |
| 16. Not as above | |
| 17. pollenretipilate | |
| 18. Clavateexine | <i>Croton sp.</i> |
| 18. exine not as above | <i>Cucurbita pepo</i> |
| 17. pollenpistilate | |
| 19. Pollen in tetrad | <i>Mimosa pudica</i> |
| 19. Pollen triad or diad | <i>Moringa</i> |

oliferia

| | |
|--------------------------------|-------------------------------|
| 10. Pollen not radial symmetry | <i>Acacia sp.</i> |
| 9. Pollen Indistinct | <i>Pongamia pinnata</i> |

Conclusions

All the study concluded that the pollens, observed species of family Fabaceae is more than the other five species. And Malvaceae two species, Euphorbiaceae two species, Myrtaceae two species.that seen great variability in the pollen of Fabaceae. Lamiaceae one species., Astraceae one species., Rosaceae one species., Malvaceae two species, Cucurbitaceae one species., Moringaceae one species., Convolvulaceae one species., Anacardaceae one species. Therefore it is essential to examine a large no. of pollen grain from family to obtain complete knowledge of that family.

| Sr. No. | Family | Members of family | Pollen structure |
|---------|----------------|--|--|
| 1 | Fabaceae | 1) <i>Acacia sp.</i>
2) <i>Butea monosperma</i>
3) <i>Caesalpinia pulcherima</i>
4) <i>Momosa pudica</i>
5) <i>Pogamia pinnata</i> | 1) polyad type
2) colporate, porate
3) 3-colporate, oblate
Shape
4) tetrad, tetragonal,
5) prolate, pores indistinct. |
| 2 | Lamiaceae | 1) <i>Ocimum sp.</i> | 1) 6-colporate, spherical |
| 3 | Asteraceae | 1) <i>Tridax procumbens</i> | 1) poratespinolous |
| 4 | Oleaceae | 1) <i>Jasminum</i> | 1) sub oblate, furrows
Short |
| 5 | Rosaceae | 1) <i>Rosa canina</i> | 1) 3-colporate, spherical |
| 6 | Malvaceae | 1) <i>Hibiscus sp.</i>
2) <i>Pavonia sp.</i> | 1) pantoporate, spheroid
2) pantoporate, spheroid |
| 7 | Cucurbitaceae | 1) <i>Cucurbitapepo</i> | 1) porate, exine is reticulate |
| 8 | Moringaceae | 1) <i>Moringaolerifera</i> | 1) ptychotreme, radial
Symmetry |
| 9 | Convolvulaceae | 1) <i>Ipomea indica</i> | 1) pantoporate, pores 70-75 |
| 10 | Anacardiaceae | 1) <i>Mangifera indica</i> | 1) colporate, porate |
| 11 | Myrtaceae | 1) <i>Eucalyptus globus</i>
2) <i>Callistemon linearis</i> | 1) colporate, porate, bilateral
Symmetry |

| | | | |
|----|---------------|--|--|
| | | | 2) colporate,porate |
| 12 | Acanthaceae | 1) <i>Adathodavasica</i> | 1) monoporate,oblate
Radial symmetry |
| 13 | Euphoebiaceae | 1) <i>Croton</i> sp.
2) <i>Euphorbia pulcherima</i> | 1) inapertulate,retipilate
Radial symmetry
2) 3-colporate,prolate
Radial symmetry |

Result and discussion

Data collected during the study is presented on Table the information incorporates 20 species belonging to 13 family. The pollen morphology in varies among different plant species; occur in varying shape and forms.They also show variation symmetry ,exine structure cassia in Fabaceae sp. Pollen of family Malvaceae are echinate. Pollen of *Adathodavasica* are oblate in shape.that the species belonging to family Asteraceae pollen type were spinolous and Malvacea epollen type were echinate. But there is variability in the pollen type belonging to family Fabaceae. Species belonging to the family Myrtaceae pollen are colporate and porate .These study will be useful for different flora used in honey bees and improve the conservation status of economically important plants.The pollen morphology is also useful to identify varies species and taxa in their respective families .Pollen of family Moringaceae are ptychotreme,radial symmetry.Family Euphorbiaceae 2 sp. are studied pollen of that species are inapertulate,retipilate radial symmetry in croton sp.pollen of Euphorbiasp.are 3-colporate,spheroid shape, furrows indistinct bilateral symmetry. Family Myrtaceae has pollen are colporate,porate bilateral symmetry.Family Acanthaceae studied *Adathodavasica* sp. Has pollen is monoporate, oblate, radial symmetry. Pollen of family Convolvaceae are porate and radial symmetry.

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Ex-Situ Conservation of Siderophore Producing Endophytes: The Way Towards Sustainable Agriculture

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ABSTRACT: *Endophytes play a remarkable role in the biosphere. They are not only the global players in the metabolism of nitrogen, phosphate, oxygen and carbon, but also act as an excellent source of various bioactive metabolites with immense scientific and economic benefit. Nevertheless, they have received very scant attention in overall reviews of biological diversity and global genetic resources. Worldwide there is an ever-growing demand for ecologically compatible and environmental friendly techniques in agriculture leading to exploration of microbe-based symbiosis in plants. These days, iron deficiency is known to occur in many regions of the world, the reason is the low solubility of Fe²⁺ and Fe³⁺ under oxic conditions. Siderophores are the low molecular chelating compounds specific for iron ions. These are produced by microorganisms under iron-limiting conditions and are able to enhance the iron uptake to the microorganisms and play an essential role for plant growth promotion. Since bacterial endophytes interact closer to the plant than rhizosphere and phyllosphere bacteria, their impact on plants may be direct and intense. Objective of the present work was to evaluate the siderophore production potential of bacterial endophytes of *V. vinifera* so as to suggest their Ex situ conservation for sustainable agriculture. Isolates BE1 to BE11 of bacterial endophytes were isolated from different plant parts of black cultivars of *V. vinifera*. Further incubation was carried out in iron deficient succinate medium for siderophore production. Preliminary detection of siderophore was carried out by CAS assay. Siderophore characterization was performed by different tests viz. FeCl₃ test for presence of siderophores, Tetrazolium test and Arnow's test for detection of hydroxamate type and catecholate type of siderophore respectively. Rate of siderophore production was determined by using UV spectrophotometer and absorbances were recorded at 630nm. It was found that almost all the isolates showed positive test for CAS assay. Among all the bacterial endophytes, it was found that 81.81% isolates showed siderophore production rate above 30%. Preparative Thin Layer Chromatography (P-TLC) was carried out with the solvent system, Butanol: Acetic acid: water (4:1:5). During the siderophore characterization, FeCl₃ test was found to be positive for almost all isolates. It was revealed that 45.45% isolates were able to produce Hydroxamate type of siderophores whereas, catecholate type of siderophores were produced by 27.27% isolates. Thus, it was found that the isolates of bacterial endophytes have potential to produce both types of siderophore which can directly help the plants by stimulating their growth and/or indirectly through a reduction of plant disease due to their ability for siderophore production. Several perennial, deciduous, as well as evergreen fruit crops develop symptoms of iron deficiency like interveinal chlorosis of apical leaves when cultivated in calcareous and alkaline soils. As a result, such siderophores produced by bacterial endophytes of grapevine plants can have great potential for plant growth promotion. Such endophytes must be conserved and made readily available for research and utilization not only in agriculture but also in academia and industry. Therefore, Ex situ conservation of such siderophore producing endophytes will be an ecofriendly way towards sustainable agriculture.*

Keywords: Siderophore, *Vitis vinifera*, Endophytes, CAS, Ex situ conservation Sustainable Agriculture.

Introduction

Sustainable agriculture is extensively promoted for increasing the crop yield by using natural abilities of plants, without any harmful effect on environment. The most promising strategy to reach this goal is to substitute use of hazardous mineral fertilizers, pesticides in the agriculture with environment-friendly symbiotic microbes, which could improve the nutrition of crops, as well as their protection against biotic and abiotic factors (Yang, J. *et al.*, 2009). Effect of the growth promotion exerted by PGPRs is mainly related to the release of metabolites and nitrogen fixation processes and provision of bioavailable phosphorus for plant uptake, sequestration of iron by siderophores, production of plant hormones like auxins, cytokinins and gibberellins, and lowering of plant ethylene levels (Glick, B.R. *et al.*, 1995; Glick, B.R. *et al.*, 1999; Tortora, M.L. *et al.*, 2011). Plants can be considered as complex micro ecosystems where different habitats are exploited by a wide variety of bacteria (McInroy, J.A. and Kloepper, J.W., 1995). These habitats are not only represented by external surfaces of plants, where epiphytic bacteria predominate, but also by internal tissues, where many microorganisms like bacteria and fungi penetrate and survive inside the plant micro system (Fisher, P.J. *et al.*, 1992). Endophytes play a remarkable role in the biosphere. They are not only the global players in the

metabolism of nitrogen, phosphate, oxygen and carbon, but acts as excellent source of various bioactive metabolites with immense scientific and economic benefit. Nevertheless, they have received very scant attention in overall reviews of biological diversity and global genetic resources. Worldwide there is an ever growing demand for ecologically compatible and environmental friendly techniques in agriculture leading to exploration of microbe-based symbiosis in plants. It is reported that bacterial endophytes have various beneficial effects on their host plant which appear to occur through similar mechanisms described for plant growth-promoting rhizobacteria (PGPR) (Zablotowicz R.M., *et al.*, 1991). Moreover, they can promote plant growth by reducing the deleterious effects of plant pathogens through direct or indirect mechanisms (Compant S, *et al.*, 2005). These days, iron deficiency is known to occur in many regions of the world, the reason is low solubility of Fe^{2+} and Fe^{3+} under oxic conditions. Crops suffering from iron deficiency grow slowly as compared to normal crops and are found to be more susceptible to various diseases. Siderophores are low molecular chelating compounds specific to iron ions. These are produced by microorganisms under iron-limiting conditions with ability to enhance the iron uptake to the microorganisms. It is reported that the bacteria can directly antagonize pathogens by competition for root niches or by producing allelochemicals (siderophores, antibiotics, biocidal, lytic enzymes, and detoxification enzymes), by pathogen virulence factor degradation or by the interference with pathogen quorum sensing (Lugtenberg B and Kamilova F., 2009). Several perennial, deciduous, as well as evergreen fruit crops develop symptoms of iron deficiency like interveinal chlorosis of apical leaves when cultivated in calcareous and alkaline soils. Therefore, the present work has been focused on study of siderophore production potential of bacterial endophytes of *V. vinefera* so as to propose their *Ex situ* conservation for sustainable agriculture.

Materials & Methods

Isolation of Bacterial Endophytes

Young and healthy plant parts of various black cultivars of *V. vinifera* were randomly collected from vineyards of Nashik valley, Maharashtra India during year 2017. These plant parts were washed under running tap water and soaked in broad spectrum systemic fungicide solution (1gm/L) for about 10-15 minute followed by washing with distilled water for 4-5 times. Surface sterilization was carried out by treating the plant material in solution of Tween-20 followed by washing with D/W. Explants were further treated with 70 % ethanol for 30 seconds and then washed sterile D/W for 3-4 times. Then explants were treated with 0.1% HgCl_2 solution (10-15 min) followed by 3-4 times washing with sterile D/W. Then Sterilized plant material (1-1.5 cm) were aseptically inoculated on plant growth media supplemented with vitamins and organics and the cultures were maintained at $25 \pm 2^\circ\text{C}$ under 16/8 h Light/dark photoperiod cycle. Observation of microbial colony was recorded every after two days interval. All the bacterial colonies which were observed during 15 to 45 days of plant material inoculation were further transferred to Nutrient agar (NA) media and incubated at room temperature for isolation and purification of endophytic bacteria. The purified isolates were labelled from BE1 to BE11 which were further transferred to nutrient broth media and incubated on orbital shaker (110 rpm) at room temperature for the further study.

Preparation of Deferrated Media

Mayer and Abdullah (MA) media was prepared by using KH_2PO_4 (6gm), K_2HPO_4 (3gm), $(\text{NH}_4)_2\text{SO}_4$ (1gm), MgSO_4 (0.2 gm) and Succinic acid (4 gm) in 1000 ml D/W. Deferration of media was carried out by addition of 8 - hydroxyquinoline dissolved in chloroform (5ml/L). Phase separation was carried out by shaking the media vigorously in the separating funnel. After the phase separation, chloroform layer was removed and the medium was repeatedly washed with chloroform to ensure the complete removal of iron complexes and any residues of 8 - hydroxyquinoline, which could inhibit the growth (Messenger *et al.*, 1985).

Preparation of Fermentation Medium for Siderophore Production

All the isolated bacterial endophytes grown in the NB (Liquid media) were further inoculated in autoclaved iron deficient succinate medium and incubated at room temperature on a rotary shaker (110 rpm).

Detection of siderophore by Chrome Azurol Sulphonate (CAS) Assay

Fermented broth was centrifuged (3500 rpm, 15 min). Then, every after 4th day, the cell free supernatant was subjected to siderophore detection test by CAS assay. Development of pink/orange colouration indicates synthesis of siderophore.

Quantification of Siderophores

Percent siderophore unit were find out by adding the supernatant to CAS solution (1:1) and mixture was allowed to incubate for 1hr at room temperature. Absorbance were recorded at 630nm. (Schwyn and Neilands.,1987) and percentage of siderophore units were calculated by formula, $[A_r - A_s/A_r] \times 100$. where, A_r is Absorbance of reference (Uninoculated media with CAS reagent).

Extraction and Purification of Siderophore

Cell free supernatant was acidified to pH 3.00 by addition of HCl (12M). Then the supernatant was mixed with ethyl acetate (10:10 v/v) the mixture was vigorously shaken for 15 minutes. Further organic phase was separated and allowed to evaporate till dryness. The extract was resuspended in deionized water. (1mg/ml)

Preparative Thin Layer Chromatography (P-TLC)

Preparative Thin layer chromatography (PTLC) of the samples were carried out on precoated silica gel plates, purchased from MERK (Germany). Different solvent systems were optimized to obtain best resolution. N-Butanol: Acetic Acid: Water (4:1:5) was selected as best system for detection of siderophore. Samples of different bacterial endophytes were loaded and air dried. Visual detection of bands were carried out by observing the plates under UV (254 nm) light.

Characterization of Siderophore

FeCl₃ Test

Presence of siderophore was detected by addition of freshly prepared 0.5 ml aqueous FeCl₃ solution (2%) to 0.5 ml of culture filtrate. Appearance of reddish brown colour indicates presence of siderophore (Neilands JB.1981)

Test for Hydroxamate Type of Siderophores

Tetrazolium Test

To a pinch of tetrazolium salt, 150 μ L of NaOH solution (2N) was added with 2 mL culture filtrate. Appearance of a cherry red colour indicates presence of hydroxamate type of siderophore (Snow, G. A., 1954).

Test for Catechol type of Siderophores

Arnou's Test

1 ml of 0.5 N HCl and 1 ml of nitrite- molybdate reagent was added to 1 ml of cell-free supernatant. Yellow colour formation showed presence of catechols ,where immediate addition of 1 ml NaOH solution resulted in red colour formation (B. Sreedevi *et al.*, 2014).

Results and Discussion

Isolation of Bacterial Endophytes

Bacterial colonies were observed during 15 to 45 days of inoculation which were labelled from BE1 to BE11. These endophytic bacteria were grown in the nutrient broth were further inoculated in iron deficient succinate medium.(Fig.1)



Fig. 1. Purified Potent Bacterial Endophyte]

Detection of Siderophore by CAS Assay

Addition of CAS reagent to the cell free supernatant showed development of orange colouration indicated synthesis of siderophore. It was found that almost all the isolates of endophytes showed positive test for production of siderophore.(Fig.2)

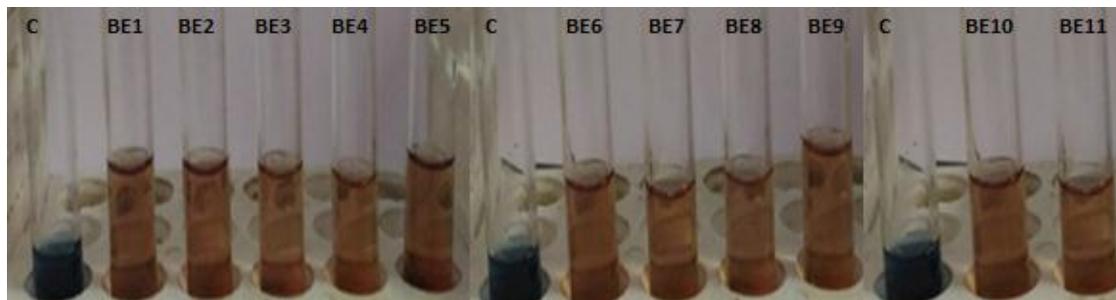


Fig 2: CAS detection assay for siderophore producing endophytes

Quantification of Siderophores

It was found that among all the eleven isolates of bacterial endophytes, rate of siderophore production was above 30% for almost nine isolates as BE1 (39.58%), BE2 (34.58%), BE4 (46.66%), BE6 (45.55%), BE7 (40.27%), BE8 (32.22%), BE9 (41.52%), BE10 (32.50%), BE11 (35.00%). Whereas, two isolates showed rate of siderophore production below 30 % viz. BE3 (26.25%) and BE5 (29.02%) (Fig.3)

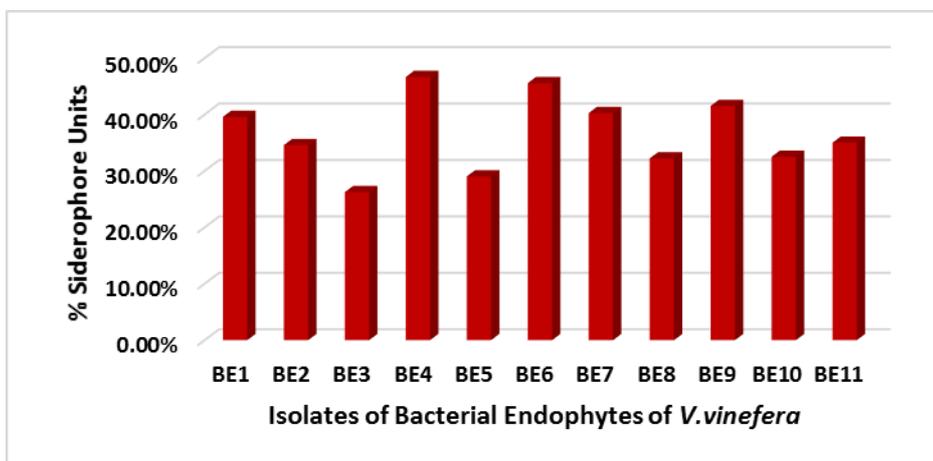


Fig 3: Percentage of siderophore units by bacterial Endophytes

Preparative Thin layer chromatography (P-TLC)

It was found that when the samples were subjected to PTLC using the solvent system N-Butanol: Acetic Acid: Water (4:1:5), bands of siderophore were noticed..It was found that the sample BE4 with high percentage of siderophore unit showed remarkable band as compare to other samples. (Fig.4)



Fig 4: P-TLC of bacterial Endophytes for detection of siderophore

Siderophore Characterization

FeCl₃ Test

The classical probe for iron reactive substances is ferric chloride reaction in which red to green colour formation occurs due to coordination of metal ion. Ferric ions react with enols, phenols, catechols and hydroxamic acids to give products with maximum absorbance. It was found that addition of freshly prepared FeCl₃ solution to the test samples showed appearance of reddish brown colour indicating presence of siderophore (Neilands JB.1981). It was observed that almost all the test samples showed positive test.

Test for Hydroxamate Type of Siderophores

The test for hydroxamate type of siderophore was found to be positive with appearance of a cherry red. Deep cherry red colour was shown by BE2, BE4, BE7, BE8, BE11. Thus, 45.45 % isolates were found to produce hydroxamate type of siderophore (Fig.5)

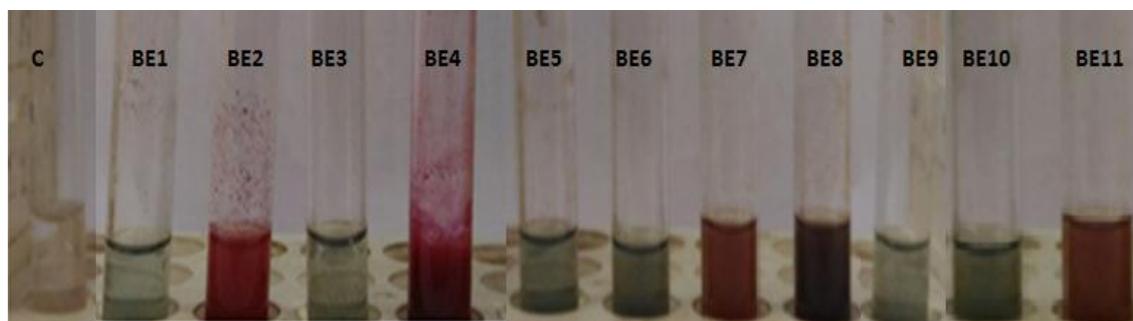


Fig 5: Test for Hydroxamate Type of Siderophores

Test for Catechol type of Siderophores

Arnow's test for detection of catechol type of siderophores was found to be positive with appearance of yellowish colouration. Deep yellow colouration was shown by BE4, BE5 and BE9 isolates. Therefore, it was revealed that 27.27% isolates ability to produce catechol type of siderophores. (Fig.6)

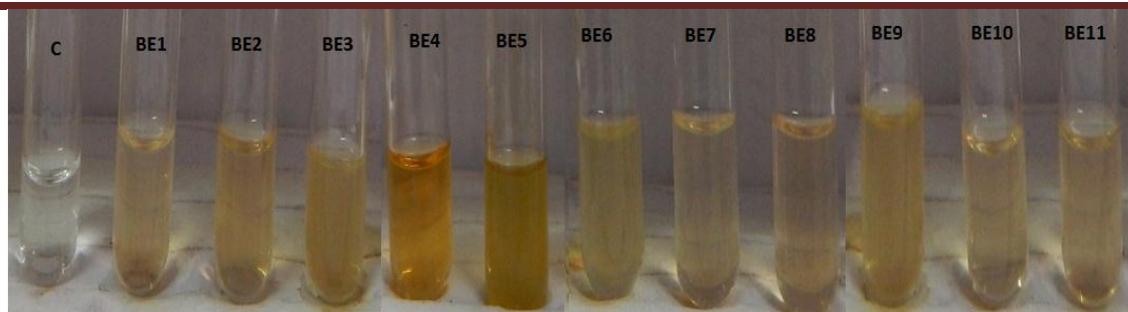


Fig 6: Test for Catechol type of Siderophores

Siderophores specifically help iron-deficient plants for nitrogen fixation since diazotrophs require Fe^{++} and Mo factors for nitrogenase synthesis and functioning (Kraepiel A. 2009). An increased knowledge of microbe-based symbiosis in plants can provide effective ways of developing sustainable agriculture in order to ensure human and animal food production with a minimal disturbance of the environment. The effective management of symbiotic microbial communities is possible using molecular approaches based on the continuity of microbial pools which are circulating regularly between soil-plant- and animal-provided niches in natural and agricultural ecosystems (Kupriyanov A. *et al.*, 2010). Analysis of this circulation could enable the creation of highly productive microbe-based sustainable agricultural systems, while addressing the ecological and genetic consequences of the broad application of microbes in agricultural practice. Since bacterial endophytes interact closer to the plant than rhizosphere and phyllosphere bacteria, their impact on plants may be direct and intense. Endophytic bacteria can directly benefit plants by stimulating their growth and/or indirectly through a reduction in the incidence of plant disease due to their ability of siderophore production and biocontrol properties by catechol, hydroxamate and/or phenolate types of siderophore (Rajkumar M. 2010). Therefore, such siderophores produced by bacterial endophytes of grapevine plants have potential for plant growth promotion and can be efficiently applied for sustainable agriculture.

Conclusion

In the present study, it was found that almost all the endophytic isolates of bacteria showed a positive test for CAS assay. Among them, 81.81% isolates showed a rate of siderophore production above 30%. The highest production potential was shown by isolate BE4. Whereas, isolate BE3 showed the lowest potential. During P-TLC, the best resolution for siderophore was shown by the solvent system, Butanol: Acetic acid: water (4:1:5). Tests for siderophore characterization using $FeCl_3$ were found to be positive for almost all the isolates. It was revealed that isolates of the bacterial endophytes exhibited the ability to produce hydroxamate as well as catechol type of siderophore which can directly help the plants by stimulating their growth and/or indirectly through a reduction in plant disease due to their ability for siderophore production. Several perennial, deciduous, as well as evergreen fruit crops develop symptoms of iron deficiency like interveinal chlorosis of apical leaves when cultivated in calcareous and alkaline soils. Therefore, *Ex situ* conservation of such siderophore-producing endophytes will be an ecofriendly way towards sustainable agriculture.

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Ichthyofaunal Biodiversity and Conservation Status of Majalgaon Reservoir, Marathwada, (M.S.), India

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ABSTRACT: This contribution focuses on the biodiversity and conservation aspects of fishes in one of the large freshwater body of Marathwada region, Maharashtra, 'Majalgaon reservoir'. The extensive survey was conducted from April, 2017 to March, 2018. A total of 42 species were recorded belonging to 29 genera, 15 families and 9 orders. As far as the fishes under different orders are concerned, order Cypriniformes consists of 20 species, Siluriformes of 8 species, Channiformes of 4 species, Perciformes of 3 species, Osteoglossiformes and Mastacembaliformes of 2 species each and Anguiliformes, Cyprinodontiformes and Mugiliformes of 1 species each. The analysis showed that as per IUCN red list category 52.38% are least concern, 19.04% are not evaluated, 9.52% species are near threatened, 7.14% are data deficient, 4.76% are lower risk near threatened and vulnerable respectively as well as 2.38% are lower risk least concern. The study confirms that this freshwater body may prove congenial for conservation of regional fish diversity, especially for local and endangered fish species.

Keywords: Conservation Status, Ichthyofauna, IUCN categorization, Threats to fish diversity.

Introduction

India has rich biological resources that qualify it as one of the mega diversity countries of the world. Fishes exhibit enormous diversity in their morphology, habitat they live in and biology. In India there are 2500 species of fishes out of which 930 are freshwater and 1,570 are marine (Kar, D. 2003). Freshwater biodiversity has declined faster than either terrestrial or marine biodiversity over the past 30 years (Jenkins, M. 2003). Stabilization of ecosystems such as wetlands is very essential for the sustainable utilization of resources. Freshwater fish are one of the most threatened taxonomic groups because of their high sensitivity to the alterations of aquatic habitats (Darwall, W.R.T. and Vie, J.C. 2005).

Ichthyofaunal diversity of an ecosystem represents the diversity and abundance of fish fauna. Many fish species have become highly endangered in freshwater ecosystems where heavy demand is placed on freshwater (Sebastian Raju *et al.*, 2014). Reservoir is not only an important source of water for drinking, agricultural operations, recreation, and sewage disposal but also considerably supports a substantial fishery. It not only supplements to nutritious diet but also is a source of livelihood for local fishing community. Hence, information about fish fauna inhabiting wetlands and other aquatic ecosystems is prerequisite for the development of culture as well as capture fishery.

The freshwater fish diversity is changing and getting depleted alarmingly fast as a result of the combined and interacting influences of over exploitation, water pollution, flow modification, destruction or degradation of habitat and invasion by exotic species (Revenga *et al.*, 2005). Present survey was conducted in Majalgaon reservoir, of Marathwada region, Maharashtra, India to explore the invaluable fishery resources of the reservoir.

Materials and Methods

The periodical survey of the Ichthyofaunal biodiversity of Majalgaon reservoir was conducted for a period of one year (from April 2017 to March 2018). Fishes were collected at different sites of the reservoir with the help of local fisherman using gill net, cast net, drag net, hooks and lin. Fishes were also collected from local fish markets located on the banks of reservoir. The collected fishes were preserved in 10% formalin according to their size and labeled them. Fishes were identified up to the species level using keys developed by Jayaram (1981), Talwar and Jhingran (1991), Jayaram (1999) & Jayaram (2010). Identified fishes were confirmed by the experts in the field of fish taxonomy. Classification was carried out on lines of Day (1989), Jayaram (1961) and Nelson (1976).

Data on current conservation status of fish was obtained from the report of the Conservation, Assessment and Management Plan (CAMP) workshop (Molur *et al.* 1998) on freshwater fishes of India and IUCN Red List Category of Threatened Species (IUCN, 2017).

Data regarding abundance of different fish species, threats faced by the fish fauna and economic importance was obtained from direct observation and interaction with the local stakeholders and internet search tools.

Result and Discussion

The results of present study confirm the occurrence of 42 fish species belonging to 29 genera, 15 family to 9 orders (Table 1). List of fish including their conservational status was given in Table 1. Out of 42 fish species order Cypriniformes was dominant with 20 (47.61%) species to be followed by order Siluriformes with 8 (19.04%) species, Channiformes with 4 (9.52%) species, Perciformes with 3 (7.14%) species while the orders of Osteoglossiformes & Mastcembeliformes each with 2 (4.76%) species, and rest of the orders, Anguilliformes, Cyprinodontiformes and Mugiliformes each with 1 (2.38%) species (Table 2).

Out of 42 species, major percent (45.23%) of fish were lower risk near threatened according to CAMP, 1998 but from the remaining 21.42% are vulnerable, 19.04% are not evaluated and 7.14% are endangered and lower risk least concern respectively. As per IUCN red list category 52.38% are least concern, 19.04% are not evaluated, 9.52% species are near threatened, 7.14% are data deficient, 4.76% are lower risk near threatened and vulnerable respectively as well as 2.38% are lower risk least concern (Table 3).

Table 1. Ichthyofaunal biodiversity and Conservation status of Majalgaon reservoir.

| Order/Family/Species | CAMP Status | IUCN Status | Frequency | Commercial Importance | Threats |
|---------------------------------------|-------------|-------------|-----------|-----------------------|-----------|
| Order Osteoglossiformes | | | | | |
| Family Notopteridae | | | | | |
| 1. <i>Notopterus notopterus</i> | LRnt | LC | C | C,F,O | HL,OE,T |
| 2. <i>Notopterus chitala</i> | EN | NT | R | F,O | AL, OE |
| Order Anguilliformes | | | | | |
| Family Anguillidae | | | | | |
| 3. <i>Anguilla bengalensis</i> | EN | LC | R | F,O | HL,OE, P |
| Order Cypriniformes | | | | | |
| Family Cyprinidae | | | | | |
| 4. <i>Chela phulo</i> | NE | NE | R | F | SP |
| 5. <i>Chela sladoni</i> | LRlc | LC | R | F,O | P,T |
| 6. <i>Cyprinus corpio</i> | NE | NE | A | C,F,O,S | SP |
| 7. <i>Catla catla</i> | VU | NE | A | C,F,S | HL,P |
| 8. <i>Cirrhinus mrigala</i> | LRnt | LC | C | C,F | HL,OE,SL |
| 9. <i>Amblypharyngodon microlepis</i> | LRlc | LC | M | O | O,F |
| 10. <i>Discognathus lamta</i> | LRlc | LC | M | F,O | HL,OF |
| 11. <i>Labeo rohita</i> | LRnt | LC | C | C,F,S | HL,OE,S,T |
| 12. <i>Labeo calbasu</i> | LRnt | LRnt | R | C,F | OE,P |
| 13. <i>Osteobrama cotio</i> | LRnt | NE | C | O | HL,P |
| 14. <i>Puntius amphibias</i> | VU | DD | R | O | HL,P |
| 15. <i>Puntius sarana sarana</i> | VU | LC | C | F,O,S | HL,T |
| 16. <i>Puntius ticto ticto</i> | LRnt | LC | M | O,F | OF,HL |
| 17. <i>Puntius sophera</i> | LRnt | LC | C | O | OF,P |
| 18. <i>Hypothalamichthys molitrex</i> | NE | NT | C | F,O,S | OF,HL,P |
| 19. <i>Thynnichthys sandkhol</i> | NE | DD | R | F,S | HL,P |
| 20. <i>Ctenopharyngodon idella</i> | NE | NE | C | C,F | SP |
| 21. <i>Rasbora daniconius</i> | LRnt | LC | M | F.O | OF,P |
| Family Cobitidae | | | | | |
| 22. <i>Lepidocephalichthys guntea</i> | LRnt | LC | C | F,O | HL,P |
| 23. <i>Nemacheilus botia</i> | LRnt | LC | C | F,O | HL,T |
| Order Siluriformes | | | | | |
| Family Bagridae | | | | | |
| 24. <i>Mystus aor</i> | NE | LC | C | F,O | HL,P |

EMERGING TRENDS IN BIODIVERSITY CONSERVATION (ETBC-2019)

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| | | | | | | |
|--------|------------------------------------|------|------|---|-------|--------------|
| | 25. <i>Mystus bleekeri</i> | VU | LC | M | F,O | OF,P,T |
| | 26. <i>Mystus cavasius</i> | LRnt | LC | C | F,O | OF,HL,T |
| | 27. <i>Mystus seenghala</i> | LRnt | LC | C | F,O | OF,P,T |
| Family | Clariidae | | | | | |
| | 28. <i>Clarias batrachus</i> | VU | VU | C | C,F,O | T |
| Family | Heteropneustidae | | | | | |
| | 29. <i>Heteropneustes fossilis</i> | VU | VU | M | C,F,O | OF,HL,T |
| Family | Siluridae | | | | | |
| | 30. <i>Wallago attu</i> | LRnt | NT | R | F,S | P,T |
| | 31. <i>Ompak bimaculatus</i> | EN | NT | R | C,F,O | OF,HL,P,T,SL |
| Order | Cyprinodontiformes | | | | | |
| Family | Belontiidae | | | | | |
| | 32. <i>Xenentodon cancila</i> | LRnt | LC | M | O | OF |
| Order | Mugiliformes | | | | | |
| Family | Mugilidae | | | | | |
| | 33. <i>Mugil cephalus</i> | NE | LC | M | F,O | SP |
| Order | Channiformes | | | | | |
| Family | Channidae | | | | | |
| | 34. <i>Channa gaucha</i> | VU | LC | M | F,O | HL,OE |
| | 35. <i>Channa marulius</i> | LRnt | LC | M | F,O | HL,OF |
| | 36. <i>Channa striatus</i> | LRnt | LRlc | C | C,F,O | OF,T |
| | 37. <i>Channa punctatus</i> | LRnt | LRnt | C | F,O | HL,OF,T |
| Order | Mastacembaliformes | | | | | |
| Family | Mastacembelidae | | | | | |
| | 38. <i>Mastacembelus armatus</i> | VU | NE | C | F,O | P |
| | 39. <i>Mastacembelus pancalus</i> | LRnt | NE | M | F,O | OF,HL,P,T |
| Order | Preciformes | | | | | |
| Family | Anabantidae | | | | | |
| | 40. <i>Anabas testudineus</i> | VU | DD | R | F,O | OF,OE |
| Family | Gobiidae | | | | | |
| | 41. <i>Glossogobius giuris</i> | LRnt | LC | C | F,O | SP |
| Family | Cichlidae | | | | | |
| | 42. <i>Oreochromis mossambica</i> | NE | NE | A | F,O | SP |

Threat Status :- LC- Least Concern, VU- Vulnerable, DD-Data deficient, NE- Not Evaluated, LRnt- Lower Risk near threatened, NT- Near threatened, LRlc- Lower Risk least concern, EN- Endangered.
 Abundance:- C- Common, R- Rare, M- Moderate, A- Abundant.
 Commercial value:- C- Cultivable, F- Food Fish, O- orentamental, S- Sport fish
 Threats:- HL- Habitat Loss, OE- Over Exploitation, P- Pollution, T- Trade, SP- Stable Poptation, SL- Siltation, OF- Over Fishing.

Table 2. Number and percent composition of families, genera and species under various orders

| Sr. No. | Order | Families | Genus | Species | % of families in an order | % of Genera in an order | % of Species in an order |
|---------|--------------------|----------|-------|---------|---------------------------|-------------------------|--------------------------|
| 1 | Osteogossiformes | 1 | 1 | 2 | 6.66 | 3.44 | 4.76 |
| 2 | Angulliformes | 1 | 1 | 1 | 6.66 | 3.44 | 2.38 |
| 3 | Cypriniformes | 2 | 15 | 20 | 13.33 | 51.72 | 47.61 |
| 4 | Siluriformes | 4 | 5 | 8 | 26.66 | 17.24 | 19.04 |
| 5 | Cyprinodontiformes | 1 | 1 | 1 | 6.66 | 3.44 | 2.38 |
| 6 | Mugiliformes | 1 | 1 | 1 | 6.66 | 3.44 | 2.38 |
| 7 | Channiformes | 1 | 1 | 4 | 6.66 | 3.44 | 9.52 |

| | | | | | | | |
|-------|--------------------|----|----|----|-------|-------|------|
| 8 | Mastacembaliformes | 1 | 1 | 2 | 6.66 | 3.44 | 4.76 |
| 9 | Preciformes | 3 | 3 | 3 | 20.00 | 10.34 | 7.14 |
| Total | | 15 | 29 | 42 | | | |

Table 3. Number and percentage occurrence of fish fauna of Majalgaon reservoir under the conservation status CAMP, 1998 and IUCN 2013

| Sr. No. | Threat Category | CAMP | | IUCN | |
|---------|----------------------------|--------|------------|--------|------------|
| | | Number | Percentage | Number | Percentage |
| 1 | Lower risk Near Threatened | 19 | 45.23 | 2 | 4.76 |
| 2 | Not Evaluated | 8 | 19.04 | 8 | 19.04 |
| 3 | Endangered | 3 | 7.14 | -- | -- |
| 4 | Vulnerable | 9 | 21.42 | 2 | 4.76 |
| 5 | Lower Risk least Concern | 3 | 7.14 | 1 | 2.38 |
| 6 | Data Deficient | -- | -- | 3 | 7.14 |
| 7 | Critically endangered | -- | -- | -- | -- |
| 8 | Least Concern | -- | -- | 22 | 52.38 |
| 9 | Near Threatened | -- | -- | 4 | 9.52 |

Further result revealed that 3 species are found abundant, 11 species are moderately found, 18 species are common and 10 species are rarely found in the reservoir. Among the fish recorded 35 species are food fish, 34 species are with ornamental value, 11 are cultivable and 6 fish species are sport fish. Exotic species recorded in the reservoir are *Cyprinus carpio*, *Hypothalamichthyes molitrix*, *Ctenopharyngodon idella* and *Oreochromius mossambica*.

Different types of fish fauna under threats of the Majalgaon reservoir concern, habitat loss is the major threats causing severe damage to 54.76% of total species followed by pollution (38.09%), over fishing and trade (35.71%), over exploitation (19.04%), stable population (14.28%) and siltation (7.14%).

A growing population and increasingly intense land use in the reservoir led to the rise in polluting inputs, including industrial effluents, pesticides and fertilizers from aquaculture, agriculture and domestic sewage (Venot, J. *et al.*, 2008). The large scale industrialization and the consequent effluent discharge are the important threat to the fish fauna. Introduced species for various purposes have been suggested as possible threats to the native fish fauna. These practices seem to have caused severe habitat degradation and decline of many important native food fishes. The fish fauna of this reservoir is also subjected to over exploitation for consumption, since the fish fauna of this lake supports the livelihood of several economic classes, there is an urgent need to design and implement conservation action plans.

Fish conservation measures on wide variety of factors must be taken into consideration to develop a comprehensive action plan. A holistic approach, integrating the concept of sustainable development and conservation measures could improve the situation. Considerable efforts should be made to conserve the biodiversity of fish. In order to conserve the valuable biodiversity of fish fauna of Majalgaon reservoir, the strategies should be adopted are: Restocking of economically important fish species, Proper introduction and control of exotic species, implementing closed seasons, regular supervision and monitoring of the reservoir, enforcement of strict rules and regulations on overfishing, Alternative livelihood to the local people, Sustainable fish harvest, captive breeding, Mass awareness, Educating and activating the fishermen cooperative societies and research and development.

Conclusions

The result of the present study revealed that, Majalgaon reservoir contains rich ichthyofaunal biodiversity. However the ichthyofaunal biodiversity of this reservoir is in declining mode due to several anthropogenic threats. In order to conserve this resource a holistic approach, integrating the concept of sustainable development and conservation measures should be adopted. Present study provides a comprehensive data on biodiversity, conservation status and the gene pool of unique ichthyofauna of Majalgaon reservoir.

Acknowledgement

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Folk Medicinal Plants Used in the Treatment of Skin Disorders of Malegaon Region

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ABSTRACT: Medicinal plants are a good source of active ingredients of herbal medicine and provide a safer and cost effective way to treat diseases. The current investigation aims to identify, collect and document the existing folk knowledge related to the utilization of medicinal flora for healing of skin ailments among the local inhabitants of Malegaon of Nashik District. Data were collected through a combination of questionnaire, group interview and discussion. A total of 21 medicinal plants representing 20 families are reported for their therapeutic use against skin ailments. The correct scientific name of plant, family and local names, preparations of medicinal recipes, dosage, and mode of administration are given. These have been gathered from medicine-men, elders and experienced informants. The impact of modernization and commercialization of medical treatment has telling effect on the number of these users and so a proper documentation and preservation of these practices are essential.

Keywords: Ethnomedicine, Traditional medicole, Skin disorders.

Introduction

According to the World Health Organization (WHO) about 65-80% of the world's population in developing countries depends essentially on plants for their primary healthcare due to poverty and lack of access to modern medicine. (Calixto, 2005). In rural societies the use of medicinal plants is both a valuable resource and a necessity, and further more a real alternative for preservation of disease. Local practitioner and indigenous healers have used botanical medicines traditionally for the preservation and treatment of different ailments. The primary benefits of using plant derived medicines are that are relatively safer than synthetic alternatives, offering profound therapeutic benefits and more affordable treatment. (Iwu *et al.* (1999). Traditional knowledge that is developed through the combined experience of many generations and still practiced in many rural and urban areas.

In India a number of studies have been in use, under indigenous systems of medicine like Ayurveda, Siddha and Unani. Ayurvedic texts viz., Charak Samhita, 'Sushrut Samhita', Sarangadhara Samhita, Bhavaprakasha Samhita, etc., explain numerous remedies to treat different ailments. Skin diseases are one such common disorders, affecting people worldwide, particularly in rural areas of developing countries due to poor sanitation and not proper dietary food supplements. (Panda T *et al.* (2013). Common skin ailments include swelling, scabies, wound, pimples etc., and are caused by a variety of microorganisms and uncomfortable environment. The current investigation aims to, identify, collect and document the medicinal plants traditionally used for the treatment of skin disorders in Malegaon region.

Documentation of traditional ethno-medicinal knowledge, indigenous herbal preparation for skin ailments could help in preserving knowledge and creating awareness regarding the need for conservation of biological resources.

Methodology

Ethno-botanical data were collected through survey during August 2016 by methods suggested by S.K. Jain (1987, 1989). Ethno-medicinal data were accrued after discussions with tribal and rural physicians, tribal headmen. (M.V. Patil & D.A. Patil, 2001). The medicinal plants used in each individual case were collected with the help of the actual users and were identified by proper flora. The plant species are deciphered using Floras by Cooke (1958), Lakshinarsimhan and Sharma (1991) Flora of Nashik District, and Flora of Dhule and Nandurbar district: D.A. Patil (2003).

The questionnaire was designed to obtain information about the locality; socio-demographic details, types of skin diseases treated by the plants, vernacular names of plants mentioned, parts used, method of preparation, dosage of forms and method of administration. The focus of the survey was to determine which plants that are growing in and around homesteads are used to treat skin disorders. (Helene De Wet, 2013).

Table 1: Plant combinations used to treat skin disorders.

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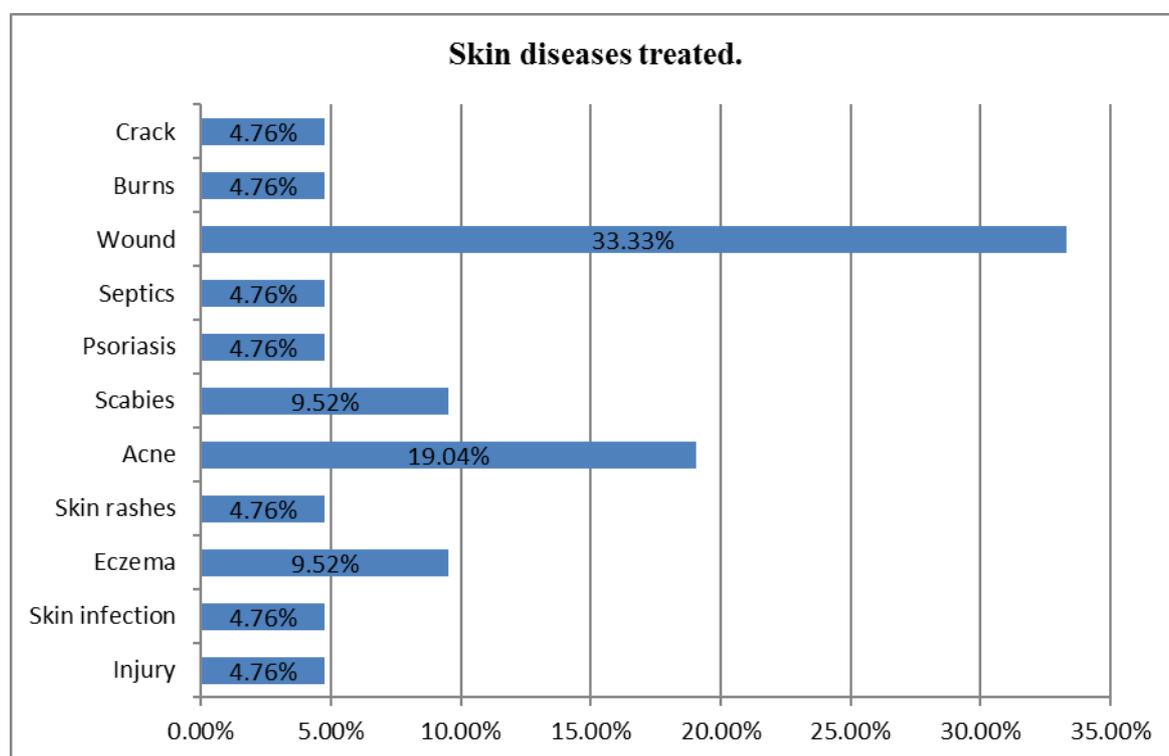
| Sr. No. | Botanical Name | Family | Local Name | Medicine |
|---------|---|----------------|-------------|--|
| 1 | <i>Aerides crispum</i>
Lindl | Orchidaceae | Ketki | Seed powder is mixed in coconut oil, paste is prepared and applied on injuries till cure.(Plant material is used if it is epiphytic on <i>Mangifera indica</i>) |
| 2 | <i>Amaranthus hybridus</i> L. | Ammaranthaceae | Rajgira | Leaves are crushed in coconut oil, this paste is applied on eczema wound till cure. |
| 3 | <i>Annona squamosa</i> L. | Annonaceae | Sitaphal | Leaves are crushed and made into paste. Paste is used to cure wounds. |
| 4 | <i>Azadiracta indica</i>
A.Juss. | Meliaceae | Neem | Leaves are boiled in water to get a green extract and it is applied externally on the whole body. It protects skin from any kind of skin infection, pimples. |
| 5 | <i>Butea monosperma</i>
(Lam). Taub | Papilionaceae | Palas | Fresh juice of leaves and bark of this plant is mixed with honey in 3:4 ratio and apply on face. It increases smoothness of skin and prevents pimples. |
| 6 | <i>Carica papaya</i> L. | Cariaceae | Papai | Pulp of ripen fruit is made into paste is applied on body to cure skin rashes. |
| 7 | <i>Chenopodium album</i>
L. | Chenopodiaceae | Chill Bhaji | A paste is made from leaves in coconut oil is applied on skin to treat psoriasis till cure. |
| 8 | <i>Citrus aurantifolia</i>
(Christm) Swingle | Rutaceae | Limbu | Slices of fruits are rubbed on the skin of the whole body, which makes smooth skin and spotless. |
| 9 | <i>Cuccuma domestica</i>
L. | Zingiberaceae | Halad | Rhizome powder is applied on wound of eczema till cure. |
| 10 | <i>Cyamopsis tetragonoloba</i> (L.)
Taub | Fabaceae | Gavar | Mature seeds are powdered. These are consumed about 10gm per day, for 2-3 days to avoid bleeding from wounds. |
| 11 | <i>Cynodon dactylon</i>
(L.) Pers. | Poaceae | Durva | Paste of leaves mixed with coconut oil is applied on wounds and cuts till cure. |
| 12 | <i>Diplocyclus palmatus</i> (L.) Jeffery | Cucurbitaceae | Shivlingi | Whole plant with fruits is crushed and make paste in coconut oil, it is useful against septics. |
| 13 | <i>Embllica officinalis</i>
Gaertn. | Euphorbiaceae | Awala | Leaves are burnt and powdered; mixed with coconut oil and applied in injury caused due to burns. |
| 14 | <i>Mentha spicata</i> L. | Lamiaceae | Pudina | A paste is prepared from the leaves of this plant and applied on face before bedtime. In the morning washed with cold water. It removes the spots and pimples. |
| 15 | <i>Nerium indicum</i> Mill | Apocynaceae | Kanher | The decoction of leaves is used externally to reduce swelling and scabies. |
| 16 | <i>Ocimum sanctum</i> L. | Lamiaceae | Tulas | Leaves are crushed with sandalwood, paste is prepared and is applied on the black spots appear after the healing of burn wounds. |

| | | | | |
|----|-----------------------------------|---------------|---------|--|
| 17 | <i>Santalum album</i> L. | Santalaceae | Chandan | Stem bark is powdered; paste is prepared used to treat scabies. |
| 18 | <i>Semecarpus anacardium</i> L.f. | Anacardiaceae | Bhilava | Seed oil is applied on foot cracks till cure especially in winter. |
| 19 | <i>Solanum tuberosum</i> L. | Solanaceae | Batata | Boil the potato in water, cooled it and meshed it and apply on burning skin. |
| 20 | <i>Tridax procumbens</i> L. | Asteraceae | Ghavati | The leaves are crushed in coconut oil; paste is applied on wounds till cure. |
| 21 | <i>Ziziphus mauritiana</i> Lam. | Rhamnaceae | Bor | Leaves are crushed , extract 2-3 drops applied on wound till cure. |

Results and Discussion

Skin diseases occur worldwide and amount to approximately 34% of all occupational diseases encountered. A total of 21 plants from 20 families and 21 genera were recorded as being used for the treatment of skin diseases like skin rash, skin infection, psoriasis, scabies, eczema, cracks, acne, crack, septics etc. Rural dwellers in the study area had showed comprehensive knowledge in the use of plant combinations to treat symptoms of different infections. Using plants is a holistic approach to treat ailments and the synergy of plant combination can have an even greater effect on treating infectious diseases. The plant parts used from the identified plants include the leaves, bark, fruit, seed and rhizome.

Fig 1: Frequency of different skin disorders treated in study area.



From the study it was observed that Wound were the most frequently treated skin condition (33.33%) followed by Acne (19.04%), Scabies & Eczema (9.52%) and Crack, Burns, Septics, Psoriasis, Skin rashes, Skin infection & Injury (4.76%).

Although many peoples in the study area have access to health facilities, the majority of the peoples preferred the use of medicinal plants for the treatment of skin disorders. Medicinal plants are effective, cheap, readily available and used for cultural reasons. Apart from these reasons, acne, burns and wounds cannot be treated with western medicine.

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This is encouraging for sustainable development purposes as the traditional use favors plant parts that can be regrown with ease. It is also noted that lay people are using their medicinal plants conservatively as it is a valuable free source in their primary health care system. So the preservation and documentation of traditional medicinal plant knowledge is important.

The plants used by the rural peoples need to be systematically screened by phytochemists and pharmacologists for the potent active principles.

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Biochemical Analysis of Farm Pond Fresh Water Algae

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ABSTRACT: Algae are a rich and diverse source of pharmacologically dynamic natural products. Present paper deals with the biochemical analysis of algal members of division Chlorophyta, Bacillariophyta and Cyanophyta. Preliminary phycochemical analysis revealed the presence of principal bioactive compounds - phenols, saponins, tannins, amino acids, coumarins and flavonoids. Current drifts in drug study from natural sources have shown that algae are hopeful organisms to afford unique biochemically active compounds. The present analysis defines the main constituent's biosynthesized by algae with nascent profitable influence in food science, therapeutic industry and community health.

Keywords: Algae, biochemical analysis, bioactive compounds

Introduction

Secondary metabolites derived from algae have a broad range of biological activities such as antibiotic, antiviral, antioxidant, antifouling, anti-inflammatory, cytotoxic and antimutagenic activities. These secondary metabolites show various applications in pharmaceutical industries. With the increasing apprehension nowadays microalgae are paid more concentration as nutraceuticals in the markets. Many researchers suggest that biological composition of microalgae such as protein, carbohydrate, minerals and bioactive compounds are of potential medicinal value that influences the nutritional value (Brown and Jeffrey 1992; Fuentes *et al.*, 2000). Bioactive compounds: polyphenols, catechin, flavonols, glycosides, and phlorotannins discovered from methanol extract of red, green and brown algae are been reported to have uniqueness in their molecular skeleton and structures contributing to the strong antioxidant activity (Khoddami *et al.*, 2013).

Materials and Methods

A) Preparation of algal extract:

Fresh algal materials were collected from the agricultural pond at Wakadi village. After collection, algal materials were immediately washed with distilled water to remove epiphytes and adhering debris, and then dried at room temperature. The dried tissues were grinded to a fine powder. 10 gm of algal powder was completely homogenized and extracted with 100 ml of methanol, acetone, ether, chloroform, alcohol solvent and distilled water for 24hrs. Clarification of algal mixture was carried out by filtration method using Whatman No.1 filter paper. The crude extracts were stored in the dark. Further these extracts were stored for estimating secondary metabolites.

B) Preliminary biochemical studies

The above condensed algal extracts, were preliminarily assessed for the biochemicals such as phenol, flavonoid, saponin, glycosides, alkaloids, tannins and terpenoids as:

C) Qualitative biochemical Analysis

Preliminary biochemical analysis was carried out for the extract as per standard methods described by Brain and Turner (1975) and Evans (1996).

1) Detection of Alkaloids: Extracts were dissolved individually in dilute hydrochloric acid and filtered. The filtrates were used to test the presence of alkaloids by using following reagents

i) **Mayer's test:** Filtrates were treated with Mayer's reagent. Formation of a yellow cream precipitate indicates the presence of alkaloids.

ii) **Wagner's test:** Filtrates were treated with Wagner's reagent. Formation of brown/reddish brown precipitate indicates the presence of alkaloids.

2) Detection of Flavonoids

i) Lead acetate test: Extracts were treated with few drops of lead acetate solution.

Formation of yellow color precipitate indicates that the presence of flavonoids.

ii) H₂SO₄ test: Extracts were treated with few drops of H₂SO₄. Formation of orange colour indicates that the presence of flavonoids.

3) Detection of Steroids

Two ml of acetic anhydride was added to 1 ml of the extracts, each with two ml of H₂SO₄. The colour was changed from violet to blue or green in some samples indicate that the presence of steroids.

4) Detection of Terpenoids

Salkowski's Test: 1 ml of the extract was mixed with 2 ml of chloroform and concentrated H₂SO₄ (3 ml) was carefully added to form a layer. An appearance of reddish brown colour in the inner face was indicates that the presence of terpenoids.

5) Detection of Anthroquinones:

Borntrager's Test: About 1 ml of the extract was boiled with 10% HCl for few minutes in a water bath. It was filtered and allowed to cool. Equal volume of CHCl₃ was added to the filtrate. Few drops of 10% NH₃ were added to the mixture and heated. Formation of pink colour indicates that the presence anthroquinones.

6) Detection of Phenols:

i) Ferric chloride test: 10 mg extracts were treated with few drops of ferric chloride solution. Formation of bluish black colour indicates that the presence of phenol.

ii) Lead acetate test: 10 ml extracts was treated with few drops of lead acetate solution. Formation of yellow colour precipitate indicates that the presence of phenol.

7) Detection of Saponins: About 0.5 ml of the extract was shaken with five ml of distilled water. Formation of frothing (appearance of creamy miss of small bubbles) shows that the presence of saponins.

8) Detection of Tannins: A small quantity of extract was mixed with water and heated on a water bath. The mixture was filtered and ferric chloride was added to the filtrate. A dark green colour was formed. It indicates that the presence of tannins.

9) Detection of Carbohydrates

Benedict's test

To 0.5 ml of filtrate, 0.5 ml of Benedict's reagent is added. The mixture is heated on a boiling water bath for 2 minutes. A characteristic colored precipitate indicates the presence of sugar

10) Detection of Protein & Amino acids

i) Biuret test: To 0.5 ml of extract equal volume of 40% NaOH solution and two drops of one percent copper sulphate solution was added. The appearance of violet colour indicates that the presence of protein.

ii) Ninhydrin test: About 0.5 ml of extract was taken and two drops of freshly prepared 0.2% Ninhydrin reagent was added and heated. The appearance of pink or purple colour indicates that the presence of proteins, peptides or amino acids.

11) Test for Glycosides

For 50 ml of extract is hydrolyzed with concentrated hydrochloric acid for 2 hours on a water bath, filtered and the hydrolysate is subjected to the following tests.

Borntrager's test: To 2 ml of filtered hydrolysate, 3 ml of chloroform is added and shaken, chloroform layer is separated and 10% ammonia solution is added to it. Pink colour indicates presence of glycosides.

12) Cardiac glycoside

Keller-Killani test- To 2 ml of extract, glacial acetic acid, one drop 5 % ferric chloride and concentrated sulphuric acid were added. Appearance of reddish brown colour at the junction of the two liquid layers indicates the presence of cardiac glycosides.

13) Test for Anthocyanins

The presence of anthocyanins has been demonstrated by adding 2 mL of the plant extract with 2 mL of 2 N HCl. The appearance of a pink-red color that turns purplish blue after addition of ammonia indicates the presence of anthocyanins.

14) Coumarins: 3 ml of 10% NaOH was added to 2 ml of aqueous extract formation of yellow colour indicates coumarins.

15) Emodins: 2 ml of NH₄OH and 3 ml of benzene was added to extract appearance of red colour indicates presence of emodins

16) Phlobatannins Deposition of red ppt when aqueous extract of each plant sample is boiled with 1% Aqueous HCl was taken as evidence for presence of Phlobatannins

Results and Discussion

The preliminary biochemical analysis of the fresh water extract revealed the presence of sugar, protein, phenols, alkaloids, flavonoids, tannins, anthocyanins, glycosides, coumarins, phlobatanins, carbohydrates, anthraquinone.

Table 1: Preliminary analysis of biochemicals.

| Sr.No. | Phytochemical | Methanol | Alcohol | Ether | Acetone | Chloroform | Aqueous |
|--------|--|----------|---------|-------|---------|------------|---------|
| 1 | Alkaloids | - | - | - | - | + | - |
| | i) Wagner's Test
ii) Mayer's Test | - | - | - | -- | + | - |
| 2 | Flavonoids | | | | | | |
| | i) Lead Acetate
ii) H ₂ SO ₄ test | + | - | - | - | - | - |
| 3 | Phenols | | | | | | |
| | i) Ferric chloride
ii) Lead acetate | - | - | - | - | - | - |
| 4 | Tannins | | | | | | |
| | i) Ferric chloride | + | + | - | + | - | - |
| 5 | Terpenoids | - | - | - | - | - | - |
| 6 | Saponin | - | - | - | - | - | - |
| 7 | Steroids | - | - | - | - | - | - |
| 8 | Anthocyanins | - | - | - | + | - | - |
| 9 | Coumarins | + | + | - | - | - | - |
| 10 | Emodins | - | - | - | - | - | - |
| 11 | Glycosides | + | + | - | + | - | - |
| 12 | Anthraquinone | - | - | - | + | - | - |
| 13 | Cardiac glycosides | - | - | - | - | - | - |
| 14 | Phlobatanins | - | + | - | - | - | - |
| 15 | Proteins | + | + | - | - | - | - |
| 16 | Carbohydrates | + | + | - | - | - | - |

Conclusion

The algae possess an excellent source of basic primary and secondary metabolites that provides them with an ability to be used as an indigenous folk medicine by traditional healers. This can further be investigated in a wide scale for the purpose of drug development against various diseases. Quantitative phytochemical estimation of algae is very important in identifying new sources of therapeutically, industrially important compounds. Primary and secondary metabolites in a good amount those are adequate enough to fight against infection and major ailments. Phytochemicals are not essential nutrients and are not required by the human

body for sustaining life, but have important properties to prevent or to fight some common diseases. The quantitative estimation of the screened phytochemicals may pave a way for the further analysis of the role that they play against any pathological process. And further studies on the isolation and characterization of the bioactive compound.

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Ex-Situ Conservation of *Adiantum Capillus-Veneris* Through Spore Culture

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ABSTRACT: India is well known for its rich and diversified flora but recently plants are facing severe threats because of habitat loss and over exploitation. Various strategies of plant conservation promotes in situ and ex situ conservation to prevent the continuous loss of plant diversity. Pteridophytes are facing probably worst hazards as they are habitat specific which require shade and extremely moist conditions. In Western Ghats 44 ferns endangered species are facing extinction and conservation of these species is a major challenge for the biologists. The present investigation is based on in vitro spore culture of *Adiantum capillus-veneris* L. using MS medium with different concentrations of IAA and 2,4 D. The medium fortified with the concentration of 2,4 D at 0.4 % and IAA at 0.2 % exhibited best results. Qualitative tests of micropropagated fern revealed the presence of various secondary metabolites tested by standard protocols.

Hence, *A. capillus -veneris* L. can be regenerated successfully using spore culture.

Keywords: Pteridophytes, *Adiantum*, ex-situ conservation, MS medium, secondary metabolites

Introduction

India is one of the 18 megadiversity centers in world as India is biodiversity hub of world comprises of about 48000 reported species out of which around 1130 are pteridophytes^[1, 2]. Pteridophytes are vascular cryptogams and spore bearing plants that include fern and fern allies. Maximum diversity of pteridophytes is observed in Himalayas, Western and Eastern Ghats. Recently Maridass and Raju ^[3] worked on fern and their allies, they particularly focused on current status of pteridophytes. They listed 272 species of ferns and fern-allies belonging to 95 genera and 34 families from Southern Western Ghats region. Most of the listed ferns are in the category of endemic and rare species and thus require urgent conservation. Currently, in India, attempts have been made for *ex situ* conservation of ferns by cultivation and propagation in botanic gardens. They play crucial role in the conservation of ferns as most of them can be grown successfully by vegetative propagation. From ancient time, ferns are known to be used in Ayurvedic and homeopathic medicines. *Adiantum* is one of the important fern mentioned in 'Charak Samhita'. Many species of *Adiantum* have been reported to have medicinal properties against various diseases such as boils, ulcers, wounds, fevers, headaches, colds, stomach pains, menstruation, childbirth, and other diseases.

Plant tissue culture is an efficient technique to conserve the germplasm which are endemic, rare and endangered as it makes use of small parts of their mother plant in the form of cells, tissues, etc. As compared to various agro practices, micropropagation through tissue culture and *in-vitro* spore germination are best applied and commercially exploited in fern species ^[4]. Tissue culture of fern species in India has been reviewed by Mehara and Cheema ^[5].

The advantages of *in vitro* spore germination of ferns have been described by many authors like Whittier ^[6] Sheffield ^[7].

Though, lots of studies focus on the medicinal properties of plants, especially angiosperms, has been taken place, unfortunately limited amount of studies have been done to explore the medicinal potentialities of the pteridophytes. Thus present investigation may turn into ideal way to conserve medicinally important ferns and the protocol developed will be a breakthrough in this field which will be available for other researchers.

Materials and Methods

Collection of plant material: *Adiantum capillus-veneris* L. was collected from Nowrosjee Wadia College campus and nearby localities of Pune. It was authenticated by BSI (Botanical Survey of India), Western Circle, Pune. The fertile fronds were dried in shade condition for two days and spores were collected. They were stored at low temperature (4°C) for further studies.

Preparation of MS medium: Murashige and Skoog's ^[8] medium is most suitable, most successful basic tissue culture medium for plant regeneration from organs, tissues, for inducing callus and other micropropagation

studies and commercial applications. Half M.S medium supplemented with 3% sucrose, 0.7% agar-agar at pH 5.8 was used for regeneration of prothallus. The medium was added with various concentrations of IAA and 2,4 D to observe gametophytic differentiation.

Qualitative analysis of secondary metabolites: Qualitative analysis of important secondary metabolites was performed by using standard protocols using standard reagents such as Mayer's, Hager's, Wagner's reagent, HCl, H₂SO₄, Benzene, Iodine solution, FeCl₃, etc.

Results and Discussion

Spore germination using tissue culture is one of the effective biotechnological methods which permit contamination free growth of gametophytes [9]. In the present study, mature spores were inoculated on aforesaid medium and were maintained at suitable environmental conditions for the development of gametophytes. The various stages of gametophytes are enumerated in the figures below.

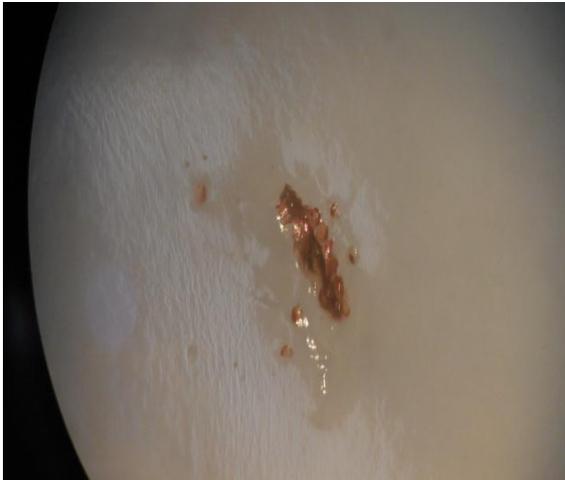


Fig. 1: Mature spore used for in-vitro culture



Fig. 2: Initial stage after spore germination

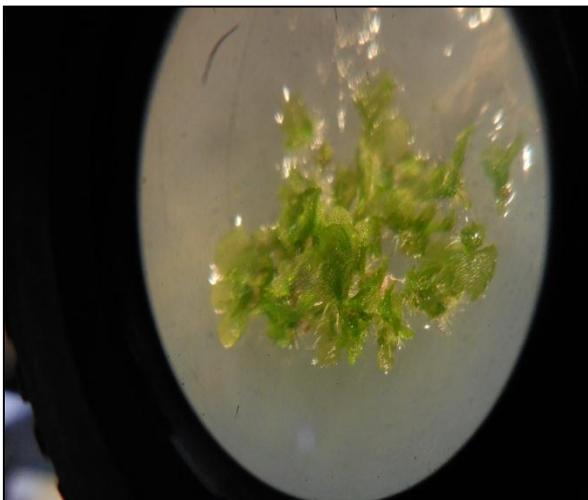


Fig. 3: Formation of prothallus (Gametophyte)

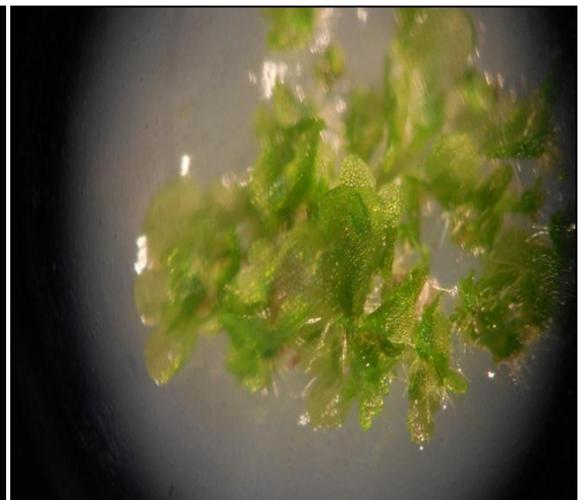


Fig. 4: Differentiation of Gametophyte

It took around 25 days for germination of spore while different morphological stages like filamentous, spatulate shaped in gametophytes were observed after 30 -35 days. Thus, the results obtained were completely in accordance with B. X. Ravi *et. al.*,^[10] that has done the similar work on endangered fern *Pteristripartite* Sw. Gametophytic generation is essential In the life cycle of fern to know its physiology and other aspects ^[11].

Generally, capacity of spore germination increases when the MS medium is supplemented with hormones, sugar and casein hydrosylate ^[12, 13]. The results in Table No. 1 showed the effect of various concentrations of

growth regulators where the best results of gametophytic development was observed when MS medium was supplemented with the concentration of 2,4 D at 0.4 % and IAA at 0.2 % .

Table No 1: Response of ex-plant (Spore) under different concentrations of Growth regulators

| Growth hormone | | Plant response |
|----------------|-------|----------------|
| IAA | 2,4 D | |
| 0.5 % | 0.5 % | ---- |
| 0.4 % | 0.2 % | + |
| 0.2 % | 0.4 % | ++ |

----: No germination detected; +: Germination occurred without gametophytic development; ++: Spore germination with gametophytic stages observed.

Various secondary metabolites were assessed qualitatively by using standard protocols. Samples were prepared in different solvents like aqueous, ethanol and methanol. The results pertaining to qualitative analysis are recorded in Table no. 2 which revealed the substantial amount of important secondary metabolites like alkaloids, glycosides, tannins, terpenes, flavonoids while Saponins were not detected.

Table No 2: Qualitative analysis of important secondary metabolites.

| Secondary Metabolite | Aqueous extract | Ethanol extract | Methanol extract |
|----------------------|-----------------|-----------------|------------------|
| Alkaloid | + | +++ | ++ |
| Glycosides | + | + | ++ |
| Saponins | --- | --- | --- |
| Terpenes | + | +++ | ++ |
| Tannins | ++ | + | +++ |
| Flavonoids | ++ | +++ | ++ |

Conclusion

Spores of *Adiantum capillus-veneris* were successfully germinated with considerable rate which further developed into prothallus and young gametophytes. Various concentrations of IAA and 2,4 D were tested for gametophytic differentiation. MS medium fortified with the concentration of 2,4 D at 0.4 % and IAA at 0.2 % exhibited best results for the said fern.

Acknowledgement

Authors are grateful to Dr. K. S. Venkatraghvan, Principal, Nowrosjee Wadia College and Dr. S. S. Gadekar, Head, Department of Botany, Nowrosjee Wadia College for providing necessary library and laboratory facilities required for this research.

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Traditional Uses of Medicinal Plant by Tribal and Rural Folk from Sangamner Taluka- Ahmednagar District, Maharashtra

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ABSTRACT: Sangamner taluka is rich in medicinal and economically important plants. Various plants are used by the tribal and rural folk as to cure diseases. During this recent exploration on about 20 plants were recorded. These plants were studied from ethno botanical point of view.

Keywords: Traditional, Tribal, Medicinal plants, Diseases.

Introduction

Sangamner has an abundant area for natural resources including medicinal plants. The region has hilly as well as plain area with its distinct flora. It has somewhat dry climatic condition. In summer day temperature gradually rises and goes up to 45°C. In winter and rainy season temperature is optimum (22°C to 29°C). Mostly brownish rocky soil is found. The area is inhabited by number of tribes viz. Vaidu, Dhanagar, Bhilla, Mahar, Paradhi etc. This flora is used by tribal of the area to cure various diseases. They prepare various forms like Kahada, churna, Arishta, Arka, Bhasma, Gutika, Asava etc. by traditional methods. In recent years, there has been a tremendous range of interest in the medicinal plants, especially those used in Ayurvedic and other traditional system of medicines. Number of plants used in the cosmetics, various ayurvedic products, which have economic value (Aher.R.K. and Aher.S.K. 2004) Medicinal plants from the basis of traditional or indigenous system of health used by the majority of the population of most developing countries (Bodeker, 2002). Screening of some medicinal plants from northern Argentina for their Antimicrobial activity. (Salvat, A. 2001). Ethnobotany of religious and supernatural beliefs of mishing tribes of Assam. (Sharma, U.K. and Pegu. 2011).

Materials and Methods

Information collected during the year 2015-16 traditional medicinal plants were used by tribal people in various region of Sangamner Taluka. The usual personal observations, oral interviews have done. Discussions with villagers, who have knowledge about indivisible plants of that region, Plant markets and tribal villages (Vankuta, Takali Dhokeshwar, Padali, Pimplegaon, and Rotha) were also surveyed. The data of ethnobotanical important plants were recorded during the field trips.

Results and Discussion

Observations of about 20 medicinal plant species are remunerated in the table-I. Plant species have been arranged in alphabetical order according to botanical name, family, local name, plant part used and cured diseases in folk medicines. Survey of Literature has revealed that no concerted efforts have been made in recent past to document knowledge and ethnic use of medicinal herbs flourishing in Kalasubai Plateau. Plants are often used as therapeutic agents as antiseptic, anti-inflammatory and in treatment of infectious disease including candidacies and dermatophytes (Bonjar. *et al.*, 2004). Many plants have been studied for their medicinal and antimicrobial properties (Branter and Grein 1994, Marinez *et al.*, 1996, Salvat, 2001, Arora *et al.*, 2005) However plants used for purpose of medicine must be fully grown up and matured with required rasa and guna. The part of Herbal plant to be taken for 'Aushadhi' is used as per requirement of people. Thereby ethnomedicinal plants have great scope in for easily feature. The aim behind this work is to aware the industrialist, agriculturists, farmers to come forward for cultivation and preservation of ethnomedicinal plants. There is a scope for collection of tribal medicinal plants from Parner area. These plants have also use in cosmetics and various Ayurvedic products, which have economic value. Certain industries based on medicinal plants may be developed which will not only be economical valuable but will also help in the economic upliftment of the nation.

Table 1: List of Medicinal Plants observed during survey

| Sr. No. | Botanical Name with family | Family | Local Name | Part used | Mode of administration |
|---------|-----------------------------------|----------------|------------|-------------------------|---|
| 1) | <i>Abrus precatorius</i> , Linn. | Fabaceae | Gunj | Leaves, Seeds | Whole plant is dried, roasted and ash is used to be applied on wounds. Concentrated plant extract taken as a blood purifier. |
| 2) | <i>Aegle marmelos</i> , Corr. | Rutaceae | Bel | Fruits | Leaf extract is used against blood pressure. |
| 3) | <i>Aloe vera</i> , L | Liliaceae | Korphad | Leaves | The juice of the roasted leaf is given for cold, cough and fever and used for skin diseases. Aloe gel is used in wrinkles and burns. Leaf juice mixed with ginger juices used to cure acute indigestion and jaundice. |
| 4) | <i>Argemone mexicana</i> .L. | Papaveraceae | Bilayat | Seeds and leaves | Seed powder is folded with leaf to smoke, which cures all dental disorders. |
| 5) | <i>Azadirachta indica</i> , Linn. | Meliaceae | Neem | Twigs | Stem along with bark used for teeth cleaning. |
| 6) | <i>Bauhinia racemosa</i> , L | Caesalpinaceae | Apata | Bark
flower
Roots | Bark extract is given for indigestion. |
| 7) | <i>Boerhaavia diffusa</i> , L. | Nyctaginaceae | Ghetuli | Whole plant | Hot water extract is used in urinary and respiratory problems. |
| 8) | <i>Cassia tora</i> L. | Cesalpiniaceae | Tarwad | Leaves | The whole plant extract is used to cure psoriasis. |
| 9) | <i>Commelinabenghalensis</i> .L. | Commelinaceae | Kana | Stem and leaves | Stem and leaves are used externally to stop bleeding |
| 10) | <i>Datura metel</i> , L. | Solanaceae | Dhotra | Seeds | Leaves relieve pain by acting as an antispasmodic. |
| 11) | <i>Eclipta alba</i> , (L) Hassk | Asteraceae | Maka | Leaves | Crushed leaf paste is used to cure skin disease. Leaf decoction is orally taken to cure stomach and headache problems. |
| 12) | <i>Euphorbia hirta</i> L. | Euphorbiaceae | Buiavala | Whole plant | Whole plant is dried, roasted and ash is used to be applied on cuts and wounds. |
| 13) | <i>Gloriosa superba</i> , L. | Liliaceae | Kalalavi | Rhizome | A part of root is boiled with water used as anodyne application is bite of poisons insect, snake bite parasitic skin disease and leprosy. |
| 14) | <i>Leucas aspera</i> .L. | Lamiaceae | Doron | Leaves | 3-5ml leaf juices are administered nostrils to reduce sinusitis. |

| | | | | | |
|-----|------------------------------|---------------|---------|--------------------|--|
| 15) | <i>Oxalis comiculata L.</i> | Oxalidaceae | Tengesi | Whole Aerial plant | Aerial plant wrapped with banana leaf and after Roasting in firewood is given with small amount of salt once daily at an interval of three days in diabetes. |
| 16) | <i>Psidium guajava, L.</i> | Myrteaceae | Gava | Twigs | As a tooth brushes. Stem and leaf extract is used as pain killer in toothache. |
| 17) | <i>Ricinus communis, L.</i> | Euphorbiaceae | Yerand | Bark and leaves | Juice of leaf and bark is used in Rheumatic arthritis and Oil from seeds is used as purgative. |
| 18) | <i>Sarcandra indica L.</i> | Fabaceae | Ashok | Barks | Bark powder are mixed with hot water and drink twice daily for few days for curing leucorrhoea. |
| 19) | <i>Terminalia chebula L.</i> | Combretaceae | Hilikha | Seeds | 25gm powdered dry seeds soaked in 100ml of water overnight and given 3times a day for 10days to cure jaundice. |
| 20) | <i>Zizyphus jujuba L.</i> | Rhamnaceae | Ber | Seeds and root | Leaf and bark paste heals fresh wounds. |

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Diversity and Density of *Scenedesmus* of Ramkund at Panchwati Dist. Nashik, Maharashtra, India

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ABSTRACT: *Algae constitute the important part of the food chain of aquatic life. Algal flora was studied earlier by many workers. The population of algae completely depends upon the physico-chemical parameters of the water quality. Scenedesmus is the algal genus of order Chlorococcales, which is one of the important groups of algae belonging to class-Chlorophyceae. This is the common non-motile colonial alga and found in vigorous growth in stagnant freshwater. It is found in planktonic form. It is 2-8 celled colonial form. During present studies, the species diversity and density of Scenedesmus at Ramkund of Panchwati area on the Godavari river was studied. During present investigations, algal samples were collected monthly during the year February 2014 to January 2015. During present studies, 15 species of Scenedesmus were recorded. Its density was more during summer, which declines in winter and is sparsely recorded in monsoon. The river receives huge quantity of domestic wastes and agricultural runoff which favours the growth of this algal group. At this station some pollution tolerant genera of Scenedesmus were also recorded indicating the organic pollution of water.*

Keywords: *Density, Scenedesmus, Ramkund, Panchwati, Pollution.*

Introduction

River water maintains its purity to some extent when either less amount of waste is added in it by its natural aquatic ecosystem or high speed of water flow. But this situation occurs only in monsoon period when rivers are flooded and thus its purification is limited. In fact, flow of river is not always the same but varies from season to season due to complex meteorological factors and varying characteristics of ground receiving rainfall. The magnitude of floods depends upon a number of factors like intensity and duration of rainfall, ground conditions and drainage characteristics.

Algal studies were made by many workers in all over the world. Studies on fresh waters have thrown much light on the life of biota and its interrelationships with habitat factors. Blum (1957) pointed out that most of information pertaining to the periodicity of algae in streams has been obtained from investigations in Europe and North America. The streams and rivers in India have been scantily investigated by many workers such as Lakshminaryana (1965 a, b), Chacko and Ganapati (1949), Balakrishnan and Gunale (1976,1978), Pingle (1981) etc.

During present studies, the diversity and quantitative analysis of *Scenedesmus* at ramkund of Panchwati area of Godavari river was carried out for 12 months.

Materials and Methods

Nashik is leading district in agriculture of Maharashtra. Nashik is situated on the great Deccan trap between 19° 35' and 20° 52' north latitude and 73° 16' and 74° 56' east longitude. It has an area of 15,582 sq.kms. i.e. 6015 square miles. Nashik is dry district having undulating surface except in Malegaon, Yeola, Sinnar and part in Nandgaon and Niphad talukas.

Godavari river originates in Sahadryis of Western Ghats at Tryambakeshwar and passing through Nashik city, it flows east wards. The present studies were carried out on the Godavari river for 12 months during the month of February 2014 to January 2015. Water samples were collected from the sampling site at monthly intervals. Sampling site is located at Ramkund at Panchawati. During summer and winter seasons, this station showed 3 to 5 feet water depth, while during monsoon it remain flooded and reached the depth above 10 feet. This is very sacred spot for Hindus and so many temples are constructed in the river basin at this site. Many people after having their sacred bath and wash in the river, visits the temples and worship the God. As it is the holy spot, many people release the human ashes (Asthi) in the river water. Besides this many religious ceremonies are commonly held at this site. At this site, thousands of people visits daily for their sacred baths. During this period, they took bath and used huge quality of detergents and soaps, which were released in water in addition to domestic waste. Thus, this site is influenced by anthropogenic activities throughout the year.

Quantitative analysis of phytoplankton

Phytoplanktons were analyzed quantitatively by Lackey’s drop method (Lackey, 1938).

Microphotography

Microphotographs of some *Scenedesmus* forms encountered during study period were taken simultaneously using research microscope “Olympus” with 10×, 40× and 100× objectives. For microphotography ‘Pentax’ -1000 camera, JSP digital camera, (DI 2018) and Aver media ezycapture computer software were used.

Phytoplankton identification was carried out with relevant literatures like Philipose (1967), Prescott (1954).etc.

Results and Discussion

Monthly variations in *Scenedesmus* species encountered during investigation period at sampling station was found. A total fifteen species of *Scenedesmus* were encountered during investigation period (Table.1). At this station maximum number of algal taxa of *Scenedesmus* were recorded during the month of May 2014 i.e. 15 taxa and minimum during the month of September, 2014 i.e. 5 and completely absent during month of August, 2014. Seasonal variation showed that, minimum *Scenedesmus* algal forms were found during the monsoon season, as most of algae were washed out due to flood condition in rainy season.

Highest density of *Scenedesmus* was recorded during the months of February to May and lowest during in June to September. During winter months (October-January) there was increase in *Scenedesmus* population.

As already mentioned, sampling station is located at Panchawati, it was under the influence of sewage waste and except monsoon season it showed the slow flow of water which favours the good algal flora.

Monthly variation in quantitative abundance of phytoplankton at different sampling stations is depicted in Table- 2.

Table 1. Qualitative analysis of algae encountered during investigation period at sampling station of Godavari river (February 2014 – January, 20015).

| Sr. No. | Name of Alga |
|---------|--|
| 1. | <i>Scenedesmus incrassatulus</i> var.mononae G.M.Smith |
| 2. | <i>Scenedesmus acuminatus</i> Chodat |
| 3. | <i>Scenedesmus arcuatus</i> Lemmermann |
| 4. | <i>Scenedesmus longus</i> var. Naegeli G.M.Smith |
| 5. | <i>Scenedesmus obliquus</i> (Turp.) Kuetzing |
| 6. | <i>Scenedesmus quadricauda</i> var. <i>Westii</i> (G.M.Smith) |
| 7. | <i>Scenedesmus quadricauda</i> var. <i>maximus</i> West & West |
| 8. | <i>Scenedesmus quadricauda</i> var. <i>parvus</i> G.M.Smith |
| 9. | <i>Scenedesmus abundans</i> var. <i>longicauda</i> G.M.Smith |
| 10. | <i>Scenedesmus quadricauda</i> var. <i>longispina</i> (Chodat) Smith |
| 11. | <i>Scenedesmus muzzaensis</i> Hyber Pestalozzi |
| 12. | <i>Scenedesmus hysterix</i> Lagerheim |
| 13. | <i>Scenedesmus carinatus</i> (Lemm.) Chobat |
| 14. | <i>Scenedesmus dimorphus</i> (Turpis) Kuetzing |
| 15. | <i>Scenedesmus acutiformis</i> Schroeder |

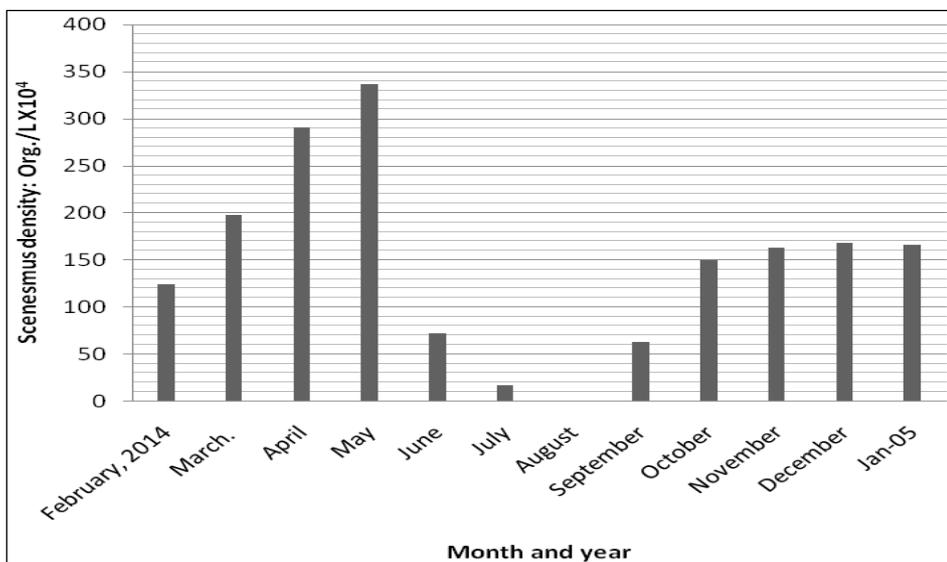
Table 2. Monthly Density of *Scenedesmus*.
(No. of organisms/L X 10⁴) during the period of Feb,2014- January,2015

| Month and Year | Season | <i>Scenedesmus</i> : Org/L X 10 ⁴ |
|----------------|--------|--|
| February, 2014 | Summer | 124.46 |
| March. | | 198.06 |
| April | | 291.15 |
| May | | 337.16 |

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| | | |
|-----------|---------|--------|
| June | Monsoon | 72.52 |
| July | | 17.55 |
| August | | - |
| September | | 62.96 |
| October | Winter | 149.61 |
| November | | 163.12 |
| December | | 168.51 |
| Jan-05 | | 166.75 |



General spectrum of *Scenedesmus* population showed that, during monsoon months the population recorded was minimum, while during winter season its number was increased and during summer peak of development took place.

During the investigation period, maximum peak of *Scenedesmus* density was noted during summer months. During the month of May 2005 it showed 337.16 org./L X 10⁴.

During months of monsoon, monthly variation in *Scenedesmus* population showed maximum peak in the month of September 2014 i.e. 62.96 org./L X 10⁴ while it was completely absent during the month of August.

In winter season (October 2014-January 2015) there was increase in *Scenedesmus* population. Maximum population was recorded during the months of December, 2014 (168.51 org./L X 10⁴) and January, 2015 (166.75 org./L X 10⁴).

In India, summer maxima and winter minima of algal forms were described by Chakrabarty *et al.* (1959) in the river Jamuna at Allahabad. Philipose (1959) recorded maximum development of algal population during summer and minimum during monsoon in the river Mahanadi. The greatest crop of phytoplankton was noted by Laxminarayana (1969 b) in winter and summer seasons and lowest number during monsoon from the river Ganges. According to him, temperature and nitrogen maxima of summer were correlated with corresponding maxima of the phytoplankton abundance. Our results agreed with Pawar *et al.* (2006) who reported the maximum algal population during summer, medium during winter and minimum during monsoon season showing the dominance of Chlorophyceae. Ganapati (1956) reported the similar condition from Cooum river at Madras. Roy (1955) on the other hand recorded maximum algal development dominated by diatoms during winter months in river Hoogly. Pahwa and Mehrotra (1966) reported the maximum phytoplankton population both in winter and summer season.

Eddy (1932) concluded that velocity of water current is one of the important factors controlling the age of water and emphasizes more on stability of ecological conditions for plankton production depending on it. Blum (1957) stated that fast water current cause mechanical danger to phytoplankton organisms but the benthic algae were benefited. Potter *et al.* (1975) recorded seasonal change in density of algae and found marked number during warmer months i.e. January and March from Moruya river, Australia.

Our results correlate with Ragothaman and Jaiswal (1995) who reported maximum population during winter and summer months and least in monsoon. Tiwari *et al.* (2001) also reported the maximum phytoplankton abundance during early summer and their number declined during monsoon from river Ganga.

Conclusion

During the investigation period, it is observed that during the summer season the maximum number and population of *Scenedesmus* was recorded, while low population was found in monsoon and its population again increases during winter. Due to bright sunlight and presence of more sewage disposal and slow flow of water in river, the growth and population of *Scenedesmus* species was recorded in more number in summer, while in monsoon due to flooding condition and flow of water most of the algal forms were washed out indicating very less number and population. The *Scenedesmus quadricauda* is pollution tolerant genus found at this site indicating the polluted nature of river water.

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