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From the Desk of Guest Editors

The Post Graduate Department of Zoology, Sant Gadge Baba Amravati University, Amravati is committed to excellence in teaching, research and community services in the field of Animal Biology, particularly, it supports academic activities occurring in the famous forests of Melghat region of the state. The efforts have always been taken by the Department for overall growth of various stakeholders. The Department of Zoology, Sant Gadge Baba Amravati University, Amravati MS organized a two day National Conference on 'Recent Trends in Life Sciences for Sustainable Development-RTLSSD-2019' during 22nd -23rd January 2019. The conference provided a platform for researchers, academicians and students to share the views and ideas during the various deliberations of the conference. The wholehearted support of scholars to organize the event and whole teamwork of us made the conference a great success. We congratulate each and every team member of the department as well as staff and students of other colleges who gave huge support to this academic event and carried out the conference work very smoothly up to the level of satisfaction of each and every delegate coming from different corners of the country. We have tried our level best to make the Proceedings of the Conference as flawless as possible in the form of this Special Issue, containing a selection of Conference papers published in this special issue of the renowned Journal, Bioscience Biotechnological Research Communications (BBRC).

Guest Editors

Dr. H. P. Nandurkar
Dr. M. M. Baig,
Dr. S. S. Pawar
Dr. V. K. Nagale

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Insect Pest Control with the Help of Spiders in the Agricultural Fields of Akot Tahsil, District Akola, Maharashtra State, India

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Department of Zoology Ghulam Nabi Azad Arts, Commerce and Science College, Barshitakli, District-Akola (Maharashtra State).

ABSTRACT

Spiders are among the most abundant insectivorous predators of Terrestrial ecosystem. Spiders are the creature which present in everywhere. Spiders play a major role as bio-control agents of insect pests in all habitats. Spiders are one of the most diverse animal groups in the World. Spiders are carnivorous creature. Spider plays an important role in regulating insect pests in the Agricultural Fields. They mostly feed on small insects, even though they may also feed on various large insects. Pesticides use is harmful and costly in agricultural fields so now a day's spiders are use as natural and safe pest control agent in agricultural fields. Spider's predatory capacity can have an effect in decreasing densities of insect pests, when they are used to balance the effect of insecticides and Pesticides. If pesticides are avoided, spiders can consistently take shelter in the fields, feed on the pests and increase the productivity. The constant use of a wide range of pesticides has caused many side effects, like loss of biodiversity, the problem of secondary pests and Environmental Pollution. Spiders eat a large number of small creatures. During the present survey I have reported 89 Species belonging to 17 Families and 42 Genera of Spiders in agricultural fields of Akot Tahsil, District Akola, Maharashtra State. Spiders of Families Araneidae, Clubionidae, Eresidae, Gnaphosidae, Hersilidae, Linyphiidae, Lycosidae, Miturgidae, Oxyopidae, Philodromidae, Salticidae, Scytodidae, Sparassidae, Tetragnathidae, Theridiidae, Thomisidae, Uloboridae were recorded during the investigation.Some spiders are among the most effective predators of leafhoppers and other pests. Some Spiders are control agents of aphids. Due to destroying the pest or insects, spiders are friends of farmer. Spiders are important Pests control agents. Predatory arachnids such as spiders are an important group of biological control agents.

KEY WORDS: Insect Pest, Spiders, Agricultural Fields.

INTRODUCTION

Spiders are among the most abundant insectivorous predators of Terrestrial ecosystem. Spiders are the creature which present in everywhere. Spiders play a major role as bio-control agents of insect pests in all habitats. Spiders are one of the most diverse animal groups in the World. Spiders are carnivorous creature. Spider plays an important role in regulating insect pests in the Agricultural Ecosystem. They mostly feed on insects, even though they may also feed on various other kinds of creatures. There are 41,218 spiders species are found all over the world in almost every kind of habitat, Plat nick (2009). Spiders are beneficial to human beings in the sense that they feed mostly on the pests of agricultural fields. A particular spiders as the giant crab spider has been known as an effective in controlling large insects and other insect pests found in the agricultural fields. Predatory arachnids such as spiders are an important group of biological control agents.

The population densities and species abundance of spider communities in Agricultural fields can be as high as in natural ecosystems. Many uses of parasitic and predatory natural enemies to control agricultural pests have been reported Greenstone (1999). They have usually been treated as an important biological control agent, because there is ecological role of spiders in pest control. Use of chemical pesticides has killed natural predators in the agricultural fields and also disturbing the natural fauna. Several toxic insecticides and pesticides are recommended to control pests in agricultural fields, Jeyaparvathi et al. (2013). These chemicals insecticides and pesticides are destroying the vegetation.

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MATERIAL AND METHODS

A survey of Spiders was carried out in Agricultural Fields of Akot Tahsil, District Akola during 2018. Spiders were collected from different areas of Agricultural Fields. For collection of spiders direct searching, collected Spiders by Insect nets, Pit fall trapping, beating steak and umbrella method were used. The Spiders Specimens were identified according to Kaston spider book (1972). The photographs were taken in different views, to get the clear eye position, shades of cephalothorax and abdomen, spines and hairs pattern.

The constant use of a wide range of pesticides has caused many side effects, the problem of secondary pests, the recovery of insect pests and Environmental Pollution. Spiders consume a large number of small creatures and do not injure vegetation.

RESULTS AND DISCUSSION

During the present survey I have reported 89 Species belonging to 17 Families and 42 Genera of Spiders in Agricultural fields of Akot Tahsil, District Akola, Maharashtra State. Spiders of Families Araneidae, Clubionidae, Eresidae, Gnaphosidae, Hersilidae, Linyphiidae, Lycosidae, Miturgidae, Oxyopidae, Philodromidae, Salticidae, Scytodidae, Sparassidae, Tetragnathidae, Theridiidae, Thomisidae, Uloboridae were recorded during the investigation. The details are provided in Table no.1.

Spiders are used to balance the effect of insecticides and Pesticides. Spider's predatory capacity can have an effect in decreasing densities of insect pests. Some spiders are among the most effective predators of caterpillars, and other pests. Some Spiders and Spider lings are main control agents of aphids. Due to destroying the pest or insects, spiders are friends of farmer. Most spiders feeds on insects that's why productivity of crop gets increased, hence spiders are important Pests control agents.

Table 1

Sr. No.	Family	Genera	Species
1	Araneidae	07	15
2	Clubionidae	01	02
3	Eresidae	01	02
4	Gnaphosidae	02	06
5	Hersilidae	01	02
6	Linyphiidae	03	08
7	Lycosidae	04	09
8	Miturgidae	02	04
9	Oxyopidae	04	07
10	Philodromidae	01	01
11	Saltisidae	07	14
12	Scytodidae	01	02
13	Sparassidae	01	02
14	Tetragnathidae	02	02
15	Theridiidae	02	03
16	Thomisidae	02	09
17	Uloboridae	01	01
	Total	42	89

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Botanical Communication

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A Statistical Approach to Find Correlation Among Various Morphological Descriptors in Bamboo Species

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ABSTRACT

Bamboos are tall woody perennial, arborescent or shrubby, fastest growing grasses of subfamily (Bambusoideae). Taxonomical classification of Bamboo is mainly based on the vegetative characters due to unusual flowering of Bamboos. So, generally for the identification one has to rely on vegetative characters. ANOVA was employed for 10 different most determining vegetative characteristics in Bamboos to establish their level of significance at which each individual character can be utilized to differentiate the species. This lead us to know that highest numbers of significant values were shown by culm-sheath blade breadth (120) followed by culm-sheath breadth (112), culm-sheath length (102), leaf breadth (102), height of culm (101), diameter of culm (91), wall thickness of culm (73), culm-sheath blade length (52) and culm intermodal length (38). Among all the observed readings the most obvious characters were considered to distinguish the Bamboo species under study. This investigation also concludes that the culm-sheath characters should be given the first priority to distinguish the Bamboos. This study was aimed to put forward the most distinguishing vegetative character in Bamboos using ANOVA.

KEY WORDS: ANOVA, Bamboo, Morphology, Statistical

INTRODUCTION

Bamboos are tall perennial woody, arborescent or shrubby, fastest growing grasses of subfamily Bambusoideae which is one of the thirteen currently recognized subfamilies within the grass family (Poaceae) (GPWG, 2001; Sanchez- Ken et al., 2007; Bouchenak-Khelladi et al., 2008). In contrast to the other grasses Bamboos are the only major lineage in the grasses to adapt and diversify within the forest habitat (Judziewicz et al., 1999; GPWG, 2001; BPG, 2012). Diversified erratically in the various part of the humid tropical, sub tropical and temperate region of the earth (Subramaniam, 1998). Mostly, occur naturally in every continent except Europe and Antarctica (Kumar and Sastry, 1999).

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Taxonomical classification of Bamboo is mainly based on the vegetative characters because of their erratic flowering. However, varying condition of environment influence the vegetative characters of Bamboo such as branching pattern, culm-sheath and stem (Wu, 1962). Bamboos got some specific characters which distinguish them from other grasses. Most distinguishing among them are woodiness, strong branching, culm sheaths clothing the young culm shoots and rhizome system. Some distinct floral characters are also present in Bamboos, no single character is diagnostic of Bamboos and there is no sharp boundary between Bamboos and other grasses (Parodi, 1961).

Bamboo classification is mainly based on vegetative characteristics has always been lingered incompatible. Balansa classified Bonia, as an independent genus and Baillon categorized it as synonym of Bambusa and ultimately considered as subgenus of Bambusa by Camus (Sun et al., 2006). Nevertheless, both vegetative and floral characteristics are also used in combination for correcting inferences of Bamboo classification, which otherwise is solely based on vegetative characteristics (Holttum, 1956; Gilliland, 1971; Tewari, 1992).

Bamboo herbaria are lacking a comprehensive collection of fertile materials because of the long flowering of plant. So, generally for the identification one has to rely on vegetative characters. Complete details of vegetative parts of Bamboo are missing in the written

Table 1: The genetic variability in term of morphological characters observed in eighteen species of Bamboos.

Taxa		Height (m)	Diameter (cm)	Inter-node Length (cm)	Wall Thickness (cm)	Culm sheath					
						Culm Sheath (cm)		Blade (cm)		Leaves (cm)	
						Length	Breadth	Length	Breadth	Length	Breadth
B. bambos	Mean	24	8.5	28	2.38	22	13.5	10.5	6.75	7.75	3
	St. dev	2.94	2.9	6	0.63	11	6.35	1.29	2.62	5.6	2.05
B. polymorpha	Mean	16.5	5.5	42	2.5	17	24.25	6.55	5.7	13.5	2.07
	Stdev	1.29	1.3	18	0.4	1.8	2.21	0.42	0.83	2.1	0.11
B. balcooa	Mean	17	9.5	25	2.43	27	21.25	11.5	7.75	19	2.25
	Stdev	3.56	2.6	9.6	0.22	6.48	2.75	4.7	2.21	7.74	0.13
B. vulgaris	Mean	15	8	35	1.23	25.5	17.5	7	3.5	15	1.25
	Stdev	5	2	9	0.46	4.43	2.08	2.58	1.29	6.48	0.24
B. burmanica	Mean	15	4.3	29	2.7	14	17.25	4.1	6	18	2.3
	Stdev	4	1.3	11	0.22	2	2.75	1.33	0.91	7.25	0.67
B. multiplex	Mean	3.38	2.25	20	1.5	4.8	1.52	1.27	1.45	7.75	0.77
	Stdev	1.38	0.65	4.1	0.14	0.6	0.42	0.22	0.13	0.95	0.22
B. tulda	Mean	16	4	36.25	1.675	18	16.25	15	10	5.25	2.65
	Stdev	6	1	17.97	0.22	2.6	1.71	4.16	1.41	2.21	0.87
B. ventricosa	Mean	4.4	1.5	6.73	1.4	3.13	1.37	1.25	0.9	9.75	1.22
	Stdev	1.7	0.4	1.15	0.18	0.85	0.65	0.21	0.33	2.21	0.17
D. giganteus	Mean	18	6.5	33	0.7	29	20.75	13.25	3.07	22.25	5.37
	Stdev	2.2	1.3	7	0.2	4	3.09	6.07	1.21	6.61	0.35
D. hamiltonii	Mean	13.8	9.25	30.3	1.1	24	13.5	6.05	2.52	22.75	5.52
	Stdev	1.89	1.71	9.32	0.2	3	1.29	0.822	0.42	10.71	1.89
D. strictus	Mean	8	3.2	23	1.95	11	5.25	1.55	0.55	12	1.1
	Stdev	2	0.5	3	0.45	1.8	1.71	0.44	0.13	2.58	0.18
D. asper	Mean	15	7.6	28	2.5	21	18.5	4.5	1.25	27.5	6.5
	Stdev	2.2	1.1	6.9	0.08	3	1.29	1.29	0.21	9.18	1.29
D. membranaceus	Mean	17	6	29	2	28	10.25	4.5	0.65	13.75	1.25
	Stdev	1.41	1	11	0.5	6.7	1.71	0.08	0.13	2.62	0.13
D. longispathus	Mean	13	3	35	1.3	28	9.75	3.92	0.97	27.5	4.5
	Stdev	2.2	0	13	0.32	6	1.7	0.45	0.51	10.14	1.3
Melocanna basifera	Mean	7.8	3.4	25	1.1	13	10.47	12	1.27	22.5	2.55
	Stdev	1	0.6	7	0.3	2	2.62	2.58	0.22	2.08	0.44
Gigantochloa ablociliata	Mean	10	4.8	32	1.33	16	12.25	8.87	2.85	28.5	3.9
	Stdev	0.8	1	6.7	0.33	3	4.27	4.13	1.15	6.55	0.84
Dinochloa andamanica	Mean	24	4	26	0.98	9	3.47	3.25	0.35	9.5	2.6
	Stdev	2.6	2	4.4	0.17	1	1.09	0.21	0.13	3.87	0.57
Guadua angustifolia	Mean	3.25	1.5	12	1.03	7.4	3.87	1.55	0.95	14.25	2.92
	Stdev	0.96	0.4	2.1	0.46	0.9	0.85	0.13	0.13	3.5	1.11

Mean of triplicates is presented with standard deviation.

accounts of Indian Bamboos by (Gamble, 1896; Karthikeyan et al., 1989; Tewari, 1992; Seethalaxmi and Kumar, 1998). All these works also suffer from the lack of identification keys to the genera and species, either based on floral or vegetative characters. These publications also show considerable disparity in the number of genera and species reported from different phyto-geographic regions of India. This disparity emphasizes the need for a review of classification on Bamboos and compilation of the information on various species, including their synonyms.

Even despite the availability of dried herbarium samples, these usually lack enough morphological resolution and thus create uncertainty in the actual field condition. Hence, the identification keys frequently dependent on different vegetative features that require further refinement and reinvestigation. In particular, the taxonomic differentiation of woody Bamboos at lower ranks, such as genera and species, are not well resolved to date. There are numerous species which are known only vegetatively, new species are constantly been described (Clark et al., 2007; Filgueiras and London, 2006; Triplett et al., 2006) and several undescribed taxa are known to occur in the wild habitat of South and Central Americas. This work has focused on the significance of vegetative characters in Bamboos and the utilization of these characters on the priority bases.

MATERIAL AND METHODS

In an extensive survey Bamboos were collected different geoclimatic regions of India. All the species collected were successfully planted

Table 2: ANOVA of morphological character (height) between eighteen Bamboo species.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1																		
2	p< 0.0034																	
3	p< 0.0231	p< 0.8005																
4	p< 0.0190	p< 0.4832	p< 0.4575															
5	p< 0.0150	p< 0.5956	p< 0.5522	p< 0.8309														
6	p< 0.0001	p< 0.0001	p< 0.0004	p< 0.0061	p< 0.0018													
7	p< 0.0550	p< 0.8770	p< 0.7854	p< 0.7199	p< 0.8463	p< 0.0066												
8	p< 0.0001	p< 0.0001	p< 0.0007	p< 0.0100	p< 0.0032	p< 0.3961	p< 0.0101											
9	p< 0.0146	p< 0.3675	p< 0.7328	p< 0.2937	p< 0.3389	p< 0.0001	p< 0.6069	p< 0.0001										
10	p< 0.0011	p< 0.0533	p< 0.1580	p< 0.7953	p< 0.5446	p< 0.0001	p< 0.5048	p< 0.0003	p< 0.0336									
11	p< 0.0001	p< 0.0006	p< 0.0044	p< 0.0498	p< 0.0193	p< 0.0240	p< 0.0400	p< 0.0766	p< 0.0007	p< 0.0063								
12	p< 0.0032	p< 0.3675	p< 0.4359	p< 0.7995	p< 1.0000	p< 0.0001	p< 0.8238	p< 0.0002	p< 0.1619	p< 0.3432	p< 0.0031							
13	p< 0.0052	p< 0.6202	p< 1.0000	p< 0.3890	p< 0.4663	p< 0.0001	p< 0.7586	p< 0.0001	p< 0.5891	p< 0.0333	p< 0.0005	p< 0.2316						
14	p< 0.0009	p< 0.0319	p< 0.1030	p< 0.6131	p< 0.3835	p< 0.0003	p< 0.3867	p< 0.0008	p< 0.0220	p< 0.6202	p< 0.0141	p< 0.1963	p< 0.0212					
15	p< 0.0001	p< 0.0001	p< 0.0024	p< 0.0432	p< 0.0140	p< 0.0020	p< 0.0360	p< 0.0135	p< 0.0002	p< 0.0013	p< 0.8519	p< 0.0008	p< 0.0001	p< 0.0044				
16	p< 0.0001	p< 0.0001	p< 0.0086	p< 0.1379	p< 0.0523	p< 0.0002	p< 0.0972	p< 0.0010	p< 0.0006	p< 0.0109	p< 0.0941	p< 0.0044	p< 0.0001	p< 0.0408	p< 0.0117			
17	p< 0.8090	p< 0.0031	p< 0.0262	p< 0.0215	p< 0.0167	p< 0.0001	p< 0.0637	p< 0.0001	p< 0.0158	p< 0.0010	p< 0.0001	p< 0.0031	p< 0.0049	p< 0.0008	p< 0.0001	p< 0.0001		
18	p< 0.0001	p< 0.0001	p< 0.0003	p< 0.0053	p< 0.0015	p< 0.8864	p< 0.0059	p< 0.2930	p< 0.0001	p< 0.0001	p< 0.0161	p< 0.0001	p< 0.0001	p< 0.0002	p< 0.0006	p< 0.0001	p< 0.0001	

1.Bambusa bambos 2. Bambusa polymorpha 3.Bambusa balcooa 4.Bambusa vulgaris 4.Bambusa burmanica 6.Bambusa multiplex 7.Bambusa tulda 8.Bambusaventricosa 9.Dendrocalamus giganteus 10.Dendrocalamus hamiltonii 11.Dendrocalamus strictus 12.Dendrocalamus asper 13.Dendrocalamus membranaceus 14.Dendrocalamus longispathus 15.Melocanna baccifera 16.Gigantochloa ablociliata 17.Dinochloa andamanica 18.Guadua angustifolia. ANOVA representing Bamboo height of 18 species studied, bold values depict non- significance between species. While as other are significant at various levels of significance set at: P<0.01, P< 0.001 and P<0.05.

Table 3: ANNOVA of morphological character (Diameter) among eighteen Bamboo species.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1																		
2	p< 0.1066																	
3	p< 0.6278	p< 0.0348																
4	p< 0.6946	p< 0.1300	p< 0.3498															
5	p< 0.0356	p< 0.2148	p< 0.0116	p< 0.0335														
6	p< 0.0055	p< 0.0041	p< 0.0018	p< 0.0031	p< 0.0300													
7	p< 0.0195	p< 0.0710	p< 0.0065	p< 0.0161	p< 0.4372	p< 0.1340												
8	p< 0.0029	p< 0.0010	p< 0.0010	p< 0.0014	p< 0.0057	p< 0.0871	p< 0.0239											
9	p< 0.2528	p< 0.3153	p< 0.0877	p< 0.3675	p< 0.0468	p< 0.0011	p< 0.0167	p< 0.0003										
10	p< 0.6704	p< 0.0128	p< 0.8791	p< 0.3250	p< 0.0033	p< 0.0003	p< 0.0017	p< 0.0001	p< 0.0424									
11	p< 0.0110	p< 0.0159	p< 0.0034	p< 0.0070	p< 0.1672	p< 0.0699	p< 0.6585	p< 0.0026	p< 0.0031	p< 0.0005								
12	p< 0.5826	p< 0.0498	p< 0.2346	p< 0.9080	p< 0.0074	p< 0.0002	p< 0.0031	p< 0.0001	p< 0.2468	p< 0.1581	p< 0.0004							
13	p< 0.1173	p< 0.6905	p< 0.0346	p< 0.1415	p< 0.0696	p< 0.0002	p< 0.0185	p< 0.0001	p< 0.3670	p< 0.0090	p< 0.0007	p< 0.0316						
14	p< 0.0080	p< 0.0078	p< 0.0025	p< 0.0047	p< 0.0745	p< 0.2193	p< 0.3482	p< 0.0060	p< 0.0017	p< 0.0003	p< 0.3366	p< 0.0002	p< 0.0003					
15	p< 0.0136	p< 0.0267	p< 0.0042	p< 0.0093	p< 0.2735	p< 0.0444	p< 0.8941	p< 0.0024	p< 0.0051	p< 0.0007	p< 0.6090	p< 0.0006	p< 0.0017	p< 0.1823				
16	p< 0.0506	p< 0.4090	p< 0.0156	p< 0.0501	p< 0.5380	p< 0.0054	p< 0.1696	p< 0.0009	p< 0.0792	p< 0.0040	p< 0.0305	p< 0.0096	p< 0.1334	p< 0.0119	p< 0.0597			
17	p< 0.0444	p< 0.2872	p< 0.0157	p< 0.0465	p< 1.0000	p< 0.0710	p< 0.5098	p< 0.0192	p< 0.0803	p< 0.0061	p< 0.2751	p< 0.0170	p< 0.1393	p< 0.1530	p< 0.3871	p< 0.6149		
18	p< 0.0030	p< 0.0010	p< 0.0010	p< 0.0014	p< 0.0058	p< 0.0921	p< 0.0247	p< 0.9379	p< 0.0003	p< 0.0001	p< 0.0026	p< 0.0001	p< 0.0001	p< 0.0061	p< 0.0024	p< 0.0009	p< 0.0197	

1.Bambusa bambos 2. Bambusa polymorpha 3.Bambusa balcooa 4.Bambusa vulgaris 4.Bambusa burmanica 6.Bambusa multiplex 7.Bambusa tulda 8.Bambusaventricosa 9.Dendrocalamus giganteus 10.Dendrocalamus hamiltonii 11.Dendrocalamus strictus 12.Dendrocalamus asper 13.Dendrocalamus membranaceus 14.Dendrocalamus longispathus 15.Melocanna baccifera 16.Gigantochloa ablociliata 17. Dinochloa andamanica 18.Guadua angustifolia. ANOVA representing Bamboo Diameter of 18 species studied, bold values depict non- significance between species. While as other are significant at various levels of significance set at: P<0.01, P< 0.001 and P<0.05.

and flourished in Central Forest Nursery, Wadali, a very small area of Wadali range which is the part of Pohara and Malkhed reserve forest at East-West corner of Amravati city, Maharashtra. It is located between 20°55'31.25" N and 77°47'38.53" E approximately the total area is about 20 hector. Essential field data related to different Bamboo species were recorded in the data sheet during the field study which included date and time of collection, habitat and area of the vegetation. The plant materials thus collected were planted in the experimental garden for further study after authentication by taxonomists.

Statistical analysis of only eighteen Bamboo species belonging to six different genera have been carried out in the present study. Three different culms were selected randomly from each clump or bamboo stand. Mean values from three independent replications were calculated for each quantitative characters. The qualitative data on culm, culm-sheath, leaves and branching descriptors were then converted to a scale.

Analysis of variance (ANOVA) and descriptive statistics were carried out for replicated quantitative data of culm height, diameter, inter-nodal length, wall thickness, culm sheath length & breadth, blade length & breadth and leaf length & breadth using statistical software programme SPPS-20. A Shapiro-Wilk's test ($p > 0.05$) (Shapiro and Wilk, 1965; Razali and Wah, 2011), Kolmogorov-Smirnov and a visual inspection of the their histogram, normal Q-Q plots and box plots for morphological parameters of 18 Bamboo species

Table 4: ANNOVA of morphological character (intermodal length) among eighteen Bamboo species.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1																		
2	p< 0.1754																	
3	p< 0.6522	p< 0.1383																
4	p< 0.2473	p< 0.4776	p< 0.1860															
5	p< 0.8187	p< 0.2565	p< 0.5773	p< 0.4586														
6	p< 0.0893	p< 0.0502	p< 0.3768	p< 0.0230	p< 0.1588													
7	p< 0.3947	p< 0.6648	p< 0.3024	p< 0.8669	p< 0.5144	p< 0.1236												
8	p< 0.0007	p< 0.0074	p< 0.0099	p< 0.0008	p< 0.0062	p< 0.0009	p< 0.0168											
9	p< 0.2724	p< 0.3941	p< 0.2034	p< 0.8315	p< 0.5318	p< 0.0159	p< 0.7662	p< 0.0003										
10	p< 0.6449	p< 0.2854	p< 0.4434	p< 0.5322	p< 0.8662	p< 0.0850	p< 0.5750	p< 0.0024	p< 0.6251									
11	p< 0.2516	p< 0.0790	p< 0.7403	p< 0.0481	p< 0.3226	p< 0.2461	p< 0.1958	p< 0.0001	p< 0.0355	p< 0.1886								
12	p< 0.9597	p< 0.1853	p< 0.6316	p< 0.2743	p< 0.8515	p< 0.0948	p< 0.4115	p< 0.0010	p< 0.3071	p< 0.6822	p< 0.2547							
13	p< 0.8176	p< 0.2556	p< 0.5755	p< 0.4564	p< 1.0000	p< 0.1561	p< 0.5135	p< 0.0059	p< 0.5294	p< 0.8656	p< 0.3190	p< 0.8506						
14	p< 0.3776	p< 0.5229	p< 0.2780	p< 1.0000	p< 0.5420	p< 0.0769	p< 0.8804	p< 0.0057	p< 0.8726	p< 0.6178	p< 0.1400	p< 0.4004	p< 0.5406					
15	p< 0.6263	p< 0.1267	p< 0.9684	p< 0.1480	p< 0.5605	p< 0.2569	p< 0.2901	p< 0.0026	p< 0.1539	p< 0.4094	p< 0.6296	p< 0.6050	p< 0.5583	p< 0.2547				
16	p< 0.3945	p< 0.3208	p< 0.2770	p< 0.6361	p< 0.6785	p< 0.0220	p< 0.6552	p< 0.0003	p< 0.7665	p< 0.8021	p< 0.0529	p< 0.4374	p< 0.6766	p< 0.7227	p< 0.2207			
17	p< 0.6278	p< 0.1211	p< 0.8922	p< 0.1179	p< 0.5689	p< 0.1060	p< 0.2895	p< 0.0002	p< 0.1104	p< 0.3930	p< 0.3838	p< 0.6047	p< 0.5661	p< 0.2438	p< 0.9106	p< 0.1690		
18	p< 0.0075	p< 0.0171	p< 0.0548	p< 0.0039	p< 0.0271	p< 0.0439	p< 0.0405	p< 0.0486	p< 0.0022	p< 0.0125	p< 0.0060	p< 0.0089	p< 0.0264	p< 0.0183	p< 0.0233	p< 0.0026	p< 0.0050	

1.Bambusa bambos 2. Bambusa polymorpha 3.Bambusa balcooa 4.Bambusa vulgaris 4.Bambusa burmanica 6.Bambusa multiplex 7.Bambusa tulda 8.Bambusaventricosa 9.Dendrocalamus giganteus 10.Dendrocalamus hamiltonii 11.Dendrocalamus strictus 12.Dendrocalamus asper 13.Dendrocalamus membranaceus 14.Dendrocalamus longispathus 15.Melocanna baccifera 16.Gigantochloa ablociliata 17. Dinochloa andamanica 18.Guadua angustifolia.

ANOVA representing Bamboo intermodal length of 18 species studied, bold values depict non- significance between species. While as other are significant at various levels of significance set at: P<0.01, P< 0.001 and P<0.05.

Table 5: ANNOVA of morphological character (wall thickness) among eighteen Bamboo species.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1																		
2	p< 0.7444																	
3	p< 0.8858	p< 0.7420																
4	p< 0.0254	p< 0.0050	p< 0.0033															
5	p< 0.3662	p< 0.3903	p< 0.1260	p< 0.0011														
6	p< 0.0349	p< 0.0025	p< 0.0004	p< 0.2943	p< 0.0001													
7	p< 0.0806	p< 0.0090	p< 0.0031	p< 0.1270	p< 0.0006	p< 0.2316												
8	p< 0.0247	p< 0.0019	p< 0.0004	p< 0.5039	p< 0.0001	p< 0.4198	p< 0.1040											
9	p< 0.0026	p< 0.0002	p< 0.0001	p< 0.0967	p< 0.0001	p< 0.0011	p< 0.0009	p< 0.0033										
10	p< 0.0076	p< 0.0006	p< 0.0001	p< 0.5226	p< 0.0001	p< 0.0175	p< 0.0085	p< 0.0584	p< 0.0927									
11	p< 0.3143	p< 0.1096	p< 0.1076	p< 0.0648	p< 0.0240	p< 0.1055	p< 0.3157	p< 0.0644	p< 0.0028	p< 0.0124								
12	p< 0.7072	p< 1.0000	p< 0.5490	p< 0.0015	p< 0.1340	p< 0.0001	p< 0.0004	p< 0.0001	p< 0.0001	p< 0.0001	p< 0.0533							
13	p< 0.3990	p< 0.1767	p< 0.1928	p< 0.0700	p< 0.0515	p< 0.1210	p< 0.3049	p< 0.0781	p< 0.0046	p< 0.0176	p< 0.8911	p< 0.1144						
14	p< 0.0224	p< 0.0027	p< 0.0011	p< 0.7964	p< 0.0003	p< 0.2921	p< 0.1002	p< 0.6036	p< 0.0247	p< 0.2534	p< 0.0563	p< 0.0003	p< 0.0653					
15	p< 0.0112	p< 0.0011	p< 0.0004	p< 0.7239	p< 0.0001	p< 0.0576	p< 0.0231	p< 0.1572	p< 0.0696	p< 0.7015	p< 0.0215	p< 0.0001	p< 0.0280	p< 0.4439				
16	p< 0.0254	p< 0.0033	p< 0.0015	p< 0.7351	p< 0.0004	p< 0.3677	p< 0.1290	p< 0.7049	p< 0.0235	p< 0.2255	p< 0.0667	p< 0.0005	p< 0.0755	p< 0.9165	p< 0.3961			
17	p< 0.0051	p< 0.0003	p< 0.0001	p< 0.3453	p< 0.0001	p< 0.0032	p< 0.0024	p< 0.0145	p< 0.1243	p< 0.6269	p< 0.0068	p< 0.0001	p< 0.0107	p< 0.1205	p< 0.4039	p< 0.1088		
18	p< 0.0133	p< 0.0025	p< 0.0015	p< 0.5590	p< 0.0006	p< 0.0944	p< 0.0430	p< 0.1786	p< 0.2825	p< 0.9259	p< 0.0280	p< 0.0007	p< 0.0325	p< 0.3608	p< 0.7239	p< 0.3285	p< 0.8445	

1.Bambusa bambos 2. Bambusa polymorpha 3.Bambusa balcooa 4.Bambusa vulgaris 4.Bambusa burmanica 6.Bambusa multiplex 7.Bambusa tulda 8.Bambusaventricosa 9.Dendrocalamus giganteus 10.Dendrocalamus hamiltonii 11.Dendrocalamus strictus 12.Dendrocalamus asper 13.Dendrocalamus membranaceus 14.Dendrocalamus longispathus 15.Melocanna baccifera 16.Gigantochloa ablociliata 17. Dinochloa andamanica 18.Guadua angustifolia

ANOVA representing Bamboo wall thickness of 18 species studied, bold values depict non- significance between species. While as other are significant at various levels of significance set at: P<0.01, P< 0.001 and P<0.05.

were tested with Skewness and Kurtotic values also calculated (Cramer, 1998; Cramer and Howit, 2004; Doane and Seward, 2011), from normality. When the normality conditions were satisfied, ANOVA was employed for different morphological characteristics to determine whether there is significance among them or not.

RESULTS AND DISCUSSION

Analysis of variance (ANOVA) was performed to describe the priority of characters for differentiation among Bamboos. The quantitative characters considered for ANOVA analysis were height, diameter of culm, internode length, wall thickness, culm-sheath length and breadth, blade length and breadth, leaf length and breadth. Mean value with standard deviation of each individual character studied have been assigned to the Bamboo species observed (Table 1). The significance of individual character helps to determine the extent of character to be applicable in the field work. This work for Bamboo statistical analysis for different characters to find out significance among different Bamboo species has been presented for first time. This is a major imitative to correlate different Bamboo species on the basis of their vegetative characters. In the present investigation has helped to overcome the major problems of identification to a greater extent among the species considered in the present investigation.

Various morphological characters of eighteen Bamboo species were studied. A Shapiro-Wilk's test ($p > 0.05$) (Shapiro and Wilk, 1965; Razali and Wah, 2011), Kolmogorov-Smirnov and a visual inspection of the their histogram, normal Q-Q plots and box plots

Table 6: ANNOVA of morphological character (culm-sheath length) among eighteen Bamboo species.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1																		
2	p< 0.3990																	
3	p< 0.4593	p< 0.0249																
4	p< 0.5726	p< 0.0121	p< 0.7156															
5	p< 0.2127	p< 0.1151	p< 0.0101	p< 0.0042														
6	p< 0.0193	p< 0.0001	p< 0.0005	p< 0.0001	p< 0.0002													
7	p< 0.4515	p< 0.7663	p< 0.0349	p< 0.0212	p< 0.1166	p< 0.0001												
8	p< 0.0134	p< 0.0001	p< 0.0003	p< 0.0001	p< 0.0001	p< 0.0229	p< 0.0001											
9	p< 0.2925	p< 0.0025	p< 0.6696	p< 0.3357	p< 0.0011	p< 0.0001	p< 0.0045	p< 0.0001										
10	p< 0.7041	p< 0.0068	p< 0.4728	p< 0.6602	p< 0.0021	p< 0.0001	p< 0.0161	p< 0.0001	p< 0.1428									
11	p< 0.0928	p< 0.0035	p< 0.0031	p< 0.0009	p< 0.0724	p< 0.0007	p< 0.0068	p< 0.0002	p< 0.0003	p< 0.0003								
12	p< 0.8322	p< 0.0820	p< 0.1324	p< 0.1295	p< 0.0156	p< 0.0001	p< 0.1616	p< 0.0001	p< 0.0241	p< 0.1610	p< 0.0016							
13	p< 0.3643	p< 0.0172	p< 0.7968	p< 0.5172	p< 0.0074	p< 0.0004	p< 0.0239	p< 0.0003	p< 0.9040	p< 0.3174	p< 0.0024	p< 0.0869						
14	p< 0.3959	p< 0.0173	p< 0.8741	p< 0.5822	p< 0.0072	p< 0.0004	p< 0.0246	p< 0.0003	p< 0.8035	p< 0.3597	p< 0.0023	p< 0.0946	p< 0.9169					
15	p< 0.1435	p< 0.0145	p< 0.0054	p< 0.0017	p< 0.3432	p< 0.0001	p< 0.0235	p< 0.0001	p< 0.0005	p< 0.0006	p< 0.2110	p< 0.0040	p< 0.0040	p< 0.0038				
16	p< 0.3502	p< 0.7049	p< 0.0254	p< 0.0155	p< 0.3628	p< 0.0005	p< 0.5763	p< 0.0003	p< 0.0038	p< 0.0123	p< 0.0319	p< 0.0940	p< 0.0179	p< 0.0182	p< 0.1088			
17	p< 0.0486	p< 0.0003	p< 0.0014	p< 0.0003	p< 0.0053	p< 0.0020	p< 0.0009	p< 0.0004	p< 0.0001	p< 0.0001	p< 0.0667	p< 0.0003	p< 0.0011	p< 0.0010	p< 0.0074	p< 0.0047		
18	p< 0.0366	p< 0.0001	p< 0.0010	p< 0.0002	p< 0.0016	p< 0.0026	p< 0.0003	p< 0.0004	p< 0.0001	p< 0.0001	p< 0.0118	p< 0.0002	p< 0.0008	p< 0.0007	p< 0.0014	p< 0.0020	p< 0.2059	

1.Bambusa bambos 2. Bambusa polymorpha 3.Bambusa balcooa 4.Bambusa vulgaris 4.Bambusa burmanica 6.Bambusa multiplex 7.Bambusa tulda 8.Bambusaventricosa 9.Dendrocalamus giganteus 10.Dendrocalamus hamiltonii 11.Dendrocalamus strictus 12.Dendrocalamus asper 13.Dendrocalamus membranaceus 14.Dendrocalamus longispathus 15.Melocanna baccifera 16.Gigantochloa ablociliata 17. Dinochloa andamanica 18.Guadua angustifolia

ANOVA representing Bamboo culm-sheath length of 18 species studied, bold values depict non- significance between species. While as other are significant at various levels of significance set at: P<0.01, P< 0.001 and P<0.05.

Table 7: ANNOVA of morphological character (culm-sheath breadth) among eighteen Bamboo species.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1																		
2	p< 0.0187																	
3	p< 0.0664	p< 0.1406																
4	p< 0.2764	p< 0.0044	p< 0.0728															
5	p< 0.3202	p< 0.0075	p< 0.0857	p< 0.8896														
6	p< 0.0094	p< 0.0001	p< 0.0001	p< 0.0001	p< 0.0001													
7	p< 0.4350	p< 0.0012	p< 0.0215	p< 0.3890	p< 0.5598	p< 0.0001												
8	p< 0.0090	p< 0.0001	p< 0.0001	p< 0.0001	p< 0.0001	p< 0.7130	p< 0.0001											
9	p< 0.0860	p< 0.1157	p< 0.8173	p< 0.1321	p< 0.1421	p< 0.0001	p< 0.0438	p< 0.0001										
10	p< 1.0000	p< 0.0002	p< 0.0022	p< 0.0171	p< 0.0487	p< 0.0001	p< 0.0424	p< 0.0001	p< 0.0050									
11	p< 0.0460	p< 0.0001	p< 0.0001	p< 0.0001	p< 0.0003	p< 0.0055	p< 0.0001	p< 0.0054	p< 0.0001	p< 0.0003								
12	p< 0.1738	p< 0.0042	p< 0.1205	p< 0.4454	p< 0.4425	p< 0.0001	p< 0.0803	p< 0.0001	p< 0.2283	p< 0.0015	p< 0.0001							
13	p< 0.3611	p< 0.0001	p< 0.0005	p< 0.0017	p< 0.0050	p< 0.0001	p< 0.0025	p< 0.0001	p< 0.0010	p< 0.0229	p< 0.0061	p< 0.0003						
14	p< 0.2976	p< 0.0001	p< 0.0004	p< 0.0012	p< 0.0036	p< 0.0001	p< 0.0017	p< 0.0001	p< 0.0008	p< 0.0128	p< 0.0098	p< 0.0002	p< 0.6932					
15	p< 0.4125	p< 0.0002	p< 0.0013	p< 0.0057	p< 0.0119	p< 0.0005	p< 0.0102	p< 0.0005	p< 0.0023	p< 0.0840	p< 0.0156	p< 0.0015	p< 0.8904	p< 0.6595				
16	p< 0.7550	p< 0.0025	p< 0.0122	p< 0.0692	p< 0.0967	p< 0.0025	p< 0.1327	p< 0.0024	p< 0.0181	p< 0.5956	p< 0.0227	p< 0.0311	p< 0.4180	p< 0.3189	p< 0.5054			
17	p< 0.0208	p< 0.0001	p< 0.0001	p< 0.0001	p< 0.0001	p< 0.0161	p< 0.0001	p< 0.0165	p< 0.0001	p< 0.0001	p< 0.1308	p< 0.0001	p< 0.0005	p< 0.0008	p< 0.0026	p< 0.0073		
18	p< 0.0239	p< 0.0001	p< 0.0001	p< 0.0001	p< 0.0001	p< 0.0027	p< 0.0001	p< 0.0035	p< 0.0001	p< 0.0001	p< 0.1999	p< 0.0001	p< 0.0005	p< 0.0008	p< 0.0030	p< 0.0085	p< 0.5858	

1.Bambusa bambos 2. Bambusa polymorpha 3.Bambusa balcooa 4.Bambusa vulgaris 4.Bambusa burmanica 6.Bambusa multiplex 7.Bambusa tulda 8.Bambusaventricosa 9.Dendrocalamus giganteus 10.Dendrocalamus hamiltonii 11.Dendrocalamus strictus 12.Dendrocalamus asper 13.Dendrocalamus membranaceus 14.Dendrocalamus longispathus 15.Melocanna baccifera 16.Gigantochloa ablociliata 17. Dinochloa andamanica 18.Guadua angustifolia.

ANOVA representing Bamboo culm-sheath breadth of 18 species studied, bold values depict non- significance between species. While as other are significant at various levels of significance set at: P<0.01, P< 0.001 and P<0.05.

showed the scores were approximately normally distributed, with a little Skewed and a Kurtotic (Cramer, 1998; Cramer and Howit, 2004; Doane and Seward, 2011), but it does not differ significantly from normality and lies between -1.96 to +1.96. ANOVA revealed intra and inter species significance tested at (p > 0.01 p > 0.001 p > 0.05) of morphological characters between eighteen Bamboo species.

Different morphological parameter showed significance at (p > 0.01 p > 0.001 p > 0.05) or below can be used to differentiate the species. If the significance between two species was found on the basis of more than one character, that indicates the level of different between those two species. However, multiple parameters were found to be significant between various species. Highest numbers of significant values were shown by culm-sheath blade breadth (120) followed by culm-sheath breadth (112), culm-sheath length (102), leaf breadth (102), height (101), diameter (91), wall thickness (73), blade length (52) and intermodal length (38) (Table 2 to 11). Species having p value above the set p value were considered non significant. Therefore, species which exhibited p value above the set p value for any observed morphological characters could not be distinguished on the basis of that particular character.

The statistical approach to correlate the Bamboo species was found to have very high significance over the usual morphological differentiation between the Bamboo species. The significance of

Table 8: ANNOVA of morphological character (culm-sheath blade length) among eighteen Bamboo species.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1																	
2	p< 0.1034																
3	p< 0.0570	p< 0.2193															
4	p< 0.1419	p< 0.6748	p< 0.4585														
5	p< 0.0670	p< 0.2782	p< 0.8568	p< 0.5601													
6	p< 1.0000	p< 0.0024	p< 0.0280	p< 0.0688	p< 0.0311												
7	p< 0.4396	p< 0.0016	p< 0.0143	p< 0.0293	p< 0.0152	p< 0.0839											
8	p< 0.5325	p< 0.0487	p< 0.0614	p< 0.1762	p< 0.0726	p< 0.1488	p< 0.0284										
9	p< 0.0155	p< 0.0448	p< 0.5466	p< 0.1681	p< 0.4196	p< 0.0048	p< 0.0028	p< 0.0115									
10	p< 0.0479	p< 0.1412	p< 0.5912	p< 0.2622	p< 0.4907	p< 0.0317	p< 0.0187	p< 0.0551	p< 0.9393								
11	p< 0.2185	p< 0.4006	p< 0.1372	p< 0.4228	p< 0.1703	p< 0.0215	p< 0.0074	p< 0.2343	p< 0.0276	p< 0.0991							
12	p< 0.0105	p< 0.0248	p< 0.2068	p< 0.0678	p< 0.1557	p< 0.0052	p< 0.0033	p< 0.0094	p< 0.3890	p< 0.5260	p< 0.0175						
13	p< 0.1013	p< 0.8864	p< 0.2466	p< 0.7330	p< 0.3130	p< 0.0052	p< 0.0026	p< 0.0590	p< 0.3890	p< 0.1541	p< 0.3790	p< 0.0281					
14	p< 0.0144	p< 0.0355	p< 0.2314	p< 0.0832	p< 0.1786	p< 0.0082	p< 0.0052	p< 0.0142	p< 0.4191	p< 0.5437	p< 0.0253	p< 1.0000	p< 0.0394				
15	p< 0.0027	p< 0.0009	p< 0.4164	p< 0.0697	p< 0.2782	p< 0.0001	p< 0.0001	p< 0.0002	p< 0.9448	p< 0.9650	p< 0.0007	p< 0.3291	p< 0.0020	p< 0.3717			
16	p< 0.0030	p< 0.0048	p< 0.1104	p< 0.0263	p< 0.0754	p< 0.0008	p< 0.0005	p< 0.0016	p< 0.2277	p< 0.3954	p< 0.0034	p< 0.8652	p< 0.0058	p< 0.8740	p< 0.1317		
17	p< 0.6264	p< 0.1187	p< 0.0707	p< 0.1954	p< 0.0843	p< 0.4141	p< 0.1055	p< 0.9144	p< 0.0158	p< 0.0590	p< 0.3240	p< 0.0112	p< 0.1193	p< 0.0161	p< 0.0010	p< 0.0025	
18	p< 0.0972	p< 0.7253	p< 0.3065	p< 0.8454	p< 0.3878	p< 0.0116	p< 0.0049	p< 0.0728	p< 0.0760	p< 0.1824	p< 0.3407	p< 0.0357	p< 0.8269	p< 0.0486	p< 0.0067	p< 0.0086	p< 0.1186

1.Bambusa bambos 2. Bambusa polymorpha 3.Bambusa balcooa 4.Bambusa vulgaris 4.Bambusa burmanica 6.Bambusa multiplex 7.Bambusa tulda 8.Bambusaventricosa 9.Dendrocalamus giganteus 10.Dendrocalamus hamiltonii 11.Dendrocalamus strictus 12.Dendrocalamus asper 13.Dendrocalamus membranaceus 14.Dendrocalamus longispathus 15.Melocanna baccifera 16.Gigantochloa ablociliata 17. Dinochloa andamanica 18.Guadua angustifolia

ANOVA representing Bamboo culm-sheath blade length of 18 species studied, bold values depict non- significance between species. While as other are significant at various levels of significance set at: P<0.01, P< 0.001 and P<0.05.

Table 9: ANNOVA of morphological character (culm-sheath blade breadth) among eighteen Bamboo species.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1																		
2	p< 0.5715																	
3	p< 0.5821	p< 0.1741																
4	p< 0.0683	p< 0.0196	p< 0.0161															
5	p< 0.6094	p< 0.9072	p< 0.1947	p< 0.0195														
6	p< 0.0069	p< 0.0001	p< 0.0013	p< 0.0196	p< 0.0001													
7	p< 0.0724	p< 0.0025	p< 0.1379	p< 0.0005	p< 0.0031	p< 0.0001												
8	p< 0.0045	p< 0.0001	p< 0.0009	p< 0.0080	p< 0.0001	p< 0.0225	p< 0.0001											
9	p< 0.0441	p< 0.0081	p< 0.0101	p< 0.6479	p< 0.0084	p< 0.0369	p< 0.0003	p< 0.0134										
10	p< 0.0193	p< 0.0003	p< 0.0036	p< 0.2016	p< 0.0005	p< 0.0029	p< 0.0001	p< 0.0010	p< 0.4240									
11	p< 0.0033	p< 0.0001	p< 0.0006	p< 0.0039	p< 0.0001	p< 0.0001	p< 0.0001	p< 0.1002	p< 0.0060	p< 0.0001								
12	p< 0.0059	p< 0.0001	p< 0.0011	p< 0.0138	p< 0.0001	p< 0.1536	p< 0.0001	p< 0.1274	p< 0.0248	p< 0.0017	p< 0.0012							
13	p< 0.0036	p< 0.0001	p< 0.0007	p< 0.0046	p< 0.0001	p< 0.0001	p< 0.0001	p< 0.2148	p< 0.0072	p< 0.0002	p< 0.3153	p< 0.0027						
14	p< 0.0050	p< 0.0001	p< 0.0010	p< 0.0109	p< 0.0001	p< 0.1223	p< 0.0001	p< 0.8149	p< 0.0187	p< 0.0035	p< 0.1588	p< 0.3584	p< 0.2647					
15	p< 0.0060	p< 0.0001	p< 0.0011	p< 0.0145	p< 0.0001	p< 0.2215	p< 0.0001	p< 0.1121	p< 0.0264	p< 0.0020	p< 0.0013	p< 0.8748	p< 0.0028	p< 0.3238				
16	p< 0.0349	p< 0.0050	p< 0.0078	p< 0.4815	p< 0.0052	p< 0.0528	p< 0.0002	p< 0.0177	p< 0.7970	p< 0.6169	p< 0.0075	p< 0.0345	p< 0.0092	p< 0.0251	p< 0.0367			
17	p< 0.0028	p< 0.0001	p< 0.0006	p< 0.0028	p< 0.0001	p< 0.0001	p< 0.0001	p< 0.0225	p< 0.0042	p< 0.0001	p< 0.0710	p< 0.0003	p< 0.0167	p< 0.0558	p< 0.0004	p< 0.0051		
18	p< 0.0045	p< 0.0001	p< 0.0009	p< 0.0077	p< 0.0001	p< 0.0015	p< 0.0001	p< 0.7908	p< 0.0129	p< 0.0004	p< 0.0047	p< 0.0498	p< 0.0167	p< 0.9277	p< 0.0445	p< 0.0171	p< 0.0006	

1.Bambusa bambos 2. Bambusa polymorpha 3.Bambusa balcooa 4.Bambusa vulgaris 4.Bambusa burmanica 6.Bambusa multiplex 7.Bambusa tulda 8.Bambusaventricosa 9.Dendrocalamus giganteus 10.Dendrocalamus hamiltonii 11.Dendrocalamus strictus 12.Dendrocalamus asper 13.Dendrocalamus membranaceus 14.Dendrocalamus longispathus 15.Melocanna baccifera 16.Gigantochloa ablociliata 17. Dinochloa andamanica 18.Guadua angustifolia

ANOVA representing Bamboo culm-sheath blade breadth of 18 species studied, bold values depict non- significance between species. While as other are significant at various levels of significance set at: P<0.01, P< 0.001 and P<0.05.

the vegetative characters provides a lead over other methods used to study the morphological differences. In a review article SijiMol et al., (2016) have put much emphasis on some morphological characters for identification of Ochlandra are (culm surface, leaf size and surface, Culm-sheath auricle and blade shape, branch size and number). However, morphological descriptors such as Culm diameter, branching and culm-sheath blade were used by (Tyrrell et al., 2018). Most of the morphological characters include in present study were used previously in various studies but some were used for the first time in this study or with different interpretations from previous studies.

Culm-sheath characters have always been considered as the most significant in the identification of Bamboo species. While analyzing the significance of the vegetative characters present investigation has also found the culm-sheath characters the most effective in the assessment of Bamboo species. However, Kurz, (1876) for the first time emphasized the role culm-sheath in the identification of Bamboo species. Other workers Ohrenberger and Goerrings (1986); Gamble (1896) and Nakai (1925) also widely used Culm-sheath for Bamboo species determination. Chatterji and Raizada (1963) identified Bambusa tulda on the basis Culm-sheath morphology. Raizada and Chatterjee, (1963); Bahadur (1979); Varmah and Bahadur (1980) have published keys for the identification of Bamboo species based on characters of Culm-sheath. Culm-sheath blade characters has shown to play

Table 10: ANNOVA of morphological character (leaf length) among eighteen Bamboo species.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1																		
2	p< 0.1034																	
3	p< 0.0570	p< 0.2193																
4	p< 0.1419	p< 0.6748	p< 0.4585															
5	p< 0.0670	p< 0.2782	p< 0.8568	p< 0.5601														
6	p< 1.0000	p< 0.0024	p< 0.0280	p< 0.0688	p< 0.0311													
7	p< 0.4396	p< 0.0016	p< 0.0143	p< 0.0293	p< 0.0152	p< 0.0839												
8	p< 0.5325	p< 0.0487	p< 0.0614	p< 0.1762	p< 0.0726	p< 0.1488	p< 0.0284											
9	p< 0.0155	p< 0.0448	p< 0.5466	p< 0.1681	p< 0.4196	p< 0.0048	p< 0.0028	p< 0.0115										
10	p< 0.0479	p< 0.1412	p< 0.5912	p< 0.2622	p< 0.4907	p< 0.0317	p< 0.0187	p< 0.0551	p< 0.9393									
11	p< 0.2185	p< 0.4006	p< 0.1372	p< 0.4228	p< 0.1703	p< 0.0215	p< 0.0074	p< 0.2343	p< 0.0276	p< 0.0991								
12	p< 0.0105	p< 0.0248	p< 0.2068	p< 0.0678	p< 0.1557	p< 0.0052	p< 0.0033	p< 0.0094	p< 0.3890	p< 0.5260	p< 0.0175							
13	p< 0.1013	p< 0.8864	p< 0.2466	p< 0.7330	p< 0.3130	p< 0.0052	p< 0.0026	p< 0.0590	p< 0.3890	p< 0.1541	p< 0.3790	p< 0.0281						
14	p< 0.0144	p< 0.0355	p< 0.2314	p< 0.0832	p< 0.1786	p< 0.0082	p< 0.0052	p< 0.0142	p< 0.4191	p< 0.5437	p< 0.0253	p< 1.0000	p< 0.0394					
15	p< 0.0027	p< 0.0009	p< 0.4164	p< 0.0697	p< 0.2782	p< 0.0001	p< 0.0001	p< 0.0002	p< 0.9448	p< 0.9650	p< 0.0007	p< 0.3291	p< 0.0020	p< 0.3717				
16	p< 0.0030	p< 0.0048	p< 0.1104	p< 0.0263	p< 0.0754	p< 0.0008	p< 0.0005	p< 0.0016	p< 0.2277	p< 0.3954	p< 0.0034	p< 0.8652	p< 0.0058	p< 0.8740	p< 0.1317			
17	p< 0.6264	p< 0.1187	p< 0.0707	p< 0.1954	p< 0.0843	p< 0.4141	p< 0.1055	p< 0.9144	p< 0.0158	p< 0.0590	p< 0.3240	p< 0.0112	p< 0.1193	p< 0.0161	p< 0.0010	p< 0.0025		
18	p< 0.0972	p< 0.7253	p< 0.3065	p< 0.8454	p< 0.3878	p< 0.0116	p< 0.0049	p< 0.0728	p< 0.0760	p< 0.1824	p< 0.3407	p< 0.0357	p< 0.8269	p< 0.0486	p< 0.0067	p< 0.0086	p< 0.1186	

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ANOVA representing Bamboo leaf length of 18 spe**cies studied, bold values depict non- significance between species. While as other are significant at various levels of significance set at: P<0.01, P< 0.001 and P<0.05.**

Table 11: ANNOVA of morphological character (leaf breadth) of eighteen Bamboo species.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1																		
2	p< 0.9569																	
3	p< 0.6691	p< 0.0723																
4	p< 0.1302	p< 0.0007	p< 0.0003															
5	p< 0.6688	p< 0.5356	p< 0.8896	p< 0.0266														
6	p< 0.0309	p< 0.0001	p< 0.0001	p< 0.0266	p< 0.0052													
7	p< 0.3907	p< 0.2589	p< 0.4300	p< 0.0232	p< 0.5791	p< 0.0064												
8	p< 0.1157	p< 0.0001	p< 0.0001	p< 0.8701	p< 0.0218	p< 0.0182	p< 0.0202											
9	p< 0.0004	p< 0.0001	p< 0.0001	p< 0.0001	p< 0.0002	p< 0.0001	p< 0.0011	p< 0.0001										
10	p< 0.0158	p< 0.0108	p< 0.0136	p< 0.0042	p< 0.0184	p< 0.0025	p< 0.0320	p< 0.0040	p< 0.8813									
11	p< 0.0793	p< 0.0001	p< 0.0001	p< 0.3559	p< 0.0142	p< 0.0643	p< 0.0144	p< 0.3559	p< 0.0001	p< 0.0035								
12	p< 0.0013	p< 0.0005	p< 0.0006	p< 0.0002	p< 0.0012	p< 0.0001	p< 0.0025	p< 0.0002	p< 0.1435	p< 0.4274	p< 0.0002							
13	p< 0.1226	p< 0.0001	p< 0.0001	p< 1.0000	p< 0.0228	p< 0.0101	p< 0.0211	p< 0.8231	p< 0.0001	p< 0.0041	p< 0.2283	p< 0.0002						
14	p< 0.0202	p< 0.0095	p< 0.0133	p< 0.0026	p< 0.0235	p< 0.0013	p< 0.0531	p< 0.0024	p< 0.2386	p< 0.4054	p< 0.0020	p< 0.0710	p< 0.0024					
15	p< 0.3499	p< 0.0812	p< 0.2416	p< 0.0021	p< 0.5599	p< 0.0004	p< 0.8837	p< 0.0014	p< 0.0001	p< 0.0222	p< 0.0009	p< 0.0012	p< 0.0013	p< 0.0289				
16	p< 0.0229	p< 0.0050	p< 0.0082	p< 0.0009	p< 0.0252	p< 0.0004	p< 0.0806	p< 0.0008	p< 0.0177	p< 0.1676	p< 0.0006	p< 0.0149	p< 0.0008	p< 0.4656	p< 0.0295			
17	p< 0.3353	p< 0.1200	p< 0.2773	p< 0.0048	p< 0.5239	p< 0.0010	p< 0.9635	p< 0.0037	p< 0.0002	p< 0.0253	p< 0.0025	p< 0.0015	p< 0.0037	p< 0.0360	p< 0.8946	p< 0.0430		
18	p< 0.2534	p< 0.1643	p< 0.2565	p< 0.0222	p< 0.3616	p< 0.0076	p< 0.6795	p< 0.0200	p< 0.0048	p< 0.0539	p< 0.0151	p< 0.0053	p< 0.0208	p< 0.1092	p< 0.5409	p< 0.2016	p< 0.6111	

1.Bambusa bambos 2. Bambusa polymorpha 3.Bambusa balcooa 4.Bambusa vulgaris 4.Bambusa burmanica 6.Bambusa multiplex 7.Bambusa tulda 8.Bambusaventricosa 9.Dendrocalamus giganteus 10.Dendrocalamus hamiltonii 11.Dendrocalamus strictus 12.Dendrocalamus asper 13.Dendrocalamus membranaceus 14.Dendrocalamus longispathus 15.Melocanna baccifera 16.Gigantochloa ablociliata 17. Dinochloa andamanica 18.Guadua angustifolia

ANOVA representing Bamboo leaf breadth of 18 species studied, bold values depict non- significance between species. While as other are significant at various levels of significance set at: P<0.01, P< 0.001 and P<0.05.

most significant in all the Bamboo species under the present investigation. Likewise, Culm-sheath blade posture was found significant (Dezhu et al., 2007; Kumar, 2002). The Culm-sheath (Raizada and Chatterji, 1963) and Culm characters were used as two major taxonomic keys for the identification of Bamboos Das et al., (2007).

Leaf breadth was found to be second most significant character for the assessment of Bamboos, which could be potentially usefulful to identify and differentiate one Bamboo species from other. These observation of leaf size were in corroboration with (Kumar, 2002; wichmann and wichtmann, 2009), also Generoso et al, (2016) divulged the importance of Leaf length.

Culms character like height, diameter, wall thickness and intermodal length were also found to be very helpful in Bamboo characterization and were determined as the main differentiating characters in all the Bamboo species corroborating with the observation reported by (Wahab et al., 2010). Kumar, (2002) has described subtribes of Bambuseae using clum characters such as size, hollowness, wall thickness, diameter and for describing genera characters used were intermodal length and colour. However, characters like Culm habit and length were used by Soderstrom and Ellis (1988) to describe the woody Bamboos of Srilanka. Similarly, Dezhu et al., (2007) used the character like Culm node thorns and diameter in the flora of China, which is in congruence with the present observations. Generoso et al., (2016) described some Dendrocalamus and Bambusa species on the basis of culm colour variation, height, and diameter.

CONCLUSION

Vegetative characters have always been appreciated as the main features which could be always used in the identification and differentiation among Bamboo species. in the present investigation it can be concluded that all the morphological characters have their own applicability in the assessment of Bamboo species but the ANOVA based priority of the characters can be further very helpful to overcome the identification and interrelation problems among Bamboo species.

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Studies on Impact of Physico Chemical Factors on the Seasonal Distribution of Zooplankton in Kapileshwar Dam, Ashti, Dist. Wardha

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ABSTRACT

Zooplanktons are depending on several physico-chemical factors , they play a significant role in transferring energy in aquatic ecosystem as primary consumers and can be used as indicator of trophic phase of water body. The present study conducted to analyse the impact of physico-chemical parameters on distribution of zooplankton diversity of Kapileshwar dam. The study area was divided into five sampling stations to cover the whole dam area comprehensively during the June 2013 to July 2014.The physico-chemical parameters were observed Temperature, Transparency, pH, Turbidity, Total Dissolved Solid, Total alkalinity DO, Total hardness, Nitrate Sulphate and Phosphate during the study. Water temperature exhibited feeble positive correlation with zooplankton. The observed zooplanktons belongs to protozoa, rotifera, cladocera, copepoda, ostracoda and worms& larvae and the percentage population abundance was in the order of Rotifera (25.98%) > Protozoa (20.91%) > Cladocera (20.49%) > Worms & Larvae (13.41%) > Copepoda (10.35%)> Ostracoda (8.85%). The dissolved oxygen in water of the dam ranged from 5.00mg/l to 9.10mg/l at station I and II characterized as good level of water body. Nutrients like nitrates and phosphate present in the water body were found in the permissible limits as prescribed by WHO, BIS for drinking water quality which confirm that the water is unpolluted and safe for drinking purposes. At present the Kapileshwar dam is of mesotrophic nature.

KEY WORDS: Physico-chemical Parameters, Kapileshwar dam, Zooplankton and Seasonal Distribution.

INTRODUCTION

Water is one of the principle elements of nature and life. It is a renewable resource and important factor for maintaining balance in the nature. Its physical and chemical properties support the biological cycles of the livings and control the climatic and geological conditions everywhere. The water as food and raw material is strictly connected with life and describes the human cultural development throughout the centuries. Zooplanktons are one of the most important biotic components influencing all the functional aspects of an aquatic ecosystem, such as food chains, food webs, energy flow and cycling of mater. Zooplanktons are also been used as biological indicators of eutrophication, In many areas, the ecological impacts from human activities will far exceed the impacts from climate change, Scholze et al., (2006) have worked on a climate-change risk analysis for world ecosystems. Their growth and distribution is influenced by various physico-chemical parameters like temperature, density, pH, hardness, nitrite, nitrate, ammonia, phosphate and so on, Patel et al., (2013); Islam (2007) in a pond of Rajshahi University, has investigated the effects of abiotic parameters on the variations of zooplankton population. Chakraorty et.al.(1997): Belgis and Guido (2003) made good contribution on zooplankton Studies with special reference to eutrophication process of fresh water pond. The present study was aimed to evaluate impact of physico chemical factors on the seasonal distribution of Zooplankton in Kapileshwar dam.

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MATERIAL AND METHODS

The Kapileshwar dam is at 78^{0}17'-00' E longitude and 20^0-12'00' N .The length of dam is 589 mtrs. and 7.31 meters high with a catchment area of 6.68 square km situated near Ashti Tahsil of Wardha District. Dam is a man made reservoir constructed on a local nalla. The gross storage capacity of the reservoir is about

1.720 mm3. For study, the area of dam was divided into 5 sampling sites .Water samples were collected regularly on monthly basis in between 8 a.m. to 10 a.m. Water, pH, DO,and TDS observed at sampling site using water analysis kit(Systronic make) while other abiotic components were analyzed at laboratory condition using the method prescribed by APHA(1989). counting of zooplankton's were done with the help of Lacky's drop count method..Identification key was used for zooplankton's given by Presecott (1954), Sehgal

S-1:-Sampling station 1
S-2:-Sampling station 2
S-3:-Sampling station 3
S-4:-Sampling station 4
S-5:-Sampling station 5

Fig 1: Map of Study area (Kapileshwar Dam of Ashti)

Table 1: Seasonal trends of zooplanktonic population (org./L.) at St.I-V

S.N.	Season	Proto zoa	Roti fera	Clado sera	Cope poda	Ostra coda	Worms & Larvae	Total Zoo planktons
				Station-I				
1	Monsoon	420	1540	350	140	350	140	2940
2	Winter	1400	770	1190	490	280	980	5110
3	Summer	840	2380	1820	700	1680	1260	8680
	Total	2660	4690	3360	1330	2310	2380	16730
				Station-II				
1	Monsoon	420	700	770	70	70	140	2170
2	Winter	1470	630	560	280	700	770	4410
3	Summer	980	2100	2030	700	420	1750	7980
	Total	2870	3430	3360	1050	1190	2660	14560
				Station-III				
1	Monsoon	350	910	280	140	70	140	1890
2	Winter	1330	980	1260	560	420	210	4760
3	Summer	1610	2240	1120	1470	280	1330	8050
	Total	3290	4130	2660	2170	770	1680	14700
				Station-IV				
1	Monsoon	490	210	140	140	140	70	1190
2	Winter	910	700	490	420	210	70	2800
3	Summer	910	1260	700	560	140	840	4410
	Total	2310	2170	1330	1120	490	980	8400
				Station-V				
1	Monsoon	910	840	140	140	140	70	2240
2	Winter	560	1190	1400	420	770	280	4620
3	Summer	1260	770	1330	630	210	840	5040
	Total	2730	2800	2870	1190	1120	1190	11900

(1983), Adoni (1985), APHA (1989), Great lake water life photo gallery.

RESULTS AND DISCUSSION

Kapileshwar Dam exhibits a heavy bulk of Zooplanktons, during the period of investigation Station wise population density are in the order of station I > station III >station II > stationV >. station IV. Seasonal variation of different group of zooplankton and station wise zooplankton is illustrated in table-1. Numerical abundance of zooplankton at five different stations is shown in table-2. The observed zooplanktons belongs to protozoa, rotifer, cladocera, copepod, ostracoda and worms& larvae and the percentage population abundance was in the order of rotifer > protozoa > cladocera > worms&larvae > copepoda > ostracoda . Rotifera

Table 2: Numerical abundance of zooplankton (org./L.) at different station of Kapileshwar Dam During 2013-14

S.N.	Zooplankton	St.-I	St.-II	St.-III	St.-IV	St.-V	Total	%
1	Protozoa	2660	2870	3290	2310	2730	13860	20.91
2	Rotifera	4690	3430	4130	2170	2800	17220	25.98
3	Cladocera	3360	3360	2660	1330	2870	13580	20.49
4	Copepoda	1330	1050	2170	1120	1190	6860	10.35
5	Ostracoda	2310	1190	770	490	1120	5880	8.87
6	Worms & Larvae	2380	2660	1680	980	1190	8890	13.41
	Total zooplankton	16730	14560	14700	8400	11900	66290	100.00

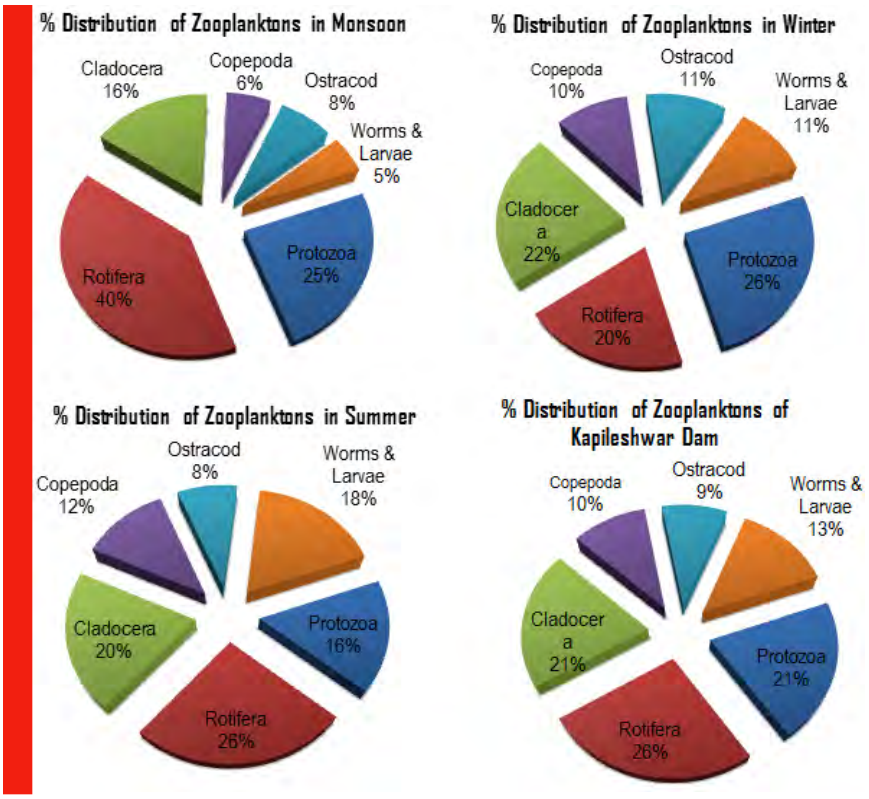

Fig. (1-4): Graphical representations of seasonal Percentage Distribution of Zooplanktons of Kapileshwar dam .

(25.98%) dominate the population density shown in table-1 and were followed by protozoa (20.91%); cladocera (20.49%); worms & larvae (13.41%); copepoda (10.35%); ostracoda(8.85%).

Protozoans during the monsoon months were recorded (2590 org./L.) less in number as compared to other season i.e. summer and winter. Their decrease in numbers may be increased in turbidity other reason might be due to influx of pollutants coming along run off.They are most sensitive to physico-chemical parameters. Seasonal variations of protozoans were observed as summer > winter > monsoon.

Branchionus falcatus, B. calciflorus and *asplanchna* are pollution indicator species of rotifer were meagre at all stations. Rotifers accelerated with the rising of water temperature it was evident by positive correlation, similarly, negative correlation observed with D.O. which might be due to respiratory activities. Highest number of rotifers were recorded during summer (8750 org./L) and lowest number during monsoon 2013 – 14 (4200 org./L) Seasonally there of the rotifers and also by utilization of oxygen for decomposition of algal bloom at higher temperature. Deb.et al., (1987) have shown insignificant correlation with rotifer and carbon dioxide similarly in the present investigation feeble negative correlation in between rotifers and carbon dioxide was observed.

The highest number of cladocerans were recorded during summer(7000 org./L.) followed by winter(4900 org./L.) and rainy seasons(1680 org./L.). Favourable temperature and availability of food in the form of bacteria, nanoplankton and suspended detritus are linked to abundance of cladocera in winter. Group cladocera shows feeble positive correlation with total dissolved solids, chloride, transparency. Where as positive correlation is observed between cladocerons and water temperature, turbidity, Nasar and Dattamunshi (1974).

The summer season shows high dominance of copepods(4060 org./L.) this might be due to the presence of blue green algae and diatoms Goswami and Selvakumar, (1977). However, winter months can be attributed to abundance of phytoplanktons and rising trends of copepods.

Ostracods are recorded large in number during summer season(2730 org./L.) and less during monsoon(770 org./L.). The positive correlation between ostracods and water temperature and also with ostracods and transparency that these are possible elements accelerate the growth and development of ostracods.

In the present study increased population density in summer could be due to low water volume and hence increase nutrient concentration Bhagat V.B.,Meshram C.B.(2010). Similarly abundance of zooplankton in the summer can be attributed to the breeding habits of zooplankton. This anomaly in the present study agrees with the observation of Sharma and Saksena (1981); Bais and Agrawal(1995). The pollution indicator zooplankton were less in number at all the station confirms that the water is safe for drinking and also for healthy fish culture.

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Seasonal Variation in Body Moisture Content of Wallago Attu (Bloch & Schneider, 1801) (Siluridae: Siluriformes)

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ABSTRACT

The freshwater catfish species Wallago attu (Bloch & Schneider, 1801) ranging from standard length group (cm) 30-35 to 105-110 and average body weight (gm) 250 to7000, collected from selected habitats i.e. Karpara Reservoir, Masoli Reservoir, Yeldari Reservoir and Siddheshwar Reservoir in Godavari river basin of Marathwada region was studied in relation to the seasonal variation in muscle moisture content. The variation observed was related to season, habitat and size group of the fish. A.O.A.C. (1999) method was used to determine the moisture content. The results of the present study indicated that the values of moisture content in body muscles of Wallago attu during Feb. 2010 - Jan. 2011 ranging from 76.15±0.71 to 80.91±0.80% and during Feb. 2011 - Jan. 2012 ranging from 76.15±0.98 to 80.95±0.69% in all three seasons. There is a significant difference ($p<0.05$) in moisture content (%) of muscle tissues of Wallago attu between seasons. In the summer season i.e. Feb-May, the body moisture content of this fish increase as compare to other seasons. Investigation on percentage moisture content in body muscle tissues of selected fish species Wallago attu an important factor to decide post-harvest processing.

KEY WORDS: Habitats, moisture content, muscles, seasonal variation

INTRODUCTION

The freshwater shark *Wallago attu* (Bloch & Schneider, 1801) belonging to Family- Siluridae is common catfish species found in India. Fishes are very delicate, perishable commodity and to grow worse quite fast compared to other animal muscle. There are various aspects on which fish quality depends such as season, sex, length, weight, age, feeding habits, maturity, environmental factors, topography and physiological composition. The amount or percentage of water within a fish's body or muscle is known as moisture content. Basic components of fish muscles are water, protein, fat, vitamins and ash. Among these, water constituent is more in fishes and other animals, making 70% or more weight of most organisms is due to water. Water is spread each and every portion of cell and a medium to transport nutrients, cytoplasmic reactions for maintenance of cell and transfer of chemical energy. The portion of water in fish varies between 65-90%, although it is normally in the range of 70-75% (Sankar, 2008). Investigation of percentage of moisture content in body muscle tissues of selected fish species Wallago attu and Sperata seenghala an important fact to decide the preservation method and further processing of fishes after the catch.

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MATERIAL AND METHODS

For the evaluation of seasonal changes in moisture content of body muscles of selected freshwater fishes Wallago attu ranging from standard length group (cm) 30-35 to 105-110 and average body weight (gm) 250 to 7000 collected from Karpara Reservoir (17^0-30'-42'' N latitude and 76^0-38'-2" E longitude), Masoli Reservoir (18^0-54'-10" N latitude and 76^0-45'-00" E longitude), Yeldari Reservoir (latitude 19^0-43'-00" N and longitude 76^0-45'-00" E) and Siddheshwar Reservoir (19^0-0'-20"N latitude and 76^0-57'-30"E longitude) in Godavari river basin of Marathwada region during Feb. 2010 to Jan. 2011 and Feb. 2011 to Jan. 2012.

Samples of two selected freshwater species were bought from fresh catch by fishermen of different habitats in the selected study

area. They were washed, dissected to collect the body muscles and weighed in their fresh condition. The moisture content in body muscles of selected freshwater fishes *Wallago attu* was estimated by the method of A.O.A.C. (1999). The moisture content was determined by drying 3 gm. for 3 hr. at 105^{0}C body muscle sample in an oven. Muscle tissues were collected from selected fish species *Wallago attu* from selected habitats i.e. Karpara Reservoir, Masoli Reservoir, Yeldari Reservoir and Siddheshwar Reservoir. The muscle samples were taken in a pre-weighted glass dish with cover and kept in oven. After drying, the dish was transferred with partially covered lid to the desiccators to cool. The percentage of moisture content was determined from the above experiment by using the formula.

$$\text{Moisture (\%)} = \frac{W_1 - W_2}{W_1 \times 100}$$

Where,
W1 =Weight (gm.) of sample before drying.
W2 = Weight (gm.) of sample after drying.

Statistical Analysis

The current results for two freshwater fishes *Wallago attu* are mean ± standard deviation acquired from the analysis of fish species. The mean values of moisture content are submitted to two - way analysis of variance using software Microsoft Office Excel 2007 statistically significant difference ($p<0.05$) are recorded. If the entire F-test was significant ($p<0.05$), then a Fishers T- test was performed to discern difference among the reservoirs and seasons.

RESULTS AND DISCUSSION

The analysis of muscles sample related to seasonal variation of moisture content (%) of selected fishes *Wallago attu* in two different years Feb. 2010 to Jan. 2011 and Feb. 2011 to Jan. 2012 from selected habitats (reservoirs) was evaluated. Each value represents the mean and standard deviation. The detail results are recorded in Table -1and 2.The values of moisture content (%) in freshwater shark, Wallago attu during Feb. 2010 to Jan. 2011 and Feb. 2011 to Jan. 2012 ranged from 76.15±0.71 to 80.91±0.80% and 76.15±0.98 to 80.95±0.69% in three seasons. From the estimated seasonal values in both years, significantly ($p<0.05$) higher moisture content were observed in body muscles of W. attu from Masoli Reservoir in summer season and lower ($p<0.05$) moisture content were observed in body muscles of W. attu from Karpara Reservoir in winter season as compared to all selected reservoirs in three seasons. Similar results were present in both years recorded as in Table- 1, 2 and Fig.- 1, 2.

The result of study indicated that the moisture content in body muscles of *Wallago attu* showed a significant difference ($p<0.05$) between seasons and reservoirs during Feb. 2010 to Jan. 2011 and no significant difference ($p\square0.05$) in moisture content (%) of muscle tissue of *Wallago attu* from reservoirs & significant difference ($p^0$0.05) in moisture content (%) of muscle tissue of Wallago attu in three seasons during Feb. 2011 - Jan. 2012 was shown below as in Table – 1.1 (a) & (b); 1.2 (a) & (b).

There is significant difference ($p<0.05$) in moisture content (%) of body muscles of Wallago attu during Feb. 2010 to Jan. 2011collected from different reservoirs in the selected study area in different seasons as shown in table – 1.1 (a) and (b). There is no significant difference ($p\square0.05$) in moisture content (%) of body muscles of Wallago attu collected from selected reservoirs but there is significant difference ($p\square0.05$) in moisture content (%) of body muscles of Wallago attu in different seasons during Feb. 2011 - Jan. 2012 was observed as in table – 2.1 (a) and (b). Following are some results discussed by various researchers.

Memon (2011) examined thirteen Indus river fish species out of these *Wallago attu* contain 75.95% moisture and Aorichthys aor contain 77.03% moisture content. In the present study the moisture content in muscle tissues of *Wallago attu* 80.95% in summer season & lowest 79.15 % in winter season. Yousaf et. al., (2011) observed water content % remain constant when the percentage of ash, fat, protein content increases with increasing body weight and length in *Wallago attu*. Jabeen et. al., (2011) found that *Labeo rohita* contain highest level of moisture and *Oreochromis mossambicus* contain

Table 1: Seasonal variation of Moisture content (%) in body muscles of Wallago attu collected from different selected habitats during Feb. 2010 - Jan. 2011.

Seasons ↓ Habitats→	Karpara Reservoir	Masoli Reservoir	Yeldari Reservoir	Siddheshwar Reservoir
Summer	80.13±0.66	80.91±0.80	80.76±0.68	80.38± 0.46
Monsoon	78.20±1.08	79.20±1.53	79.12±0.67	78.45± 0.96
Winter	76.15±0.71	76.84±0.55	77.24±0.83	76.40±1.44

The data is shown as mean±standard deviation (n=10)

Table 2: Seasonal variation of Moisture content (%) in body muscles of Wallago attu collected from different selected habitats during Feb. 2011 - Jan. 2012.

Seasons ↓ Habitats→	Karpara Reservoir	Masoli Reservoir	Yeldari Reservoir	Siddheshwar Reservoir
Summer	80.91±0.70	80.95±0.69	80.85±0.83	80.86±0.73
Monsoon	78.90±1.31	79.40±0.93	79.26±0.74	79.28±0.76
Winter	76.15±0.98	76.90±0.59	77.50±1.34	76.90±1.92

The data is shown as mean±standard deviation (n=10)

lowest level of moisture content. Kumaran et. al., (2012) reported moisture content of *Mugil cephalus* was 75.27% and important for nutrient composition of fishes and better understanding of human nutrition.

Flowra et. al., (2012) conducted chemical composition of *Puntius ticto, Labeo bata, Wallago attu, Channa striatus, Palaemon sp*. Among these selected fish species, highest moisture content was found in *Palaemon sp*. and lowest moisture content was found in *Puntius ticto* (12.13%). Remaining three fish species contain moisture content as Labeo bata (12.35%), *Wallago attu* (14.70%), Channa striatus (16.03%). Flowra et. al., (2012) analyzed the five

Table 1.1 Seasonal variation of Moisture content (%) in body muscles of Wallago attu collected from different selected habitats during Feb. 2010 - Jan. 2011 as given in table 1.1 (a) and (b) shown below. Table 1.1 (a) - ANOVA: Two factors without replication for Moisture Content (%)

SUMMARY	Count	Sum	Average	Variance	SD
Summer season	4	322.18	80.545	0.1263	0.355387
Monsoon season	4	314.97	78.7425	0.243892	0.493854
Winter season	4	306.63	76.6575	0.232158	0.481828
Karpara Reservoir	3	234.48	78.16	3.9613	1.990301
Masoli Reservoir	3	236.95	78.98333	4.176433	2.043632
Yeldari Reservoir	3	237.12	79.04	3.1024	1.761363
Siddheshwar Reservoir	3	235.23	78.41	3.9613	1.990301

Table 1.1:(b) - ANOVA (Analysis of variance) for Moisture content (%).

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Seasons	30.27852	2	15.13926	730.4829	6.84E-08	5.143253
Reservoirs	1.6827	3	0.5609	27.06393	0.000694	4.757063
Error	0.12435	6	0.020725			
Total	32.08557	11				

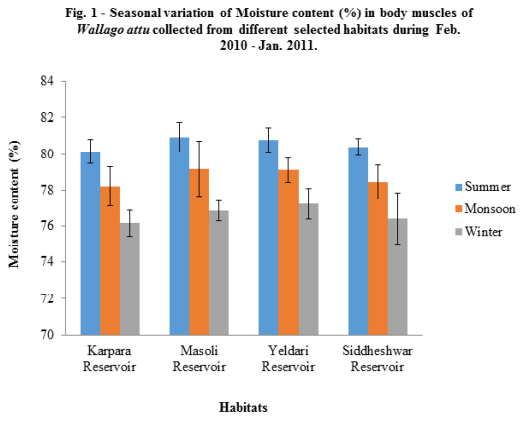

Fig. 1: Seasonal variation of Moisture content (%) in body muscles of Wallago attu collected from different selected habitats during Feb. 2010 - Jan. 2011

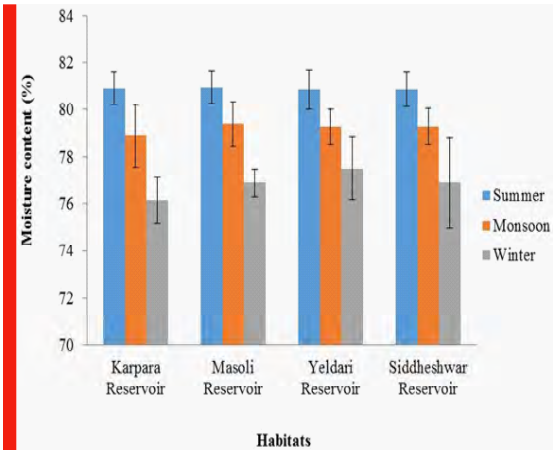

Fig. 2: Seasonal variation of Moisture content (%) in body muscles of Wallago attu collected from different selected habitats during Feb. 2011 - Jan. 2012

Wallago attu

dried fish species *Mystus vittatus*, *Channa punctatus*, *Chanda nama*, *Corica soborna* and *Trichuirus haumela*. Among these selected fish species, highest moisture content was found in *Corica soborna* (24.58%) and lowest moisture content was found in *Trichuirus haumela* (14.06%).

Zafar et. al., (2011) examined the three fish species *Mystus seenghala, Wallago attu* and *Channa morulius* found that there was not much difference in moisture content among the three carnivorous fishes. Some season oriented differences were occurring but not species oriented. Chabungbam et. al., (2014) investigated that small indigenous fishes like *Channa striata*, *Tricogaster fasciatus* and *Puntius sophore* contain 80.11%, 78.05% and 78.95% moisture respectively. Sankar T. V. (2008) examined changes in biochemical composition of fish and found that there was inverse relationship between water and fat contents. The high water content was found in a Bombayduck (*Harpodon nehereus*) which contain about 90% of water in flesh. Abisoye et. al., (2011) reported that the based on all chemical properties dendrogram showed two hierarchical clusters of fish species using Wards method studied and resulted moisture content for the fish species in first group i.e. *Scomber scombrus, Sardinella aurita* were below 60% while fish species in second group i.e. *Micropogonias furnieri*, Clarias *gariepinus* and *Trachurtus tracurtus* had higher moisture content (above 70%). Cluster analysis was successfully used to classify the fish samples into two major group of high lipid high protein fish and medium lipid high protein.

Majid et. al., (2011) studied highest amount of moisture content in *Cyprinus carpio* 75.48% and lowest in *Ctenopharyngodon idella* 73.1%. There was significant difference in muscle tissue of both fishes. Askary et. al., (2012) reported that moisture content in *Cyprinus carpio* was higher 78.23% and lower in *Oncorhynchus myskiss* 77.9%. Mahdi et. al., (2006) examined six freshwater fishes *Barbus sharpeyi, Barbus luteus, Carassius auratus, Alburnus mossulensis, Liza abu, Silurus triostegus*. Out of these percentage of moisture content was higher in Barbus sharpeyi 79.41% and lower in *Liza abu* 69.64%. Saoud et. al., (2008) reported rabbifish; *Siganus rivulatus* an algaevore had less moisture content than White Sea bream, *Diplodus sargus*. Taiwo et. al., (2014) examined moisture percentage in muscles of wild catfish clarias *gariepinus* was 77.83% and in the muscles of cultured catfish was 75.58%. Daniel (2015) reported the moisture content was lowest 63.97% in *Cynoglossus senegalensis* and highest in *Polydactylus quadrifilis*. Ayeloja et. al., (2013) reported the percentage of moisture content ranged from 75.85% in clarias *gariepinus* and 78.825% in Oreochromis niloticus. Olgunoglu et. al., (2011) studied moisture in shabut (*Barbus grypus*) ranged from 72.40 to76.93 g/100g.

CONCLUSION

The higher moisture content in body muscles of *Wallago attu* collected from Masoli Reservoir was observed in summer season and lower moisture content in body muscles of Wallago attu collected from Karpara Reservoir were observed in winter season. There is significant difference ($p<0.05$) in moisture content (%) of body muscles of *Wallago attu* collected from different reservoirs in the selected study area in different seasons during Feb. 2010 to Jan. 2011. There is no significant difference ($p^{0}0.05$) in moisture content (%) of body muscles of *Wallago attu* collected from different selected reservoirs but there is significant difference ($p^{0}0.05$) in moisture content (%) of body muscles of *Wallago attu* in different seasons during Feb. 2011 - Jan. 2012 was observed.

RECOMMENDATION

High moisture content in body muscles of two species was observed which is disadvantage. It increases fish sensitivity to microbial spoilage, oxidative degradation of polyunsaturated fatty acids therefore high moisture content in fish body decreases the quality of fishes for longer preservation time. It is recommended to sale the fish species as early as possible within few hrs. of ice preservation or if not marketed then need to subject for sun drying. There is significant difference for the moisture content in the selected fish species in the selected reservoirs in different seasons. Therefore the post harvest processing of the *Wallago attu* will be similar but may need different timings for sun drying or to process the species to prevent the rigor mortis.

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Zoological Communication

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Phytoplanktons of Washim Region (M.S.) India

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ABSTRACT:

Phytoplankton includes microscopic organism such as diatoms, dinoflagellates, blue-green algae, cryptomonads as well as green algae. The present paper is based on identification of phytoplanktons in Washim region, Maharashtra, India, research work conducted during August 2018 to December 2018. Phytoplankton have been reported from various wetlands such as Dev talav, Padmtirtha, Borala dam, Adol dam, Keli dam, Nagartas and Narayan baba talav in Washim region. From the study area 10 species of phytoplankton belonging to four class, eight order and nine families were identified. In Washim region phytoplankton are widely present so, it is necessary to conduct some study on phytoplankton, Hence this is small step towards studying phytoplankton in Washim region.

KEY WORDS: Phytoplanktons, Washim.

INTRODUCTION

India is having very rich sources of inland waters in the form of lake, reservoirs and rivers. Planktons are the diverse collection of organisms that live in large bodies of water and are unable to swim against a current. They provide a crucial source of food to many large aquatic organisms. They are two main types of planktons - Phytoplankton and zooplankton. Phytoplankton include microscopic organism such as diatoms, dinoflagellates, blue-green algae, cryptomonads as well as green algae. Out of these diatoms and dinoflagellates are predominant. Phytoplankton is a key food item in both aquaculture and mariculture and it is utilized as food for animals being farmed. It is also used to feed many varities of aquacultured molluscs including pearl oysters. Phytoplanktons are the principle photosynthesizing agent in ponds and lakes. Chunne and Nasare (2018) studied phytoplankton diversity of Nandgaon and Arwat lakes of Chandrapur District M.S. India study carried out on phytoplankton diversity from the February 2016 to January 2017. Total 74 species of phytoplankton were recorded during study period. Summarwar (2012) studied plankton diversity in Bilaspur reservoir. They investigate plankton diversity in different months during period of February 2008 to January 2009. Oscillotoria, Euglena and Navicula were recorded. Manjare (2015) researched on Status of phytoplankton diversity of Vadgaon freshwater tank of M.S. India. The study revealed that total 11 species of phytoplankton resides in the tank.

Ecological study of phytoplankton from Dahanu creek- west coast of India was conducted by Kadam and Tiwari (2011) total 52 genera of phytoplankton were observed during study period comprising diatoms, dianoflagellates and other algae. Kather et al. (2015) studied on plankton diversity and water quality of Ambattur Lake, Tamilnadu. The study shows that the total 22 species of plankton consisting phytoplankton and zooplankton were recorded. Prajapati et al. (2014) studied on Phytoplankton biodiversity in panvel lakes (visharale, Krishnale and Dewale Lake) in district Raigad. The present study is carried out the period of February 2010 to January 2011. In all three lakes 16 genera of phytoplankton were recorded. In Washim region phytoplankton are widely present so, it is essential to study phytoplankton but till today there is not a

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Table 1: Taxonomic classification of different phytoplankton

Sr.No	Class	Order	Family	Genus	Species
1.	Chlorophyceae	Chlorococcalaes	Hydrodictyaceae	Pediastrum	*P. duplex*
2.	Chlorophyceae	Sphaeropleales	Hydrodictyaceae	Pediastrum	*P. duplex*
3.	Cyanophyceae	Oscillatoriales	Oscillatoriaceae	Pectonema	*P. wollei*
4.	Bacillariophyceae	Naviculales	Diploneidaceae	Diploneis	*D. elliptica*
5.	Bacillariophyceae	Naviculales	Pinnulariaceae	Pinnularia	*P. mobilis*
6.	Bacillariophyceae	Naviculales	Naviculaceae	Gyrosigma	*G. kulzingii*
7.	Bacillariophyceae	Fragilariales	Fragilariaceae	Fragilaria	*F. capusina*
8.	Bacillariophyceae	Bacillariales	Bacillariaceae	Cylindrotheca	*C. fusiformis*
9.	Cyanophyceae	Coccales	Microcystaceae	Microcystis	*M. aeruginosa*
10.	Zygnematophyceae	Zygnematales	Zygnemataceae	Zygnema	

Padmatirtha

DevTalav

Borala Dam (Adol Dam)

Narayan Baba Talav

Nagartas

Keli Dam

R.A. College, Washim, Fish Farm

Photo plate 1: Sampling Sites of Washim District

single study regarding phytoplankton is conducted. The objective of the present study is to investigate the phytoplankton in different water bodies of Washim region in relation to fisheries. The main aim of this study is to identify different types of phytoplankton and to understand the role of phytoplankton in ecosystem.

MATERIAL AND METHODS

Study area: Many sites were selected for the sampling in Washim district, such as Padmatirth, DeoTalav, Borala Dam (Adol Dam), Narayan Baba Talav, Nagartas, Keli Dam and R.A. College, Washim, Fish Farm. Sites selected for sampling are shown in photo plate I.

Method

The sampling was made during the period August 2018 to December 2018. For the qualitative analysis of phytoplankton a proper collection method was necessary, for this purpose standard method given by Clesceri et al. (1998, 2006, 2008) were used. The phytoplankton collection primarily involves the netting process, by which water is collected in the bottle. The sampling collection largely depends upon the selection of a suitable gear. The netting was done for the qualitative analysis. This method was used mainly for collecting phytoplankton. The water is collected at the sampling site in bottles with 10ml capacity. Then identification of different phytoplankton was carried out and their photographs were capture with the help of Cos lab. The identification was done by comparing photographs with the help of EDM Algae identification key. Identification was carried out by studying PhD thesis of Solanke (2015).

RESULTS AND DISCUSSION

The present work was carried out on phytoplankton in Washim district region, Maharashtra, from August 2018 to December 2018. The phytoplanktons observed in the study region of Washim district

Photo plate 2: Phytoplanktons of Washim region

along with their classification are presented in the photo plate II and table I.

Ten different species of phytoplankton were observed belonging to four class that is Chlorophyceae, Cyanophyceae, Bacillariophyceae and Zygnematophyceae belonging to eight different order Chlorococcalaes, Sphaeropleales, Oscillatoriales, Naviculales, Fragilariales, Bacillariales, Coccales, Zygnematales belonging to nine family namely Hydrodictyaceae, Oscillatoriaceae, Diploneidaceae, Pinnulariaceae, Naviculaceae, Fragilariaceae, Bacillariaceae, Microcystaceae, Zygnemataceae having nine different genus namely *Pediastrum, Pectonema, Diploneis,*

Pinnularia, Gyrosigma, Fragilaria, Cylindrotheca, Microcystis, *Zygnema*. . In Washim region phytoplankton are widely present so it is essential study them.

Kather et al. (2015) studied plankton diversity and water quality of Ambattur Lake, Tamilnadu. The study shows that the total 22 species of plankton consisting phytoplankton and zooplankton. Kadam and Tiwari (2011) carried out their researched on ecological study of phytoplankton from Dahanu creek- west coast of India. Total 52 genera of phytoplankton were observed during study period comprising diatoms, dianoflagellates and other algae. Nair et al. (2015) studied Effect of water quality on phytoplankton abundance in selected ponds of Nedumangad block Panchayat, Kerala. The result of phytoplankton abundance in selected ponds of Nedumangad as study clearly shows that the water is not good for human consumption and also struggling for their existence. Chunne and Nasare (2018) carried out research to study phytoplankton diversity from the February 2016 to January 2017. Total 74 species of phytoplankton were recorded during study period. In Nandgaon lake 43 species of phytoplankton and Arwat Lake 31species of phytoplankton were recorded. Summarwar (2012) studied on plankton diversity in Bilaspur reservoir. The study investigates the plankton diversity through different months during period of February 2008 to January 2009. During the present study the most pollution tolerant species and were recorded.

CONCLUSION

Floating of algal mats and aquatic seed plants furnish the larger forms as well as the small epiphytic forms. Diatoms are unicellular algae, usually microscopic, that are characterized by having cell wall of silica and the critical identification usually involves examination of cleaned material with an oil immersion objective. Phytoplankton are important in an environmental impact study is as much they are extremely responsive to change in the environment and fluctuation that may occurs Phytoplankton act as a biological indicators of water pollution. Phytoplankton's are the producers in an aquatic ecosystem and also primary food base for nektons like fishes and other fishable organism. In the tropical country like India, highly seasonal rainfall and heavy discharge of water during monsoon result in high flushing rate in the most of the reservoirs or Lakes. Therefore, the consistency and productiveness of the component is variable. The occurrence of particular species of algae determined more by ecological condition than its geographical location. The algae present mainly in those places where the moisture and minerals is present.

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Zoological Communication

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Study of Human and Leopard Conflict a Survey in Human Dominated areas of Western Maharashtra

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ABSTRACT

Indian leopard Panther Parades Fusca is one of the most popularly of five big cat family The African continent leopard is well adapted for its natural environment in catching the prey by running after it utilizes its energy in natural food attack. But in Asian continent India leopard have adapted known for its unique migrating and attacking in Human Inhabitants skills of jumping and adaptation of city culture. The leopard is one of the five big cats found in India known to have migrated and adapted to Human inhabitants. But in recent years we find leopard have migrated in human inhabitants for food on domestic wealth as due increase in Deforestation for Development,Industria l,Agricultural and Urbanization Extinct of natural species habitat lack of food and conversion of rural areas in urbanization expanding of urbanization and increase in population of humans and migration of leopard in search of prey ,predator without much effort in hunting is creating a daily conflict in a fight for dominance of area between humans and leopard so study of survey was carried out .

KEY WORDS: leopard population, No leopard attack on Domestic Wealth, No leopard attack and Migration on Human inhabitants Maharashtra.

INTRODUCTION

The main occupation in India is agriculture since after independence major Development have Increased and decreased the forest land converting into Agriculture, Industrial and Urbanization The natural environment required by the different species of wild life have been lost The National Remote Sensing Agency, forests covered 14.1% of India's territory in 1980-82; this forest area has decreased by 22.4% in 10 years.(Haeuber R)This has been continuously decreasing in the past decades which contributed to lost of species and many of have become endangered and others have become Extinct .

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The leopard population have increased the reason may be due frequent environmental conditions suitable for mating without attacked by other predator and less competition in survival in recent years due to natural habitats and food sources , and reproduction leopards mate all year round, The Natural environment in forest which has tough competition from predators like hyena in protecting the litters gestation period of female last for 90-105 days ,2-4 litters are born .The life span of leopard is 12-17 years. due increase in population in recent decades humans are motivated to migrate in rural areas and are slowly converting to urban areas expansion of agricultural land in forest areas Leopard are main habitats but since humans have occupied their territory they are considered to be unwanted trespassers by villagers but recent years leopards have migrated to human settlements due to loss of habitat and decrease of wild prey where they prey on domestic animals (Dogs, Goats, Sheep, Cow etc) which they require less efforts for hunting they prey as compare to forest they easy to access of domestic food source so mostly they are noticed in human habitants .

Phylum: Chordate
Class: Mammalian
Order: Carnivore
Family: Felidae
Genus: *Panthera*

Species: *Paradus*
Sub sp: *Fusca*

As main occupation of the people is farming in Maharashtra and is the leading producer of sugarcane and ranks second in sugarcane production 4% farmland in Maharashtra is under sugarcane, majority of people in west coast Maharashtra take sugarcane as the main source in field. One commonly farmed crops that draw leopard's sugarcane as it is source for hiding as in forest natural grasses and other plants are reduced Sugarcane fields are becoming main hiding shelters as they provide them shelters and also are good for hiding for their litter's cubs as sugarcane field cutting starts many of the hiding places for cubs are exposed and they attack on the human domesticated animals. Many of them are also found in fallen of the wells for drinking water. Recently many leopard conflicts have been noticed in human dominated areas of junnar taluka of pune district which is main areas of conflict with farmers but nowadays we can hear in other parts of taluka rather junnar in Ambegaon, Shirur, Daund which are coming in Pune District in daily Newspapers, Television, Social Media there is leopard rehabilitation center in junnar known as Manikdogh Rehabilitation center where leopards of near by areas are caught and admitted to the center but still the question arises as how many leopards can be kept inside as the problem of food and habitat becomes a major problem Recently there attacked are increased due to insufficient food and scarcity of water, natural species, natural environment availability we can notice slowly they are forcing to enter in other talukas nearby main metropolitan cities like Pune.

Table 1: Attack on Domestic Animals 2017-18

Sr.no	Place	Tal /Dist		Attack on domestic wealth
1	Rajuri Kademala			Goat
2	Phatethan	Daund		6 Goats were killed
3	Adewad	Junnar		
4	Talegaon Dhemere	Shirur	Aug	2Goats &1 Sheep were killed
5	Abhangwadi			Dog was killed
6	Koregaon Bhima Digajwadi		Sep	Sheep Goat Dog Calf were killed
7	Dhingore Amale Shivar	Junnar	Sep	2 Goats1Sheep and Dog
8	Vadegaon rajuri	Velha		1 Sheep was killed
9	Nirgudsar	Ambegaon	Sept	Calf died
10	Chastan	Khed		2 Goats were killed
11	Lenyadri	Junnar	Oct	2 Sheep
12	Nirgudsar	Ambegaon	Oct	8 Hens were killed
13	Sardwadi Takli Haji	Shirur Tal	Nov	Pregnant Sheep
14	Garade Ketkawade	Purandar	Nov	2yrs Calf was killed
15	Shindhodi Kolpe wasti	Shirur	Nov	Sheep were killed
16	Ambasen Baglan Madhavwasti	Nashik	Nov	5 Sheeps were killed
17	Pilkhod chalisgao Deshmukhwadi	Jalgaon	Nov	2 kokara
18	Pingori Valhe	Purandar	Nov	1 Sheep was killed
19	Pimparkhed	Shirur	Nov	1 yr calf
20	Narayangaon	Junnar		3 Months Goat was killed
21	Kalamb Shilamada wasti Ganeshwadi&Surajinath wasti	Ambegaon	Dec	Sheep &Calf
22	Nagargao Sathewasti	Shirur	Dec	Sheep, Dog
23	Tekhlewadi	Daund		
24	Takli Haji	Shirur	Dec	On Horse was killed
25	Takli Haji Ghadge wasti		Dec	Sheeps were killed
26	Mahaduge padvad kalamb	Ambegaon	Dec	Calf and Sheep
27	Takali Haji Kavte Yemai	Shirur	Jan	Goat was killed
28	Takali Haji Shingadwadi	Shirur	Jan	Calf was killed
29	Udapur Morachi waen	Junnar	Jan	11Goats were killed
30	Pimpalwadi Bangla wasti	Junnar	Jan	

Table 2: Attack on Humans

Sr.no	Place	Tal/Dist	Humans attacked/killed
1	Paragon	Junnar	6rl
2	Mangoan	Sindhudurgh	On Farmers
3	Nan durbar		On Farmers
4	Pilkhod chalisgao Deshmukh wadi	Jalgaon	12yrs boy 1 Girl 1man
5	Hivare Khurd Netwad phata		
	Lokeswar Malaya	Junnar	
	4 Motar bike were attacked		
6	Baglan	Nasik	On Farmers 2
7	Chalisgaon		6 people
8	Ambegao pondewadi,Rodewadi	Ambegaon	
9	Chafyachapada Aare milk colony	Mumbai	2 middle age wwwwwww
10	Aarey colony	Mumbai	4kids attacked
11	Royal palms Goregaon	Mumbai	13 yr boy was attacked
12	Pargaon Adefata Shivdema	Junnar	On Farmer
13	Nanepada Mulund	Mumbai	6people were killed
14		Nagpur	
15	Nirgudsar Pargao		
16	Koregaon Bhima Digajwadi	Shirur	

Table 3:Found in Sugarcane fields

Sr.no	Place	District	Found on fields
1	Rajuri	Junnar	Suga
2	Mangrur	Junnar	Sugarcane field
3	Pirangut		Sugarcane field
4	Chandhoha	Shirur	Sugarcane field
5	Pavnanagar	yedse	Sugarcane field
			Sugarcane field Ield
6	Gaodara	Haveli	Sugarcane field

Table 4: Found in Humans inhabitants

Sr.no	Place	District	Humans inhabitants
1	Kondwa	Pune	
2	Pavnanagar	yedse	
3	Ganegao Khalsa	Shirur	
4	Chikdav wasti Rajini	Ambegao	2 Cubs sugar
5	Ratnagiri		In Well
6	MangrulAdephata	Junnar	Cub found in field
	sriramnagar		
7	Pimpalwadi	Junnar	Found in wells
	Bangla wasti		

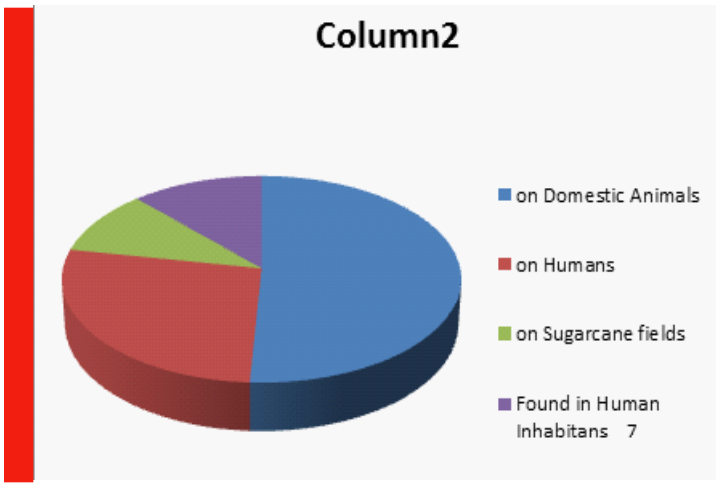
RESULTS AND DISCUSSION

Table no 1 shows that the number of attack on cattle on the field Were more majority of domestic wealth of farmers were lost. The most lost are in major dominant places like Junnar, Shirur, Ambegaon were daily attacked news .This might be due to major Sugarcane field in areas which is hiding places for leopards.

Table no 2 Shows no of attack on Humans have increased in Rural areas and also found in some urban areas like School Hotels and Society.

Table no 3 Shows that as sugar cane field were major hiding places and for their young ones so sugarcane field areas are one Of the Most suitable places for their habitat.

Table 4 shows that mostly cubs are found in sugar cane fields.



1 Attack on Domestic Animals 30
2 Attack on Humans 16
3 Found in Sugarcane fields 6
4 Found on Human Inhabitants 7

Due growing Urbanization Deforestations and increasing population Leopards habitat are lost due to which Migrating to the rural areas in search of food prey as domestic animals are easy prey for them without many efforts for catchment of prey. Also as their reproduction is for whole Year.

Therefore the population is increasing and for survival they are migrating to Human inhabitants causing conflict not only in sugarcane areas but also in cosmopolitan cities like areas nearby Bombay, Pune, Nagpur there has been also conflict in other states of India like Uttarpradesh.Himachal Pradesh and Madhya Pradesh.

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Hendra Gunawan ofianiskandar, Vivins. Sihombing, Robby Wienanto Cuvier, 1809) in Western Java, Indonesia (Hendra Gunawan ofianiskandar, Vivins. Sihombing, Robby Wienanto Conflict between humans and leopards (*Panthera pardus melas)*.

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Exposure of Chlorpyrifos on Some Biochemical Constituents in Liver and Kidney of Fresh Water Fish, *Channa punctatus*

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ABSTRACT

Pesticides are considered one of the toxic chemical which is harmful for both flora and fauna. It can cause dread to plants and assassination for animals. Pesticides take harmful part in environment, but have been used good for agriculture purposes. Organophosphate chlorpyrifos an insecticide which is widely used at a large scale. The aquatic ecosystem gets disturb by the chlorpyrifos through rainfall runoff. This very particular work shows decrease in biochemical constituents by the use of chlorpyrifos in liver and kidney of fresh water fish channa punctatus. In biochemical estimation the total glycogen was estimated by anthrone reagent and total protein was estimated by folin and wu method. So in liver glycogen decreases, 17%, 18%, 34% and 45% in 24 hrs, 48 hrs, 72 hrs, and 96 hrs respectively, and protein was found to be decreased about 7%, 12%, 37% and 53% in 24 hrs, 48 hrs, 72 hrs, and 96 hrs respectively. Similarly in kidney the glycogen percentage decreases, and was found 19%, 35%, 46% and 60% in 24 hrs, 48 hrs, 72 hrs, and 96 hrs respectively, and protein decreases 37%, 42%, 48% and54% 24 hrs, in 48 hrs, 72 hrs, and 96 hrs respectively.

KEY WORDS: Chlorpyrifos, Glycogen, Protein, *Channa punctatus*, ;iver and Kidney.

INTRODUCTION

Due to the over exploitation, high natality rate and the rapid industrialization have increase the population; it was seen that the water pollution has become a worldwide and serious problem in the present days (Bella and Prasad 2008). As the water pollution are industrial outflow. Various pollutants such as domestic waste, industrial waste, sewage as well as pesticide which pollute and contaminate the rivers, lakes and other water source (Maruthanayagam and Sharmila 2004). Various change takes place due to the entrance of pesticide in the aquatic ecosystem and causes change in growth rate, reproduction rate, nutrition value and behavior pattern. It can also cause ill effects to the aquatic environment, which ultimately leads to pass to the humans by the food chain.

Chlorpyrifos is one of such an organophosphate pesticide, which plays vital role in agriculture, aquaculture, and domestic purposes in order to control the pests. Due to the highly use of pesticides various issues have been created in the environment (Ahmet et al., 2014). Various biochemical and histopathological alteration have been studied by (Xing et al., 2012). India is rich in self crop production, therefore pesticide are used extensively, therefore chlorpyrifos was to be considered as the highest selling product throughout India and is commonly used to control crop pests on paddy field, cotton, orchids, pasture and paddy (Rao et al., 2003).

Biochemical composition like protein, lipid, glucose, enzymes etc are very easy in checking the toxicity of any chemical after getting the body contents (Singh and Yadav, 2010). Such biochemical parameter give rise serious outcome in the form of variety of disease in non target animal like fish, and these also exposed physiological conditions of the organs, tissues of organisms (Obomanu et al., 2009). Fish is pioneer food for poor people and is highly proteinous, so it was observed that the biochemical composition like protein, lipids, glucose, and other components in the fish was highly affected by the water pollution. (Saradhamani et al., 2009).

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Snake headed fish is a common name of *Channa punctatus* and it is a carnivorous by feeding habit. For the present study purpose the Channa punctatus a fresh water fish was selected, and chlorpyrifos as a pesticide was selected for the particular doses, in order to check the valuable effect of the given pesticide. Both fish as well as pesticide were readily available in the market. The purpose and aim of the study is to investigate chlorpyrifos an organophosphate effect on kidney and liver.

Table 1: Parenthesis value indicates percentage (%) change.

Tissue	Biochemical constituent	control	24 hrs	48hrs	72hrs	96hrs
Liver	Glycogen	1.84 ±0.084	1.54±0.61	1.52±0.91	1.22±0.706***	1.00±0.658**
			17%	18%	34%	45%
	Protein	52.85±1.520	49.25±2.124*	46.78±1.401	33.22±10.992*	25.28±9.035**
			7%	12%	37%	53%
Kidney	Glycogen	1.46±0.962	1.19±0.718***	0.95±0.721	0.784±0.633	0.57±0.510**
			19%	35%	46%	60%
	Protein	36.57±2.835	23.36±4.429	21.06±3.423	18.934±2.431*	16.63±2.699
			37%	42%	48%	54%

Values in mean +S.E. (standard deviation) n=5,*P<0.05, **P<0.01, ***P<0.001 when compared with control, ns = non signification.

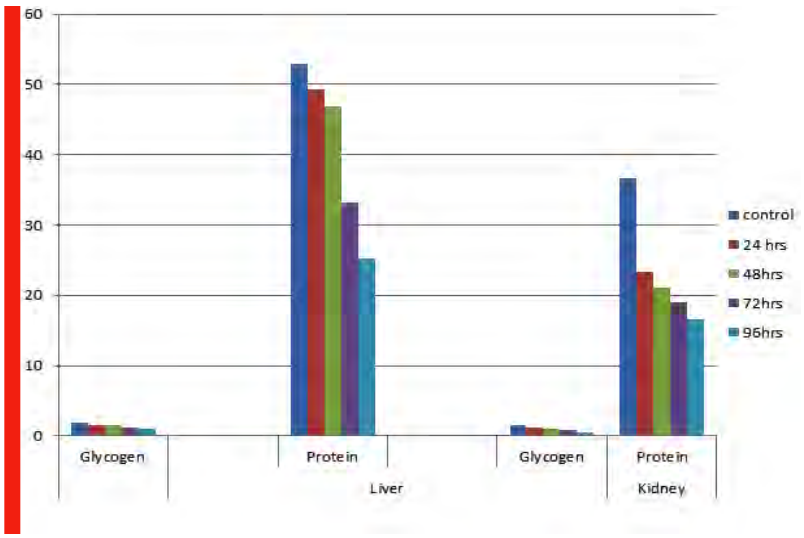

Fig. 1: Relative changes in glycogen and protein content (mg/g wet wt of tissue) in liver and kidney of fish *Channa punctatus*, exposed to sublethal concentration of chlorpyrifos for 24, 48, 72 and 96 hrs.

MATERIAL AND METHODS

As the *Channa punctatus* was readily available in the month of October and November in the fishery market district Amraviti. The fish was measured by scale and normal average length of fish was found to be 16 ± 1, and its weight was done in the laboratory which was found near about 53±5 gm. The fish was washed by potassium permanganate solution. The healthy fishes were acclimatized near about 10 days. Later the fish was treated with chlorpyrifos for 24, 48, 72 and 96 hrs. At the end of doses, fish was dissected in the laboratory and particular organs were removed for the biochemical estimation purposes. The total glycogen is estimated by Anthrone reagent method (Seifter et al., 1950). The total protein was determined by Folin reagent (Lowry et al., 1951).

RESULTS AND DISCUSSION

The result shows the significant decrease in glycogen and protein. Below the table shows gradual change and difference between control and 24 hrs to 96 hrs in both organs liver and kidney.

It is clears from above table, that chlorpyrifos effects on different organs of the fish *Channa punctatus* and shows the significant decrease in biochemical components. The change or alteration

in biochemical parameter such as protein, glucose, and lipid were found significant decrease to indicate the liability of organ system of pollution (Hyalij 2013). Proteins play the vital role and have the top priority in the body of organisms, because whole the body is made up of proteins. Proteins are valuable and have chief significant in the living world by their biological specificity among various types of cell (Bhushan et al., 2002).

CONCLUSION

It was concluded that the pesticide chlorpyrifos is very harmful for both flora and fauna. The chlorpyrifos is used in various factories, industries, orchids and agriculture purposes as well as commercial purposes, is washed out through rain and ultimately reaches to the nearby river or lakes were it directly or indirectly effect on the fauna organisms which plays vital role in the ecosystem. Here the chlorpyrifos was found to decrease the protein and glycogen level in fish. It can also effect the reproduction, behavioral pattern and even leads to death.

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Effect of Sodium Fluoride on Feed Consumption and Body Weight of Wistar Albino Rats

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ABSTRACT

Changes in feed consumption and body weights of control and experimental rats were observed after every 7 days (week) to know the overall effect of fluoride on the animal body. In control rats, a continuous gradual increase in food consumption was seen and it was almost positive exponential with the increase in age of the rats upto 26 weeks. However, in experimental rats irregularity in feeding upto first 6 weeks and later there was decrease in feed consumption as time passed. Female rats exhibited less feed consumption when compared with male rats. At the end of experimentation (26th week), feed consumption in male control rats was 20.71 g per rat, which exhibited 72.58 % rise over initial feeding by these rats. The experimental male rat was found to consume only 13.00 g food after 26 week of fluoride feeding showing 8.33 % rise in feed consumption over the feed consumption at the beginning of the experiment. Similarly, in female experimental rats this rise in feed consumption was just 5.52 % after sodium fluoride feeding for 26 weeks.

KEY WORDS: Fluoride, feed ,body weight,Wistar Albinno Rat.

INTRODUCTION

The word fluorine was derived from Latin fluere, meaning, “to flow”. There are 38 compounds found to contain fluorine. It is the 13th or 14th most abundant element on the earth. Fluorine toxicosis in sheep was first observed about the year 1000 A.D. in Iceland due to the volcanic eruptions. Georgius Agricola described fluorine in the form of fluorspar in 1529 for its use as a flux. In 1670 Schwandhord found that glass was etched when exposed to fluorspar. It was first discovered by Karl Steele in 1771 but later on Henri Moissan in 1866 electrolyzed potassium fluoride to isolate pure fluorine (F2).

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Environmental contamination by fluorides exposes many organisms to potential toxic effect and may exert some stress on the ecological interrelationships among plant and animal populations in natural biological communities. Animals normally ingest small amounts of fluoride without adverse effects. One part per million of fluoride (1PPm.F-) in water is essential for optimal health in man. It favors mineralization of bones. Thus, in small amounts it may be beneficial to animals. Fluorides are harmful when ingested in excessive amount.

Fluoride Toxicosis

There are two patterns of fluoride toxicity in the world, endemic fluorosis and industrial fluorosis. Endemic fluorosis is related to high concentration of fluoride present in drinking water (Li and Cao, 1994) or produced by domestic coal use (Wei and Finkelman, 1994). On the other hand, industrial fluorosis is mainly due to air pollution by fluorine. All these types collectively constitute fluoride toxicity or toxicosis. Fluorosis cause damages to the human body, which is characterized by a vast array of symptoms and pathological changes, in addition to well-known effects onskeleton and teeth (Whitford and Zahvoronkov, 1978).

The excessive ingestion of fluoride can develop into an acute or a chronic disease (Shupe and Alther, 1966). The chronic disease is more severe and oftenly used as fluoride toxicosis. A few epidemiologic studies of Chinese populations have reported IQ

deficits in children exposed to fluoride at 2.5 to 4 mg/L in drinking water. (Li and Cao, 1994).

The effect of fluoride on human health has long been of interest to medical researchers. Fluorosis is a serious clinical and public health problem in several parts of the world (Singh and Jolly, 1970). The global prevalence of fluorosis has been reported to be about 32% (Mella et al., 1994). There are several million people in India exposed to drinking water sources with high fluoride content. Excess fluoride ingestion is a major health problem, in 20 of the 30 states including Union territories in India and being endemic for fluorosis (Susheela, 1993). Fluoride concentration up to 38.5 ppm has been reported in drinking water (Susheela and Ghosh, 1990), Teotia and Teotia (1984) have reported dental and skeletal fluorosis

Table 1: Alterations in feed consumption(g) of the control and experimental male and female Wistar albino rats fed with sodium fluoride (NaF) for 180 days.

Week	Male				Female			
	Control	Percent Variation	Experimental	Percent Variation	Control	Percent Variation	Experimental	Percent Variation
1	12.00	–	12.00	–	11.80	–	11.40	–
2	15.20	+26.66	14.90	+24.16	13.10	+11.01	12.80	+17.79
3	15.90	+32.50	15.60	+30.00	14.00	+18.64	13.90	+17.79
4	16.30	+35.83	16.20	+35.00	14.20	+20.33	14.00	+22.80
5	16.80	+40.00	16.00	+33.33	14.50	+22.88	14.10	+23.68
6	17.00	+41.66	16.20	+35.00	15.00	+27.11	14.40	+26.31
7	17.01	+41.75	16.09	+34.08	15.20	+28.81	14.10	+23.68
8	17.20	+43.33	15.90	+32.20	15.25	+29.23	13.70	+20.17
9	17.60	+46.66	15.91	+35.58	15.29	+29.57	13.50	+18.42
10	17.90	+49.16	15.30	+27.50	15.60	+32.20	13.37	+17.28
11	17.94	+49.50	15.14	+26.16	15.69	+32.96	13.22	+15.78
12	18.10	+50.83	15.00	+25.00	15.81	+33.98	13.02	+14.21
13	18.17	+51.41	14.02	+16.83	15.97	+35.50	13.00	+14.03
14	18.42	+53.50	14.00	+16.66	16.10	+36.44	13.00	+14.03
15	18.77	+56.41	13.90	+15.83	16.32	+38.30	12.91	+13.24

in residents or rural areas consuming water containing 0.6-ppm fluoride. Skeletal fluorosis has been observed in areas with mean fluoride levels of 3 ppm (Jolly et al., 1976).

Animals exposed to sodium fluoride developed anemia (Korkmaz., 2000), alterations in neuronal and cerebrovascular integrit (Varner et al., 1998), neurodegeneration in hippocampus (Bhatnagar et al., 2002), testicular toxicity (Ghosh et al., 2002), a decrease in kidney and brain phospholipid contents (Guan et al., 1998) and inhibition of enzyme activity with interruption of glycolysis and synthesis of proteins (Camargo, 2003). I fluoride treated rabbits the brain showed significant decline ($P< 0.001$) in soluble, basic, total protein and the free amino acid levels, decreased RNA content ($P< 0.001$) in the brains of rabbit injected with 5 to 50 mg/kg-body weight/day,

Dental Fluorosis

Developing teeth are extremely sensitive to excessive fluoride. Fluortic lesions in permanent dentition are one of the most of obvious signs of excessive fluoride ingestion (Shupe and Miner, 1962).During dental fluorosis incisor enamel turns dull white to chalky, mottling (horizontal patches in the teeth), hypoplasia (defective development) and hypocalcification of teeth. According to the Center for Disease Control, 32% of American children now have some form of dental fluorosis, with 2 to 4 % of children having the moderate to severe stages (CDC, 2005).Poor nutrition increases the incidence and severity of dental and skeletal fluorosis (Pandit et al., 1940; Murray and Wilson, 1948). Comparison of dietary adequacy, water fluoride levels and the incidence ofskeletal fluorosis in several villages in India suggested that vitamin C deficiency plays a major role in the disease (Pandit et al; 1940). Dental fluorosis is the first visible indicator that severe thyroid hormone dysfunction has occurred and is occurring.

Skeletal Fluorosis

If the levels of fluoride ingestion are sufficiently higher than normal for appreciable length of time, structural changes in the bones occur (Shupe and Alther, 1966). There is osteo-fluorotic lesions of the ribs, mandible, metaphysical areas of the metatarsal and metacarpal bones of the limbs. There is also bending of vertebral column, bowing of long bones of forelimbs and hind limbs. Skeletal fluorosis, especially in its early stages, is a difficult disease to diagnose and can be readily confused with various forms of arthritis including osteoarthritis and arthritis. In its advanced stages, fluorosis resembles a multitude of bone/joint diseases. In individuals with kidney disease, fluoride exposure can contribute to and/or exacerbate renal osteodystrophy.

MATERIAL AND METHODS

Experimental Animal Model

In the present investigation the Wistar albino rats, *Rattus norvegicus* (male rats weighing about 90 ± 5 g and female rats weighing about 80 ± 5 g) were used as test animals. The rats were procured from National Institute of Nutrition (NIN), Hyderabad, India. Animal experimentations were conducted according to INSA-Ethical guidelines for the use of animals for scientific research purpose ,after getting permission from Ethical Committee.

The animals were kept in vivarium throughout the period of experiment. They were regularly fed on standard pellet diet provided by National Institute of Nutrition, Hyderabad and water was given ad-libitum. The remaining food andwaste matter was removed from the cages on the next day and proper care was taken to avoid any infection. Only healthy rats were used for the present experiments.

Experimental animals were acclimatized for 8 days. After recording their initial body weights and temperatures, then were divided into two main groups: Group: I as control and Group: II as experimental. The duration of the experiment was 180 days i.e. chronic exposure. Experimental set-up was carried out as ,Control (5 males + 5 females) Experimental (10 males + 10 females).The animals were observed daily for any mortality and signs of intoxication upto 180 days i.e. 6 months (the period of experimentation). No mortality was recorded during the 180 days of experiment both in control and experimental animals.

Doses

The control group were given tap water ad libitum and the experimenal group were fed with 10mg F/kg/body weight/per day (i.e.22.22 mg NaF/ kg/body weight/per day) for 180 days.

Body Weight and Organ Weight Study

Changes in the body and organ weights of male and female albino rats from both control and experimental groups were noted regularly. The body weights of the control and experimental male and female rats were recorded daily upto 180 days (6 months). Food consumption for individual rat was recorded during experimental period and average food consumption was calculated after a week. After 180 days control and experimental male and female albino rats were sacrificed with cervical dislocation and the tissues like liver, kidney, stomach, intestine, thyroid, adrenal and gonads etc. were removed. The tissues were then washed with saline, blotted, labelled,weighed with electronic balance and were fixed in Bouin's fluid for histological purpose.

Observations

Changes in feed consumption and body weights of control and experimental rats were observed after every 7 days (week) to know the overall effect of fluoride on the animal body (Table 1). In control rats, a continuous gradual increase in food consumption was seen and it was almost positive exponential with the increase in age of

Table 2: Alterations in body weight (g) of the control and experimental male and female Wistar albino rats fed with sodium fluoride (NaF) for 180 days.

Week	Male				Female			
	Control	Percent Variation	Experimental	Percent Variation	Control	Percent Variation	Experimental	Percent Variation
	90.00 ±5	-	90.10 ±5	-	85.20 ±5	-	83.20 ±5	-
1	115.00	+27.77	109.00	+20.97	96.00	+12.67	97.00	+16.58
2	127.00	+41.11	117.00	+29.85	102.00	+19.71	99.90	+20.07
3	137.00	+52.22	132.00	+46.50	104.00	+22.06	103.10	+23.91
4	155.00	+72.22	152.20	+68.92	110.00	+29.10	109.50	+31.61
5	167.50	+85.55	155.90	+73.02	120.50	+41.43	112.19	+34.84
6	190.09	+111.21	167.30	+85.68	121.10	+42.13	119.00	+43.02
7	192.50	+113.88	178.50	+98.11	130.60	+53.28	123.14	+48.00
8	209.10	+132.33	185.60	+105.99	130.60	+53.28	122.14	+46.80
9	217.20	+141.33	197.00	+118.64	139.10	+63.26	135.00	+62.80
10	230.14	+155.71	205.50	+128.06	150.60	+76.76	147.70	+77.52
11	239.00	+165.55	210.50	+133.62	152.27	+78.72	150.42	+80.79
12	242.60	+169.55	226.14	+150.48	162.40	+90.61	160.00	+92.30
13	248.60	+176.22	227.00	+151.94	167.30	+96.36	162.30	+94.95
14	255.60	+184.00	225.40	+150.16	170.50	+100.11	162.10.	+94.83
15	270.00	+200.88	231.14	+145.40	177.10	+107.86	160.00	+92.30
16	272.88	+208.66	222.10	+146.50	185.60	+117.84	162.00	+94.71
17	287.00	+218.88	220.17	+144.33	198.60	+133.09	163.30	+96.27
18	302.40	+236.00	221.00	+145.28	205.14	+141.34	164.50	+97.71
19	308.12	+242.35	225.38	+150.05	216.33	+153.90	166.13	+99.67
20	312.10	+246.77	230.18	+155.46	220.00	+158.21	169.00	+103.12
21	315.51	+250.56	232.04	+157.53	229.14	+168.94	170.20	+104.56
22	318.11	+253.45	236.30	+162.26	235.00	+175.82	176.00	+111.53
23	322.22	+258.02	240.00	+166.37	247.60	+140.61	180.00	+116.34
24	329.00	+265.00	252.40	+180.13	260.30	+205.51	182.00	+118.75
25	323.60	+269.55	252.60	+180.35	271.50	+219.41	187.38	+125.12
26	339.33	+277.03	255.60	+183.68	275.34	+233.11	190.22	+128.62

All values are mean of six observations.

the rats upto 26 weeks. However, in experimental rats irregularity in feeding upto first 6 weeks and later there was decrease in feed consumption as time passed. Female rats exhibited less feed consumption when compared with male rats. At the end of experimentation (26th week), feed consumption in male control rats was 20.71 g per rat, which exhibited 72.58 % rise over initial feeding by these rats. The experimental male rat was found to consume only 13.00 g food after 26 week of fluoride feeding showing 8.33 % rise in feed consumption over the feed consumption at the beginning of the experiment (Table 1). Similarly, in female experimental rats this rise in feed consumption was just 5.52 % after sodium fluoride feeding for 26 weeks.

At the start of experiment the average weight of control male rat was 90 g + 5 and after six months of normal feeding (i.e.26 weeks) the average weight of these rats became 339.33 g recording 277.03 % rise. However, the experimental rats with almost the same average weight (90.10 g) showed average weight of 255.60 g after 26 weeks, having 183.68 percent increase in body weight which is significantly less than the body weight rise in control rats (Table 2). Female experimental rats showed only 128.62 percent rise in body weight after 26 weeks (Table 2).

DISCUSSION

It is generally agreed that the use of fluoride via drinking water as a cariostatic agent must be well controlled. The aim of this study was to observe the effects of excess fluoride supplied via drinking water on various membrane bound enzymes, hematological parameters, rat behavior regarding feeding and the histological alterations. Females given 10 mg fluoride per kg body weight per day (22.22 NaF/Kg/body weight/day) for 180 days ate comparatively less feed and gained significantly less weight also throughout the experimental period than did the control group and the male experimental rats. (Tables 1 and 2). This might be a defensive behavior of the female rats to protect the ovary or developing foetus. Collins et al., (1995) have reported decreased fluoridated water consumption by pregnant female rats and as such foetal development was not affected. The rats maintained on fluoridated water for 180 days showed an adverse effect on the level of different enzymes in the serum, liver and kidney. Ferguson, (1971); Riesktniece et al., (1965), suggested changes in blood enzymes and proteins, due to ingestion of fluoride could result from a change in the membrane permeability and from the rate of loss of the enzymes from the different tissues.

SUMMARY AND CONCLUSION

The albino rats were given 10 mg fluoride/ gm/ body weight (22.22 NaF/ gm/ body weight/ day) in drinking water daily for 180 days to study the effects of high dose of fluoride for longer duration.After 180 days of fluoride consumption, the rats became lethargic and ate less, drunk less resulting in to reduced increase in body weights when compared to control. The body became bent between thorax and abdomen. Sharp tips of incisors were lost. Bone density was found to be increased. Kypho – scoliosis of dorso- lumbar spine was developed.

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Toxicity of Inorganic Metal Pollutants Copper and Lead to the Air Breathing Freshwater Fish, *Clarias batrachus* (*Linn.*)

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ABSTRACT

Heavy metals are of serious concern nowadays, as it is threatening the life of flora and fauna anywhere the concentrations are beyond threshold limits, may be in soil or in water. Since, the higher concentrations of heavy metals are passing through food chains and intimidating the well being of animals and human beings; therefore, the concerns have become more necessary and of primary attention. Toxicity tests are being analyzed in the laboratories by various test methods such as USEPA (1975), OECD (1981) and APHA (1989). Present investigation determined the toxicity of copper and lead using the model animal freshwater fish Clarias batrachus. Statistical method using probit analysis (Finney's 1964; Wilcoxon, 1949) revealed that copper is more toxic than lead. Lethal concentration for 50% mortality at intervals of 24, 48, 72 and 96 hrs was determined and values for copper were 25, 20, 17.5 and 15 mg/l respectively. Whereas, values for lead were 42, 37, 34 and 29 mg/l respectively. The finding reveal Clarias batrachus is highly sensitive to both metals used for toxicological study, confirming copper being more lethal than lead.

KEY WORDS: *Clarias batrachus*, Copper, Lead, Probit Analysis.

INTRODUCTION

Heavy metals through the food chain are of serious concern in day to day life, since they endanger the health of animals and human beings (Bi et al.2018). Metals like copper (Cu), Zinc (Zn), Iron (Fe), Manganese (Mn), Cobalt (Co) and Nickel (Ni) are essential to living organisms but in traces and can be harmful when in excess (Pelgrom et al., 1994, Li et al.2019). In the same vein these metals become toxic to the aquatic organisms at unusually high concentrations (Wepener et al., 2001, Mulk et al.2017). Some non-essential trace metals like cadmium are major contaminants of the aquatic environment (Munger et al., 1999, Sahodaran and Ray 2018) which is toxic to aquatic organisms even at very low concentrations.

Alterations in the natural aquatic environment through pollutants induce changes in the physiological aspects of the inhabitants, particularly in the freshwater fishes (Shukla et al., 2007; Yoon et al., 2008). The degree of toxicity produced by these (copper, lead, cadmium etc.) toxic substances is dependent upon environmental conditions (Duijn, 1966, Lors et al.2018). Ecosystem is dynamic and complex affected by organic and inorganic toxicant(s), therefore vigilance on continuous basis is essential, even though the reports of heavy metals present is in very low concentration in natural aquatic ecosystems (Nussey, 1998).

The metal, copper is essential in small concentration for several metabolic functions in fishes as it plays an essential role in physiological processes like cellular respiration, free radical defense, neurotransmission etc. Copper has an essential role in metabolic processes occurring in the body (Baker, 1969; Li et al., 1998). At higher concentration in water, *cu* has an adverse effect (Pelgrom et al., 1995). The toxicity of *cu* becomes adverse when its concentration exceeds the limit, which even after detoxification still exists in the body. Lead as one of the naturally occurring heavy metal that could be found in earth's crust, soil, rocks and water. Lead found in water has been resourced from human based activities

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such as: mining, coal burning, smelting, cement manufacturing, batteries, use of gasoline, paint and batteries (Ramesh et al., 2009). Gills are the prime organs affected by the higher concentration of lead, hence induces lipid peroxidation in tissues and causes an irreversible damage to the respiratory organs of fish.

Acute toxicity tests are performed in laboratory using accurate analytical methods laid down by USEPA (1975), OECD (1981) and APHA (1989). The acute toxicity tests of (96 hour) provide a measure of the toxicity to a given test species under specific environmental conditions. They reflect the damage caused by sudden exposure to lethal concentration of contaminants. The studies on the acute effects of pollutants are useful in determining the threshold of response to a particular toxicant and the end point is expressed as lethal concentration, LC_{50}. Probit analysis is considered as valid test to study the toxicity of any chemical and can help in framing the toxicity level of any chemical. The regression equation developed can help in making the correlation between the dependent (mortality) and independent (concentration of chemical) variable.

MATERIAL AND METHODS

Metal Salts and dilutant- Analytical grade: The heavy metal salts viz. copper sulphate, lead acetate were selected for toxicological studies all throughout the experimentation. Water used for experiment was free of chlorine and characteristics of dechlorinated water were examined as per (APHA, 2012). The determined physico-chemical characteristics of water were pH (7.2-7.4), Temperature (24-280 C), Dissolved oxygen (6.9-7.1 mg/L) and Alkalinity (as CaCO3) 160-170 mg/l. Test compounds (copper sulphate and lead acetate) stock solutions and their dilutions were prepared in accordance with the standard guidelines of APHA, 2012 (OECD, 1993).

Test Species: Healthy fish, *Clarias batrachus* weighing about 40-50 gm was collected from natural unpolluted local water bodies, and were examined for any pathological symptoms in the laboratory. These fishes were treated with 1% $KMnO_4$ solution to circumvent any type dermal infection. Tubifex worms and minced goat liver was the food provided once in a day during the morning hours. Healthy fishes were selected, maintained in two separated aquaria one in control and other in treatment group.

Experimental Setup: Toxicity Tests: The tests were carried for maximum 96 hrs with periodic observation at intervals of 24, 48 and 72 hrs. A static bioassay method was adopted to determine the 96 hr LC_{50} (Sprague, 1969). The experiments were carried to expose the fishes for determination of LC_{50} values for selected heavy metal salts viz. copper sulphate and lead acetate for 96 hr duration.

Acute Bioassay: Toxicity evaluation was carried out to find the 24, 48, 72 and 96 hr LC_{50} values of the heavy metal salts, copper sulphate, lead acetate, for Clarias batrachus (Linn.) The toxicity of selected heavy metal salts was unknown to the fishes, so range finding tests were conducted to determine their toxicity. Aqueous solution of each heavy metal salt was added to the glass aquaria of size 105 x 50 x 50 cm. containing about 175 litres of water in the desired range. Then, acclimatized 10 fishes were transferred to the test solution.

Initially, range finding tests were performed for the selected heavy metal salts. Each test with appropriate control was performed in duplicate, using 10 fishes in each test container (APHA, 1989). At the end of the test, the mortality was assessed by visual observation of immobility ascertained by prodding the fish with a glass rod. The dead fishes were removed from the aquarium immediately and the number was recorded up to 96 hr with an interval of every 24

Table 1: LC_{50}, 95% Confidence limits and Slope function values of Copper to Clarias batrachus

Exposure Period (hr.)	Parameter	Value
24	LC_{50} mg/L	25
	95% confidence interval	20.40 – 30.60
	Slope function	y=15.35X – 14.28
	Regression (R^2)	0.979
48	LC_{50} mg/L	20
	95% confidence interval	16.39 – 24.40
	Slope function	y=15.35X – 14.28
	Regression (R^2)	0.979
72	LC_{50} mg/L	17.50
	95% confidence interval	14.30 – 21.35
	Slope function	y=13.21X + 2.857
	Regression (R^2)	0.910
96	LC_{50} mg/L	15
	95% confidence interval	10.59 – 20.50
	Slope function	y=15.35X + 0.00
	Regression (R^2)	0.932

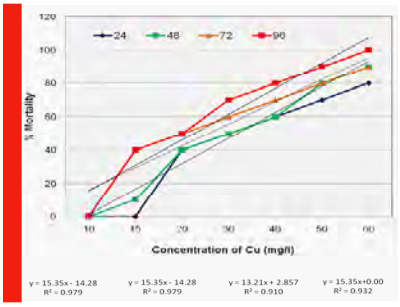

Fig. 1: Showing slope function and regression values for *Clarias batrachus* exposed to copper

hr. Survival of the test fish in control was always recorded to be 100%. The fishes were not fed during the bioassay experiments. The pH of test solution was measured at initial and final stages of 24 hr exposure period.

RESULTS AND DISCUSSION

Acute Toxicity Evaluation

Presently heavy metals are being worldwide incorporated into the aquatic environment via. Industrial processes, mining activities, sewage disposal, soil leaching and rainfall. As compared to other pollutants, a fairly low concentration of heavy metals negatively affects the aquatic life, Such negative effects of heavy metals are attributed to their complex nature (Stebbing and Fandino, 1983). Environmental pollutants like heavy metals are known to interfere with several physiological and biochemical parameters and alter the capacity of fish to perform the vital body functions. A relatively high concentration of the toxics in the water bodies leads to the death of fishes. Such mortality due to the high concentration of toxics was considered as the end point of toxicological studies (Jones and Reynolds, 1997). Whereas, changes in the biological organization of fish was also reported due to the sublethal concentration of the toxics (Adams, 1990).

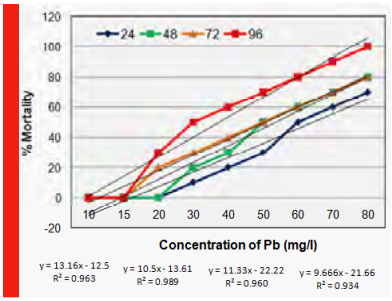

Fig. 2: showing slope function and regression values for Clarias batrachus exposed to lead

Table 2: LC50, 95% Confidence limits and Slope function values of lead to Clarias batrachus

Exposure Period (hr.)	Parameter	Value
24	LC_{50} mg/L	42
	95% confidence interval	33.60 – 52.50
	Slope function	y=13.16x – 12.5
	Regression (R^2)	0.963
48	LC_{50} mg/L	37
	95% confidence interval	29.13 – 46.99
	Slope function	y=10.5x – 13.61
	Regression (R^2)	0.989
72	LC_{50} mg/L	34
	95% confidence interval	26.56 – 43.52
	Slope function	y=11.33x – 22.22
	Regression (R^2)	0.960
96	LC_{50} mg/L	29
	95% confidence interval	21.46 – 39.15
	Slope function	y=9.66x – 21.66
	Regression (R^2)	0.934

Lead contamination occurs through anthropogenic activities, as lead is widely used as an additive in fuels, production of batteries, paints, anti-radiation armour and pesticide formulations (Pacyna, 1984). Lead particles from the atmosphere are brought down to water bodies through rain and also as dry deposits (Gnassia-Barelli and Romeo, 1993). Lead poisoning in fish results in hematological, neuronal, muscular and effect like coagulation of surface mucus (Sorensen, 1991; Haux et al., 1986). LC_{50} value calculation is useful in toxicological investigation of metal. Short duration experiment are highly valuable in order to obtain the information regarding sublethal concentrations and such observations can put forward the events as a response by test animal to sublethal concentrations (Sprague, 1971; Nobbs and Pearu, 1976; Perkin, 1979).

In order to assess the environmental pollution, fish can be used a sentinel, thus its response to sublethal concentrations is of prime importance.In the present investigation, the acute responses obtained from Finney's Probit Analysis of Clarias batrachus revealed 96 hour LC_{50} when exposed to copper sulphate 15 mg/L and lead acetate 29 mg/L. The toxicity tolerance of freshwater Clarias batrachus to copper and lead was dose and duration dependent, it was also observed that mortality enhanced with increase in concentration. LC_{50} values of copper and lead exhibited the susceptibility of catfish to lethal concentrations in acute short term exposure.

Increasing concentrations and exposure time caused the higher percentage mortality of fish. These findings obtained were in congruence with the observations of researchers worked earlier on different species like *Oncorhynchus mykiss*, *Oncorhynchus tshawytscha* and on *Salvelinus confluentus* (Finalayson and Verrue, 1982; Hansen et al., 2002), *Labeo rohita* (Dutta and Kaviraj, 2001), *Poecilia reticulata* (Yilmaz et al., 2004), *Oreochromis niloticus* (Garcia et al., 2006) and *Cyprinus carpio* (Muley et al., 2000; Dardenne et al., 2007),Examined LC_{50} values clearly revealed that the toxic effect has enhanced with increase in dose and duration. These results are also in corroboration with the observation of Yilmaz et al. (2004) who has reported 96 h LC_{50} value of cadmium to guppy (*Poecilia reticulata*). However, other different analysis regarding the same aspect has supported the present observations, as reported by Oryan and Nejatkhan (1997), Woodal et al. (1988) and Muley et al. (2000).

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Paraquat Dichloride Induced Carbohydrate Metabolism Alterations in Fresh Water Teleost Fish *Channa punctatus* (Bloch, 1793) after acute Exposure.

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ABSTRACT

Paraquat dichloride is a broad spectrum herbicide used all around the world. The present study was designed to evaluate effect of herbicide, paraquat dichloride on carbohydrate metabolism of a model animal fresh water teleost fish, Channa punctatus (Bloch 1793). Fish were exposed (96hrs) to paraquat dichloride 32.5 mgL-1 (LC50/2 of 96 hrs) for acute treatment. Blood glucose and tissue (liver, muscle) glycogen were studied after every 24hrs interval up to 96hrs. In the present study, glucose level in blood of Channa punctatus after exposure to paraquat dichloride increased significantly in the experimental group after acute doses. The elevation in level of glucose proceeded as the exposure prolonged. The Pearson's correlation of glucose approached significant as the exposure prolonged during acute treatment. Glycogen level both in muscle and liver of experimental fish was significantly depleted. Pearson's Correlation for glycogen between the studied groups were quite favorable varying from moderate to strong. Increase in glucose level suggests glycogenolysis and supply of energy substrates to most vital organs to cope up with the stress and energy demand. While observed reduction in the glycogen content indicates the utilization of the stored glycogen to meet the high energy demand. Alteration in carbohydrate metabolism in fish due to toxicant can help in sensing the stressful environment.

KEY WORDS: Paraquat Dichloride, *Channa punctatus*, Glucose, Glycogen, Toxicity.

INTRODUCTION

Agriculture crops are damaged by pests, thus are prevented by the use of pesticides. Pesticides have been used in the environment extensively, resulted in contaminating the environment affecting the nontarget organisms also (Tripathi and Shasmal 2011: Kumar et al., 2014). Organochlorines, organophosphates and carbamates are the three main classes of pesticides that pose a serious problem (Dyk and Pletschke, 2011). In order to meet the demand of the growing population, Government of India has promoted the use of insecticides, herbicides and fungicides (Binukumari and Subhisha, 2010). Further occupational exposure to pesticides is an alarming situation, resulting 3 million cases of acute poisoning and 0.22 million deaths annually (Marrs, 1993; USDA, 1994; Yasmashita et al., 1997). Pesticide ultimately reach to water bodies thus effects on non-targeted organisms especially fishes. Pesticides become relatively more toxic (about thousand times) to fish species as compared to that of mammals and birds, when exposed to xenobiotics as they have poor ability to metabolize and eliminate such xenobiotics as compared to those of higher vertebrates (Edwards et al., 1986; Bradbury and Coates 1989).

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Paraquat

Paraquat (PQ) (1, 1'-dimethyl-4, 4'-bipyridinium dichloride), a bi-quaternary broad spectrum herbicide, normally synthesized as dichloride salt (Tsai, 2013; Lock and Wilks, 2010). Paraquat is sprayed on the unwanted weeds before planting the crops. Paraquat is fast acting destroys tissue of green plants once in contact by translocation within the plants. Paraquat is one of the most common herbicide used world-wide. Paraquat exerts its herbicide property by inhibiting the electron chain transfer during photosynthesis I by inhibiting reduction of NADP to NADPH (Donaldson, 2013). Paraquat is commercialized in various forms, like solid, liquid, and granular forms, thus for better herbicide property it has been used in combination with herbicide diquat (Donaldson, 2013). Paraquat

also been used as an alternative to glyphosate resistant weeds (Santos et al., 2013). After spraying, paraquat has high persistence in soil, Half-lives of 16 months (Rao et al., 1980), hence has high chances of being run off to water bodies, Therefore contamination of water bodies is certain (Sidhouma et al., 2013).

Paraquat has been linked to the formation of superoxide anion, singlet oxygen, and hydroxyl and peroxyl radicals, ultimately resulting the death of leading to cell death (Suntres 2002). Various reports of Paraquat poisoning has been reported (Singh et al., 1999; Sandhu et al., 2003; Agarwal et al., 2006). For the present study test organism, Channa punctatus was selected for toxicology assay. *Channa punctatus* is one of the most cultured and edible fish in India. The existing literature revealed that excessive use of paraquat has ended up in water body, hence affecting non targeted organisms particularly fishes. Therefore present study will help in assessing the toxicity of paraquat, using the model animal Channa punctatus. For the present study, fish were exposed to paraquat dichloride for acute treatment. Blood glucose and tissue (liver and muscle) glycogen were studied. These parameters can help and may be used as indicators of stress and health of the organism.

MATERIAL AND METHODS

Experimental fish collection, transport, acclimatization : CP were brought from nearby water bodies of Amravati, Maharashtra, India 20° 56'14.73"N 77046'46.38''E to laboratory. For present study, fish of weight between 27- 39 g and length 14-16 cm were selected and acclimatized for one week in static system as suggested by (Mohapatra, 1989, 1994).

Exposure: After acclimatization, fish were exposed (96hrs) to paraquat dichloride 32.5 mgL-1 (LC_{50}/2 of 96 hrs) for acute treatment. Commercial formulation of PD, (24% SL) with trade name Ozone, manufactured by Dhanuka Agri-tech Limited under Reg.No Cir-6510/87 was used.A control was also maintained with same number of fish (No. = 10) in separate aquarium. At the end of 24, 48, 72, 96 hours live fish were randomly selected from both experimental and control aquaria for glucose and glycogen estimation from blood and tissue respectively. In experimental aquarium negligible mortality was observed during this period.

Collection of blood and serum preparation: Common method venipuncture was used to draw blood from caudal vein (Houston, 1990). Blood collected was centrifuged at 10,000 rpm for almost 20 minutes at 4°C. The serum obtained was used for glucose estimation.

Biochemical analysis: Glucose: Glucose in serum was estimated by Glucose kit by (GOD-POD End point Method) manufactured by Tran Asia Bio Medical Ltd. UP, India under the trade name ERBA, Code No. 120200, M. L. No.: MB/06/347, Lot: BO31701. The serum obtained was followed through Trinder's method for determination of glucose. The principal of method involves action of Glucose oxidase on the sample glucose and is oxidised to gluconic acid and hydrogen peroxide. The reaction is further carried by Peroxidase which catalyzes the oxidative coupling of 4-Aminoantipyrine with phenol to yield a coloured quinoneimine complex. The absorbance read at 505nm of complex formed is proportional to the concentration of glucose in sample Glucose in mg/dl = (OD. Test /

Table 1: Glucose, liver and muscle glycogen level of the control and treated Channa punctatus exposed to acute concentration (32.93 mg/L). Each value is a mean ± SD; n = 3, (+) Denotes percent increase over control. (-) Denotes percent decrease over control. *P < 0.001, **P = 0.001, ***P < 0.01, $P < 0.05.

Biochemical Parameters	Exposure period (hours)	Acute concentration Of Paraquat dichloride (1/2 96 hrLC50 = 32.93 mg/L)		
		Control	Experiment	Percent change
Glucose	24 h	65.89 ± 0.21	83.33 ±1.26$	+26.46
mg/dl	48 h	67.43 ±0.79	85.42 ±0.62*	+26.68
	72 h	72.33 ± 0.91	95.17 0.98*	+31.57
	96 h	74.05 ±0.71	112.84±0.69*	+52.38
Liver Glycogen	24 h	4.73 ±0.15	2.10 ±0.10***	- 55.60
mg/g	48 h	4.38 ± 0.11	1.73 ± 0.15***	- 60.50
	72 h	4.29 ± 0.18	1.40 ± 0.10**	- 67.36
	24 h	4.73 ±0.15	2.10 ±0.10***	- 55.60
Muscle	24 h	1.70± 0.10	1.24 ± 0.03$	- 27.05
Glycogen	48 h	1.55 ± 0.05	1.15 ± 0.30$	- 25.80
mg/g	72 h	1.47 ± 0.02	0.97 ± 0.02**	- 34.01
	96 h	1.45 ± 0.02	0.83 ± 0.02*	- 42.75

OD. Standard) X Concentration of standard mg/dl).

Glycogen: Glycogen from tissues (Liver and muscle) was estimated by following the protocol of Montgomery (1957). In currently used method for the determination of glycogen, tissue was extracted by boiling with 30 % potassium hydroxide solution (KOH). The glycogen was then precipitated by adding alcohol followed by dissolving precipitate in distilled water, later added with alcohol and concentrated Sulphuric acid. Reading was measured at 624nm against blank.

Calculation:-

$$\frac{\text{Reading of unknown}}{\text{Reading of standard}} X \frac{\text{Conc .of standard}}{\text{Tissue taken}} X\ 1000\ X\ \frac{4}{2}$$

Where, Concentration of standard = 0.2

Statistical Analysis

Sample characteristics

The statistical software programme SPPS-20 was used. A Shapiro-Wilk's test (p > 0.05) (Shapiro and Wilk, 1965; Razali and Wah, 2011), Kolmogorov-Smirnov and a visual inspection of their histogram, normal Q-Q plots and box plots for both control and experimental groups were tested with Skewness and a Kurtotic values also calculated (Cramer, 1998; Cramer and Howit, 2004; Doane and Seward, 2011). When the normality conditions were satisfied, student's t-test was employed to determine whether there were significant differences between the control and experiment groups. SPSS provides the value of Pearson's r and the two-tailed significance value. Significance was tested at P value (P ≤ 0.001, P ≤ 0.01 and P ≤ 0.05) and data was presented as mean ± Standard deviation of three individual readings.

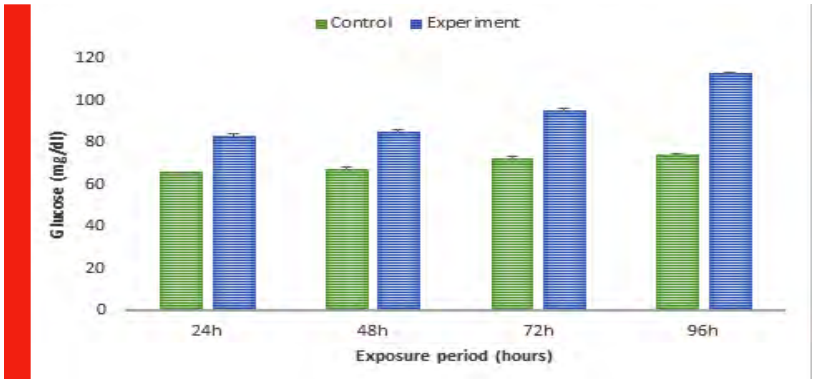
RESULTS

Fish behavior: During the experiment period various behavioural alterations were observed like: respiratory distress, increased rate of gill operculum, hyper-excitability and sometimes loss of equilibrium Biochemical parameters: A Shapiro-Wilk's test (p > 0.05) (Shapiro and Wilk, 1965; Razali and Wah, 2011), Kolmogorov-Smirnov and a visual inspection of the their histogram, normal Q-Q plots and box plots showed the scores were approximately normally distributed for biochemical parameters studied of both control an experimental groups, with a little Skewed and a Kurtotic (Cramer, 1998; Cramer and Howit, 2004; Doane and Seward, 2011), but it does not differ significantly from normality and lies between - 1.96 to + 1.96. Student's t-test showed continuous significant increase in glucose level in experimental group during the exposure time from 24 to 96 hours, while decrease in glycogen level was observed in both the tissues (liver and muscle) in experimental group from 24 to 96 hours when compared with control. The significance was tested at (P ≤ 0.001, P ≤ 0.01 and P ≤ 0.05) change in percentage from that of control is summarized in Table 1.

Each pair, control and experiment from 24h up to 96h of biochemical parameters studied which showed Pearson's correlation among them. Pearson's correlation in case of glucose and liver glycogen was from strong to very strong. While in case of muscle glycogen Pearson's correlation was from weak to very strong. The increased percentage change in case of glucose was from +26.46 to +52.38. Liver glycogen decrease in percentage was from –55.60 to –71.15. In case of muscle glycogen percentage decrease was from –27.05 to –42. 75.

DISCUSSION

Blood is regarded as the pathophysiological reflector of whole body and the hematological, serum biochemical, and immunological screening are important indices to reveal about the internal environment of fish (Luskova et al., 2002). Any alteration in the blood parameters may help in diagnosing the status of fish when exposed to toxicants (Adhikari et al., 2004). Carbohydrates being radiant source for energy liberation during the stressed conditions offer an

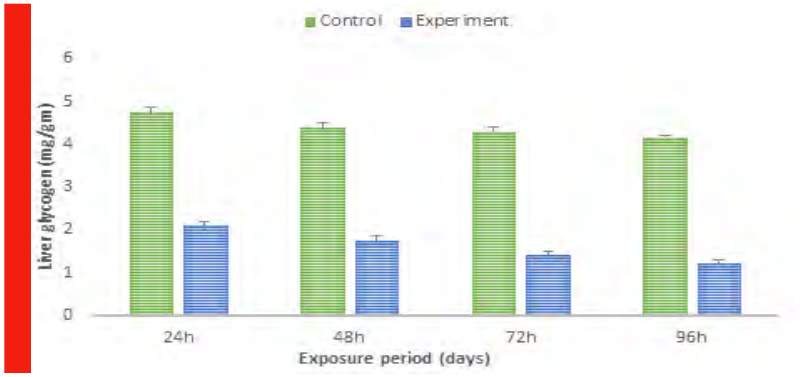


Graph 1: Glucose level of the control and treated *Channa punctatus* exposed to acute treatment (32.93 mg/L). Each value is a mean of three individual readings ± SD; h= hours.

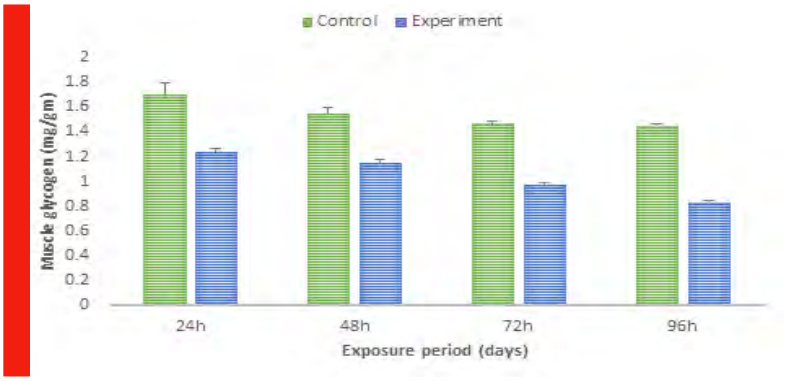
important tool to study alterations in physiology of animals.

In the present study, elevation of blood glucose level and decrease in tissue glycogen level in experimental fish indicating toxicity induced by paraquat. The elevation of glucose and decline in glycogen proceeded with extension of paraquat exposure period. Elevation of glucose in serum of CP in present study shown in (Graph. 1.) may be due to glycogenolysis in order to provide energy for the increased metabolic demand enforced by PD. Increase in glucose level under undesirable conditions is to provide energy substrates to most vital organs to cope up with the stress and energy demand (Banaee et al., 2008; Saha and Kaviraj, 2009). The increase of glucose level in teleost fish is mainly been mediated by the effect of catecholamine's on liver to release glucose (Van Raaji and Van den Thillart, 1995). Stress imparted by paraquat may have stimulated the hypothalamo-pituitary interrenal axis, which lead to elevation of cortisol and possibly is associated with change in liver metabolism causing activation of liver glycogenolysis, and gluconeogenesis to provide energy under stressed conditions (Sheridan, 1986; Soengas et al., 1996). Similar information of increase in plasma glucose level in teleost fish *Cyprinus carpio* during acute and chronic exposure to lindane has been reported by Saravanan et al., (2011). Serum glucose level of *Cyprinus carpio* increased significantly by Cr and Ni exposure (Canli, 1995). Congruence elevation of glucose level in *Mystus vittatus* following acute exposure to pesticides thiotox, dichlorvos and carbofuran was observed by Dalela et al., (1981) and reason suggested was disrupted carbohydrate metabolism mediated by adrenocorticotropic hormone, glucagon, thus enhancing liver glycogen breakdown.

Glycogen is the main reserve of energy source for animals and its utilization or formation is normal process. During unfavorable condition glycogen content in muscle or liver alters thus its content in liver or muscle can give indices of fish when exposed to chemical substance. In the present investigation glycogen level both in muscle (Graph. 2.) and in liver (Graph. 3.) of experimental fish was significantly depleted. The observed reduction in the glycogen content indicates the utilization of the stored glycogen to meet the high energy demand (Dange, 1986) due to the stress induced by the paraquat dichloride. While demand of high energy may also be



Graph 2: Liver glycogen level of the control and treated *Channa punctatus* exposed to acute treatment (32.93 mg/L). Each value is a mean of three individual readings ± SD; h= hours



Graph 3: Muscle glycogen level of the control and treated *Channa punctatus* exposed to acute treatment (32.93 mg/L). Each value is a mean of three individual readings ± SD; h= hours

to synthesize the detoxifying enzymes (Begum and Vijayaraghavan, 1995; Hori et al., 2006).

In liver, glycogen was mobilized to glucose and provided to extra hepatic cells, however muscle glycogen was readily made available for muscle cells to meet the demand of energy. Significant Depletion of glycogen in liver can also be judged by increase in blood glucose level indicating catabolism of glycogen. Similar findings of depletion of glycogen content in *Clarias batrachus* was reported by Begum and Vijayaraghavan, (1995); Begum and Vijayaraghavan, (1999) when exposed to dimethoate and roger respectively. Glycogen depletion in liver and muscle of Mystus cavasius was found when exposed to electroplating industrial effluent (Palanisamy et al., 2011). Saravanan et al., (2011) reported depletion of glycogen in liver and muscle in *Cyprinus carpio* (Actinopterygii: Cypriniformes) during acute and chronic exposure to lindane. Congruence depletion of glycogen in Channa punctatus was reported by Maruthi and Subba Rao, (2000) exposed to distillery effluent. Similar views were about depletion of glycogen in channa punctatus were held by Srivastava and Srivastava (2008) when exposed to sublethal concentrations of ZnSO4.

CONCLUSION

The biochemical parameters measured in blood and in tissue in the present study during acute treatment revealed paraquat does alter their level either in blood or in tissue. Exposure of paraquat during acute treatment induces significant alteration of both studied parameters. The fish glucose level was elevated in order to meet the energy demand, while as depletion of glycogen in both muscle and liver are the indication of stress as conversion to glucose was need of hour. Still understanding the other biochemical parameters may be helpful in better understanding the paraquat induced toxicity. Alteration in carbohydrate metabolism can be used as tool to study the stress induced by any toxicant. The findings suggest that appropriate use of PD should be there in agriculture fields surrounding water bodies or in water bodies for eradication of weeds.

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Diversity of Rotifers from Washim Region of Vidarbha, Maharashtra, India

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ABSTRACT

Rotifers are a group of zooplanktons which mainly reside in fresh water habitats in the aquatic ecosystem. Due to the presence of crown of cilia surrounding the mouth, they are commonly called as "wheel animalcules". They are an important part of live supplementary feed for fishes. They can also be regarded as water quality indicators. The changing climatic conditions due to the Global Warming may also be responsible for changing diversity of rotifers species. The present research was carried out in the Washim district, Maharashtra during a period of five months from August to December 2018 for analysing the diversity of rotifers along with their ecological role. Samples were collected from four different water bodies viz. Padmatirtha Talav, Dev Talav, Narayan Baba Talav and Adol Dam and the analysis of the samples revealed a total of 19 different species of rotifers belonging to 2 orders (Ploima and Floscullariaceae) and 6 families (Brachionidae, Trochosphaeridae, Tricocercidae, Lepadellidae, Asplanchnidae, Synchaetidae). Brachionidae family was dominant followed by Trochosphaeridae.

KEY WORDS: Diversity, Rotifer, Washim

INTRODUCTION

The diverse collections of organisms that reside in large water bodies and which are unable to swim against the water current are called as planktons. They provide an important source of food to many aquatic organisms like fishes. Planktons include algae, bacteria, protozoa, zooplanktons etc. Rotifers are a group of zooplanktons and 90% of the rotifer species inhabits in freshwater habitats. They feed mainly on microscopic organisms like algae, bacteria and protists etc. They seldom reach 2mm in body length. They are broad, flattened or spherical in shape.It shows distinct sexual dimorphism. Females are fully developed and large sized while the males are small sized and consists of well-developed reproductive system. The rotifers are commonly called as "wheel animalcules" because of the crown of cilia which surrounds the mouth. The body is divisible into head, trunk, tail or foot. The crown of the cilia at the anterior end is called the corona. The corona is surrounded by a double ciliated ring, and the outer ciliary band and inner ciliary band. Ciliary movements help in feeding and respiration. The trunk of the rotifer is cylindrical or flattened. It is enclosed in a transparent and flexible lorica, Dhanpati, (2000). At the end of the trunk, a single or paired dorsal antennae is present. A lateral antenna is present on the posterior end of the trunk. The mid-dorsal anus is located at the union of the trunk and tail. The tail of the rotifer also called as the foot is covered by cuticular rings. The foot of rotifer ends in one to four movable toes containing pedal glands. The pedal glands of rotifers secret an adhesive which is used to attach the animal.Corona: It is the most striking feature of rotifers, the corona or wheel organ, and is important for food collection and locomotion. In the middle of the buccal area lies the mouth, which is surrounded by small ciliated portion. The corona may have trochus and cingulum which are the anterior and posterior lines of cilia. The variation in the structure of corona is useful in the classification of rotifers, Tayade and Dabhade, (2011).

Lorica: Many rotifers have a thin and flexible cuticle throughout the body. Many other rotifers have stiffened cuticle in some places which is called as Lorica, Tayade and Dabhade(2011).Devi and Kumar

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(2014) analysed the rotifer community of Kullurchand reservoir from the period between May 2007 to April 2008 with respect to physico-chemical parameters. They identified 40 species of rotifers with various categories such eurythermal, stenothermal, alkalophilic and eutrophic indicators. Kabra et al. (2016) studied the quantitative analysis of zooplanktons of freshwater ecosystem in Washim town. The research revealed a total of 29 species of zooplankton, of which 9, 9, 10 and 1 species belonged to rotifer, cladocera, copepod and ostracod respectively.

Solanke and Dabhade (2016) investigated the rotifer communities in the Upper Morna Reservoir, Malegaon taluka of District Washim. The study was conducted during the year 2012 and 2013 which revealed a total of 18 species of rotifer. Dagneet al. (2008) studied the special composition, spatial distribution and abundance of rotifer and crustacean zooplankton in Lake Ziway from late April to early July 2004. 49 species of rotifer were recorded.Shayestehfaret al.(2008)investigated the effects of physico-chemical parameters on surface water density of rotifers.Between the population density of rotifera and the water current as well as between the water temperature and the population density, an inverse relationship was observed in all the sampling stations throughout their study period. Ekhandeetal.(2013) analysed the seasonal variation of rotifers and their correlation with physiochemical parameters of Yashwant Lake, Toranmal (M.S.), India. This study of seasonal variation of rotifers density and species richness presented that the density of rotifers was maximum in summer and was minimum in post-monsoon. Species richness of rotifers was maximum in summer while it was minimum in winter. Shrivastavaet al.(2015) investigated the rotifers in Dhanras fly discharge water pond in Korba district, Chhattisgarh. The water pond was dominated by Philodina sp. while the least abundant one was the Prolinopsis sp.

Rotifers feed on the phytoplanktons, which are the primary producers in aquatic ecosystem, and fishes or another higher organism's feed on them. In this way rotifers play an important role in the nutrient cycle in an aquatic ecosystem. The zooplankton can also play an important role in indicating the presence or absence of certain species of fishes or in determining their population densities, Pawar et al. (2003). Higher aquatic organisms eat certain zooplanktons and any harmful or stressful change in the density of these zooplanktons directly affects the quantity of fishes in that water body. They are an important component of aquatic ecosystem as they participate in natural purification of water and mainly act as primary consumers. Rotifers are very important source of natural


Padmatirtha Talav


Dev Talav


Narayan Baba Talav


Adol Dam

Photo-plate I: Natural photographs of the locations in Washim District


Brachionus angularis


Brachionus caudatus


Brachionus caudatus

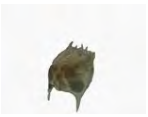

Brachionus calyciflorus with eggs


Brachionus diversicornis


Brachionus diversicornis


Brachionus falcatus with egg


Brachionus forficula


Brachionus patulus


Keratella valga tropica


Keratella tropicana


Keratella cochlearis


Trichocerca rousseleti


Lepadella ovalis


Asplanchna priodonta


Filinia longiseta


Filinia opoliensis


Filinia terminalis


Polyarthra minor

Photo-plate II: Microscopic photography of different Rotifers

Table 1: Taxonomic summery of rotifers

Sr.no	Phylum	Class	Order	Family	Genus	Species
1.	Rotifera	Eurotatoria	Ploima	Brachionidae	Brachionus	*B. angularis*
2.	Rotifera	Eurotatoria	Ploima	Brachionidae	Brachionus	*B. caudatus*
3.	Rotifera	Eurotatoria	Ploima	Brachionidae	Brachionus	*B. calyciflorus var. hymani*
4.	Rotifera	Eurotatoria	Ploima	Brachionidae	Brachionus	*B. calyciflorus*
5.	Rotifera	Eurotatoria	Ploima	Brachionidae	Brachionus	*B. diversicornis*
6.	Rotifera	Eurotatoria	Ploima	Brachionidae	Brachionus	*B. durgae*
7.	Rotifera	Eurotatoria	Ploima	Brachionidae	Brachionus	*B. falcatus*
8.	Rotifera	Eurotatoria	Ploima	Brachionidae	Brachionus	*B. forficula*
9.	Rotifera	Eurotatoria	Ploima	Brachionidae	Brachionus	*B. patulus*
10.	Rotifera	Eurotatoria	Ploima	Brachionidae	Keratella	*K. valga tropica*
11.	Rotifera	Eurotatoria	Ploima	Brachionidae	Keratella	*K. tropicana*
12.	Rotifera	Eurotatoria	Ploima	Brachionidae	Keratella	*K. cochlearis*
13.	Rotifera	Eurotatoria	Ploima	Lepadellidae	Lepadella	*L. ovalis*
14.	Rotifera	Eurotatoria	Ploima	Asplanchnidae	Asplanchna	*A. priodonta*
15.	Rotifera	Eurotatoria	Ploima	Synchaetidae	Polyarthra	*P. minor*
16.	Rotifera	Eurotatoria	Ploima	Trichocercidae	Trichocerca	*T. rousseleti*
17.	Rotifera	Eurotatoria	Floscullariaceae	Trochosphaeridae	Filinia	*F. longiseta*
18.	Rotifera	Eurotatoria	Floscullariaceae	Trochosphaeridae	Filinia	*F. opoliensis*
19.	Rotifera	Eurotatoria	Floscullariaceae	Trochosphaeridae	Filinia	*F. terminalis*

food for larvae of many aquaculture species. In semi-intensive systems, which are the dominant type of carp production, many fish species feed on both zooplankton and zoo-benthos as adults, while larvae and fry rely mostly on zooplankton. It provides them with high quality nutrients and other molecules such as proteolytic enzymes, hormones and growth factors, which support digestive processes in immature larval gut, Grubisic et al.(2012). The water bodies around Washim region could be checked for the presence of diversity of rotifers as it gives vital data which can be used for water assessment as well as for checking whether fish culture is suitable in that water body and for earning maximum yields of fishes. The present study was carried out to analyse the diversity of rotifer species and their ecological role in various fresh water bodies of Washim region.

MATERIAL AND METHODS

Following sites in the Washim district were studied for the qualitative analysis of rotifers. The sites included were Padmatirtha Talav, Dev Talav, Narayan Baba Talav, Adol Dam.

For the qualitative estimation of zooplankton, a proper collection method was necessary. For this purpose, standard methods given by Clesceriet al.(1998, 2006, 2008) in APHA were referred. The zooplankton collection primarily involves the filtration by net, collecting the water in bottles. The sampling collection largely depends upon the selection of a suitable gear, mesh size of netting material, time of collection, water depth of the study area and sampling strategy.Sample collection was conducted during the morning time due to the diel vertical migration of the zooplanktons. Net with a mesh size of 25µ was used for sample collection. The samples were preserved with few drops of 4% formalin and few drops of glycerine along with pinch of detergent for preservation, Dabhade (2006). The samples were studied and photography was done using the Coslab Inverted Microscope.

RESULTS AND DISCUSSION

The species were identified using various identification keys, like Dhanpati (2000),Edmondson (1959),Tayade (2011) and Solanke (2016), while websites, www.nies.go.jp, rotifera.hausdernatur.at, cfb.unh.edu were also used. The present study was conducted on 4 sites in the Washim district of Maharashtra, India namely Padmatirtha talav, Dev talav, Narayan Baba Talav and Adol Dam. These sites were studied for the diversity of rotifer species. The research was conducted during the period of 5 months namely, August to December of the year 2018 which revealed a total of 19 different species belonging to 2 orders and 6 families. Brachionidae family was found to be the dominant one followed by Trochosphaeridaefrom the analysis of samples. The Brachionidae family was also dominant in the research of Solanke and Dabhade (2016) in the Upper Morna reservoir, Medshi of taluka Malegaon,

district Washim, Maharashtra. The detail classification of the rotifer species is mentioned in Table I.Keratella valga tropica and Keratella tropicana were the most dominant species in all the sites while the Genus Brachionus was dominant in all locations.Tijare and Thosar (2008) also recorded that the Brachionus and Keratella species were dominant in the three lakes of Gadchiroli district.

The species that were identified in this research was also found in the researches of Tayade and Dabhade (2011, 2015) their research was conducted in the district of Washim, Maharashtra, and a total of 100 taxa (97 species) of rotifers were found in the year 2011 while 52 taxa (49 species) of rotifers belonging to 14 families and 22 genera were found in the year 2015 from the ephemeral ponds around Washim district. Kabra et al.(2016) research on the quantitative analysis of zooplanktons of the freshwater ecosystem of Washim district revealed a total of 29 species, out of which, 9 belonged to rotifer group, the data indicated the biodiversity pattern of the zooplankton groups as rotifers>cladocera>copepod>ostraco d. Wanjari (2016) investigated the limnology of Kurala dam of district Washim, Maharashtra and his study revealed 26 zooplanktons out of which 11 belonged to rotifers, Brachionus was found to be the dominant species. Mankar et al.(2015) studied the diversity of rotifers in Sonala Dam, Washim, Maharashtra and identified 16 rotifer species similar to the present study.

CONCLUSION

The present study reveals the diversity of the rotifer species in the Washim region. The study from four sites revealed a total of 19 rotifer species dominated by Brachionidae family followed by Trochosphaeridae. The abundance of rotifer species indicates the trophic status of the water bodies. The rotifers have a vast potential of reproduction as they utilize the nutrients from food more rapidly, thus play an important role in the maintaining of the ecological balance.

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Diversity of Dipteran Flies in Government Vidarbha Institute of Science and Humanities Campus, Amravati

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ABSTRACT

In present study 15 species of dipteran flies were collected from different habitats and localities of GVISH campus, Amravati. Total 15 species belonging to 8 families, having 8 genera. From all species, 4 species belonging to family Sarcophagidae, 2 of Calliphoridae, 1 of Anthomyiidae, 2 of Dolicodidae, 1 of Tachinidae, 1 of Culicidae, 1 of Syrphidae and 1 of Muscidae and remaining 2 are unidentified. Some of them are reported as pollinators and it is well adapted in climatic condition Amravati region.

KEY WORDS: Diversity, dipteran flies

INTRODUCTION

Diptera is an order of insects commonly referred to as true flies. Diptera stands for two-winged insects (di = two; ptera= wings), because the first pair of wings is primarily used for flying and the second pair is modified to form a small, club-shaped structure called halteres which aids in flight. Also flies have a mobile head, with a pair of large compound eyes, and mouthparts designed for piercing and sucking (mosquitoes, black flies, and robber flies),or for lapping and sucking in other groups.Flies undergo complete metamorphosis; the eggs are laid on the larval food source and the larvae, which lack true limbs, develop in protected environment, often inside their food source. The pupa is a tough capsule from which the adult emerges when ready to do so; flies mostly have short lives as adult. Diptera is one of the three largest and diverse insect orders in terms of species richness, habitat exploitation, and life habits (Skevington and Dang 2002; Samyank et al., 2008; Courtney et al., 2009), representing about 10% of world's biodiversity (Brown 2005). It is one of the most important in terms of its interaction with humans - especially in terms of spreading diseases and causing agricultural losses (Courtney et al., 2009; Pape 2009; Marshall 2012). The benefits that Diptera provide to the ecosystem are significant although less understood). Dhamorikar (2017) studied on dipteran flies from Mumbai metropolitian region and recorded 50 families.

Flies contribute to pollination of plants, biological control of pest insects, help in degradation of dung, carrion, and other organic matter (Skevington and Dang 2002; Marshall 2012). They are also of crucial importance in forensic sciences (Singh and Bharti 2000). Several authors (Pape 2009; Ghorpade 2011; Marshall 2012) have emphasised on the study of this diverse group of insects, not only for their impact on humans, but also for their role in ecosystem function. Flies are highly adaptive insects and their larvae develop successfully in a very wide range of media. Most larvae of Diptera are scavengers and contribute to the decomposition of organic material, which in turn, provides nutrients for plants and support for healthy ecosystems and clean environments. Their diverse feeding habits too have insightful impact on ecosystems and the Earth as a whole. They provide varied ecosystem services, (Dhamorikar 2017).

The first pioneering work on the study of Diptera in India was undertaken by Brunetti (1912, 1920, 1923) and White et al., (1940). Contributions from the Zoological Survey of India (ZSI) and other

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institutions have led to a better understanding of the diversity of this order across the country (Ghorpade, 2011). Saha et al., (2012) and Sharma (2012a, b) have created a checklist of Diptera of the state of Maharashtra as a part of the State Fauna Series. Very little study was carried from Amravati region. Keeping in view, an attempt was made to study the diversity of Dipteran flies in G.V.I.S.H. campus and different nearby localities from Amravati region.

Fig. 1: Insect Collecting Net

Fig. 2: Specimen Bottles

Fig. 7: ***Sarcophaga crassipalpis***

2.Sarcophaga crassipalpis Macq.1839 (Fig. 7)

Order - Diptera
Family - Sarcophagidae
Genus - Sarcophaga
Species - crassipalpis

3.Sarcophaga spp.1 (Fig. 8)

Order - Diptera
Family - Sarcophagidae
Genus - Sarcophaga spp

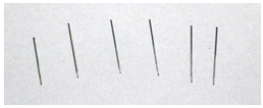


Fig. 3: Insect pins

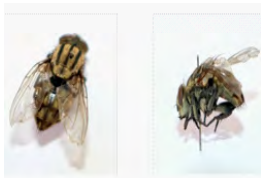
Fig. 4: Forecep

Fig. 5: Insect Storage Box

Fig. 6: Insect Storage Box

1.Sarcophaga africa Wied. 1824 (Fig. 6)

Order - Diptera
Family - Sarcophagidae
Genus - *Sarcophaga*
Species - *africa*



4.Sarcophaga spp.2 (Fig. 9)

Order - Diptera
Family - Sarcophagidae
Genus - Sarcophaga spp

MATERIAL AND METHODS

Material and methods is very much essential component in research. Material facilitates for technical hold and methods help for getting better results (Plate-I, fig. 1-5).Material required for research are Insect Collecting Net, Plastic containers, Specimen bottles, Insect Spreading board, Oven, Insect storage box, Hand lens, Camera, Entomological pins, Card sheet paper, Chemicals. The study was mainly undertaken using visual surveys at mostly morning session between 8 to 10 a.m. and in the afternoon from 3 to 5 p.m. The survey collection was chiefly undertaken in different vegetation areas of G.V.I.S.H campus Amravati. The study was conducted during months of August 2017 to March 2018.

Collection: Flies were collected mostly in gardens were mostly vegetation occurs, residential area, also in garbage dump sites, also on dead and decaying matter of animals or plants. Flies species were collected by sweeping net on flowers of plants were flies are visited.

Photography: Flies were photographed and notes were taken on their habits and the habitats they occupied. All the areas of G.V.I.S.H (college) campus visited at least three times.

Flies were photographed through various angles to obtain morphological details such as wing venation, head and leg features, and their habitat. Specimens were sampled under this study, although dead specimens were considered as present in the area.

RESULTS AND DISCUSSION

In Order Diptera 130 families are included which contains around 1,50,000 species. During present work 15 species of Dipteran flies

Table 1: Flies recorded in present work

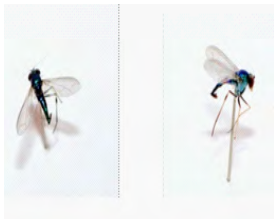
Sr. No.	Family	Species
1.	Sarcophagidae	a.Sarcophaga Africa
		b.Sarcophaga crassipalpis
		c.Sarcophaga spp 1
		d.Sarcophaga spp 2
2.	Calliphoridae	*a.Callphora vomitoria*
		b.Pollenia rudis
3.	Anthomyoidae	*a.Anthomyia illacata*
4.	Dolicodidae	*a.Condylostylus longicornis*
b.	Condylostylus spp	
5.	Tachinidae	*a.Anaeogmena stritalis*
6.	Culicidae	*a.Culex quinquefasciatus*
7.	Muscidae	*a.Musca domestica*
8.	Syrphidae	*a.Unknown (hover fly)*

5.*Calliphora vomitoria* Linn. 1758 (Fig. 10)

Order - Diptera
Family - Calliphoridae
Genus - Calliphora
Species - vomitoria

7. *Anthomyia illocata* Walk. 1856 (Fig. 12)

Order - Diptera
Family - Anthomyiidae
Genus - Anthomyia
Species - illocata



9.*Condylostylus spp*. (Fig. 14)

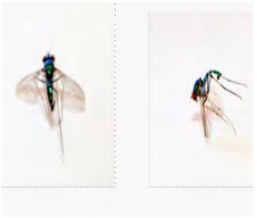
Order - Diptera
Family - Dolichopodidae
Genus - Condylostylus spp

11.Culex quinquefasciatus Say, 1823(Fig. 16)

Order - *Diptera*
Family - *Culicidae*
Genus - *Culex*
Species- *quinquefasciatus*

6. *Pollenia rudis* Fab. 1794 (Fig. 11)

Order - Diptera
Family - Calliphoridae
Genus - Pollenia
Species - rudis



8. *Condylostylus longicornis* Walk.1849 (Fig. 13)

Order - Diptera
Family - Dolichopodidae
Genus - Condylostylus
Species- longicornis

10.*Anaeogmena stritalis* Des. & Bhoj., 2017(Fig. 15)

Order - Diptera
Family - Dolichopodidae
Genus - Anaeogmena
Species- stritalis

12.Musca domestica Linn. 1758 (Fig. 17)

Order - *Diptera*
Family - *Muscidae*
Genus - *Musca*
Species- *domestica*

1.Unknown (Hover fly) (Fig. 18)

Order - Diptera
Family - Syrphidae

Fig. 19: Unknown- 1

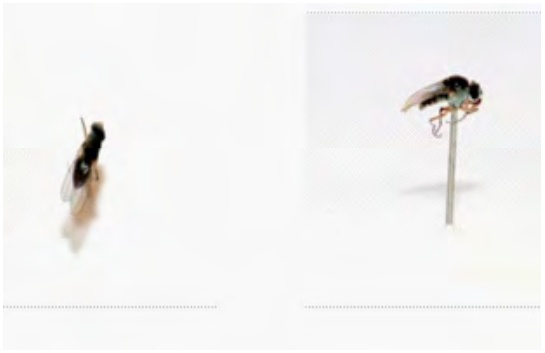


Fig. 20: Unknown- 2

were collected. These flies are belonging to following families: Sarcophagidae, Calliphoridae, Anthomyoidae, Dolicodidae, Tachinidae, Culicidae, Muscidae, Syrphidae, etc.

Length- 16 mm. S. africa is known to cause myiasis in humans and livestock. The species is useful in forensic entomology due to this quality. S. africa is coprophagus, lays eggs in faeces, and possibly cultured from human and animal faeces.

Length- 13 mm. It is a frequent laboratory animal used in the study of gene expression and the study of diapause in insects. This fly conforms to the basic bilateral symmetry body plan for arthropods and insects by sclerotized external cuticle, possessing jointed-appendages and an internal muscular system that functions as levers for movement.

Length- 17 mm. Body of fly with yellow color, long setae last segment of abdomen. Abdomen is enlarged. Transparent wings with long in length. Vibrissae crossed.

Length- 15mm. Body of fly with yellow color and abdomen is enlarged. Eyes brown in color, plumose type of antannae. Labile palps are observed.

This fly is 10–14 mm long, slightly larger than a housefly. The head and thorax are dull gray, the back of head has extended yellow-orange setae and the abdomen is clear metallic blue with

black markings. Its body and legs are covered with black bristle-like hair. Bluebottle fly adults nourish on nectar and they are good pollinators of flowers.

Size- 09-12mm length. Pollenia rudis, is the common cluster fly, also known as the attic fly. Body shows dark gray with checkered black and silvery-black abdomens. Yellow frons. Head with aristate antennae. Earthworms are a chief source of food for Pollenia rudis.

Body is 0.8- 15 mm in length. Anthomyia is diverse genus of fly in the family Anthomyiidae. They look like little houseflies, but normally have conspicuous black-and-white patterning.

Size 0.5-1.5 cm. Abdomen elongated, tapering. Wings transparent. Body with shiny metallic bluish in colour. Antennae long. Legs yellow white.

Size 0.5-1.5 cm. Abdomen elongated, tapering. Wings transparent. Body with shiny metallic -green in colour. Antennae long. Legs yellow white.

Size 15-25 mm. Wings with black opaque stips. Abdomen black white. Antennae small, setaceous. Last two abdominal segments totally black in color. Eyes fused. Good biocontrol agents.

Size 14-18mm. Wings transparent. Abdomen segments with black faint yellow colour. Antennae small, plumose. Last abdominal segments bend. Well known as vectors for carrying many serious diseases to human.

Size 12-17mm. Wings with black opaque strips. Abdomen black yellow. Antennae very small, setaceous. Wing transparent. Eyes brown. Well known for being a household nuisance.

Size 18 mm. Wings transparent. Abdomen dorsoventrally compressed at last 2 segments. Antennae with silver color. Last two abdominal segments black in color and remaining with yellow color. Ventrally yellow pollinoisity present.

Size 8 mm. Wings transparent. Body completely black. Legs light yellow in color. Eyes dark brown. Abdomen small, rounded.

Size 10 mm. Wings transparent, overlapped. Body completely blackish-brown. Legs yellow in color. Eyes dark brown. Abdomen small, elongated with white colorant ventral side. The diversity of insects may be because of variety of flora and intricate ecological conditions, rainfall pattern and temperature (More and Nikam, 2016). Dhamorikar (2017) studied on dipteran flies from Mumbai metropolitian region and recorded 50 families. Ahmed et al., (2005) studied diversity, abundance and seasonal occurrence of biting flies from Southern Nigeria. Mitra et al., (2015) studied diversity true flies from Himachal Pradesh and reported 503 species from 44 families. Mitra, B. (2010) studied diversity of flower visiting flies in India and their role in pollination. He studied 116 species from 16 families.

Haematophagous dipterans belonging to 4 genera were studied by Roche (1949) and Dipeolu (1977) from Nigeria. In their studies 15 blood sucking fly species of genus Stomoxys were abundant and 8 species of Tabanus were recorded. Povolny and Verves, (1997) recorded 15 species of flesh flies in central Europe.

In the present study 15 species of dipteran flies were collected from different habitats and localities of GVISH campus. Total 15 species belonging to 8 families, having 8 genera. From all species, 4 species belonging to family Sarcophagidae, 2 of Calliphoridae, 1 of Anthomyiidae, 2 of Dolicodidae, 1 of Tachinidae, 1 of Culicidae, 1 of Syrphidae and 1 of Muscidae and remaining 2 are unidentified. Some of them are reported as pollinators and it is well adapted in climatic condition Amravati region.

CONCLUSION

From above studies it is concluded that, family Sarcophagidae was observed abundant in number as compared to other families. Increased number of family Sarcophagidae was only due to favorable environment, availability of food and good climatic condition.

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Studies on Application of Disinfectant for Prevention of Diseases in Tasar Silkworm, *Antheraea myllitta* D. (Lepidoptera: Saturniidae)

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ABSTRACT

The rearing of tasar silkworm is outdoor activity; therefore mortality is tremendous due to parasites, predators, nature's vagaries and diseases. To prevent the occurrence of diseases leading to larval mortality; various surface disinfectants and leaf surface micro flora (LSM) were used. Pathogenic mortality is dominant in A. myllita and most of the larvae were affected by viral or bacterial infection. When disinfectants were used by adopted farmers, less mortality is observed at rearing site of adopted farmers as compared to control rearers. Among the biotic factors viral infection was most common and loss due to viral infection was around 30-40% followed by bacterial infection leading to 20-25% mortality. When disinfectants were used by adopted farmers, less mortality is observed at rearing site of adopted farmer. To check the mortality, disinfectants after testing in the laboratory were given to adopted farmers to analyze their effect on total gain in cocoons. It was found that total mortality was reduced. When larval mortality at traditional farmer with adopted farmer was compared it was found that in case of adopted farmers mortality was reduced.

KEY WORDS: *Antheraea Myllitta*, Disinfectant, Dhivar, LSM

INTRODUCTION

Tasar silk worm rearing is forest based industry & best suited to the economy and social structure. It provides regular income and self-employment to small farm holders and tribal's. Sericulture is adjudged as one of the main activities for rural development. The silk worms producing silk belong to family, Bombycidae and Saturniidae of the order Lepidoptera. These commercial silk worms are divided into two categories i.e. mulberry and non mulberry. Antheraea mylitta is a wild silkworm and it is distributed wildly with regard to varied environmental conditions (Jolly et al.,1968; Sengupta, A.K., Sinha A.k. and Sengupta K. (1993.); Singh and Srivastava, 1997).

In Maharashtra, tasar sericulture is limited to Gadchiroli, Chandrapur, Bhandara and Gondia districts. (Yadav,et al.,1997;Mathur, et al.,2000). T. tomentosa and T. arjuna are the primary host plants found in considerably large area in the natural forests of these districts. Mainly Dhivar community in these areas practiced tasar silkworm rearing. The rearing of tasar silkworm is outdoor activity; therefore mortality is tremendous due to parasites, predators, nature's vagaries and diseases. Arjun and Asan are the common food plants of tasar silkworm found naturally in the districts of Vidarbha. Among the biotic factors viral infection was most common and loss due to viral infection was around 30-40% followed by bacterial infection leading to 20-25% mortality. Tasar silkworm is holometabolous insect pass through the four stages of development: Egg- Larva- Pupa and Adult.Though, modern techniques are available the overall returns from the tasar culture, at times become quite discouraging mainly due to incidences of diseases like bacterial, viral, protozoan and fungal , pest & predators. Silkworms suffer heavily due to predators and occurrence of diseases. Total loss due to diseases reaches to around 50-70% (FAO, 1987; Dandin, 2005).

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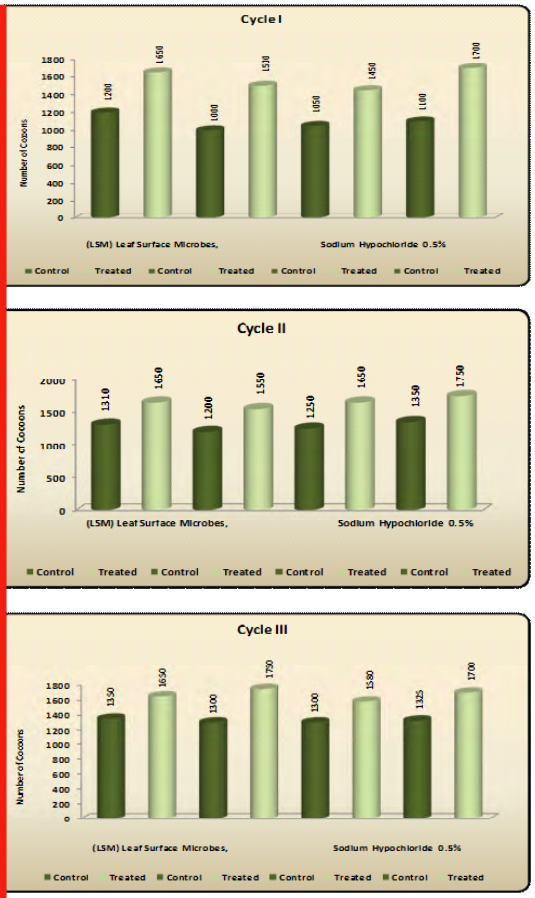

Graph A, B, C: Economic recovery using disinfectants at experimental sites during 2012-13.

In the present study incidences of diseases of tasar silkworm were studied during year 2012-2013.To prevent the occurrence of diseases leading to larval mortality; various surface disinfectants and leaf surface micro flora were used.

MATERIAL AND METHODS

To study the effect of disinfectants on the diseases in the fields, two farmers were selected from Nishti site in Bhandara district as adapted farmers and control farmers (traditional rearing). The farmers selected from Devalgaon site in Gadchiroli -District, Taluka-Aarmori, adopted for rearing, and for control (traditional rearing). Disinfectants tested in laboratory and in the fields of *T. tomentosa & T.arjuna* at CSBR were distributed to adapted farmers. Economic improvement using surface disinfectant, Sodium hypochlorite (0.5%) and leaf surface microbes (LSM) containing *Bacillus lateroporus* and *Bacillus sphaericus* produce natural antibiotic to protect against harmful microorganisms. Equal numbers of dfl's were distributed to the farmers for control and treated groups. The harvested normal and flimsy cocoons were sold and the amount received was compared to that of untreated (control) harvest. At all the experimental rearing sites the profit with the use of Sodium hypochlorite and LSM was observed and analyzed.

To prevent the occurrence of diseases leading to larval mortality, various surface disinfectants and leaf surface micro flora were used are: Sodium Hypochlorite (0.5%) Sodium Hypochlorite about 2.5 ml/1L water was sprayed in the morning on the leaves after first moult and repeated after every moult.

L.S.M.: Leaf Surface Microbes LSM prepared using bacteria selected for strong antagonistic action, such as *B. laterosporus* and

Table 1a: Economic recovery using disinfectants at experimental sites during 2012-13

Group	Control/ Treated	Number of larvae used	Cocoons	Amount (Rs)	Cocoons	Amount (Rs) Cocoons	Total no. of (Rs)	Total Amount (Rs)	Improvement over Control
			Good Number		Flimsy Number		Total Number		
A. Leaf Surface Microbes (LSM)	Control	5000	1000	850	200	20	1200	870	
	Treated	5000	1350	1147.5	300	30	1650	1177.5	307.5
	Control	5000	900	765	100	10	1000	775	
	Treated	5000	1350	1147.5	150	15	1500	1162.5	387.5
B. Sodium hypochlorite 0.5%	Control	5000	900	765	150	15	1050	780	
	Treated	5000	1250	1062.5	200	20	1450	1082.5	302.5
	Control	5000	900	765	200	20	1100	785	
	Treated	5000	1550	1317.5	150	15	1700	1332.5	547.5

B. sphaericus. LSM ampoule was mixed with freshly prepared soil water. The soil water prepared using soil collected from rearing field, 6-8" below soil surface approximately 5-10 kg. Mixed thoroughly in a bucket of water and allowed to settle down the soil particles. About 5 ml LSM mixed in 1 liter of water sprayed twice on the larvae and the leaves of food plants throughout the rearing period. Spraying was done after first and second moult.

RESULTS AND DISCUSSION

Environmental fluctuations also affect host plant development and nutrition. Due to poor nutritional values of host plants, larval growth was poor and larvae become susceptible to the pathogens producing diseases in tasar silkworm. Once a few worms are infected, the disease spreads within the population and the worms release the pathogens through excreta or by direct contact leading to secondary infection in silkworm population (Sahay Sahay and Thangavelu (2001). When the data recorded on diseases at traditional farmer's site analyzed, indicated that viral infection was more as compared to bacterial infection; the lowest percentage was of protozoan infection.Analysis of data recorded where farmers adopted the new methods of rearing technology, revealed around 8-15 % reduction in disease incidences than traditional farmer. They adapted new techniques and some disinfectants like LSM, 0.5% Sodium hypochlorite against pathogens.

Table 1b: Economic recovery using disinfectants at experimental sites during 2012-13.

Group	Control/ Treated	Number of larvae used	Cocoons Good Number	Amount (Rs)	Cocoons Flimsy Number	Amount (Rs)	Total Cocoons Total Number	Total Amount (Rs)	Improvement over Control (Rs)
A. Leaf Surface Microes (LSM)	Control	5000	1160	986	150	15	1310	1001	
	Treated	5000	1400	1190	250	25	1650	1215	214
	Control	5000	1100	935	100	10	1200	945	
	Treated	5000	1350	1147.5	200	20	1550	1167.5	222.5
B. Sodium hypochlorite 0.5%	Control	5000	1050	892.5	200	20	1250	912.5	
	Treated	5000	1400	1190	250	25	1650	1215	302.5
	Control	5000	1200	1020	150	15	1350	1035	
	Treated	5000	1600	1360	150	15	1750	1375	340

Table 1c: Economic recovery using disinfectants at experimental sites during 2012-13.

Group	Control/ Treated	Number of larvae used	Cocoons Good Number	Amount (Rs)	Cocoons Flimsy Number	Amount (Rs)	Total Cocoons Number	Total Amount (Rs)	Improvement over Control (Rs)
A.Leaf Surface Microbes (LSM)	Control	5000	1200	1020	150	15	1350	1035	
	Treated	5000	1450	1232.5	200	20	1650	1252.5	217.5
	Control	5000	1150	977.5	150	15	1300	992.5	
	Treated	5000	1550	1317.5	200	20	1750	1337.5	345
B. Sodium hypochlorite 0.5%	Control	5000	1100	935	200	20	1300	955	
	Treated	5000	1400	1190	180	18	1580	1208	253
	Control	5000	1150	977.5	175	17.5	1325	995	
	Treated	5000	1500	1275	200	20	1700	1295	300

Among the used disinfectants used, LSM has given better results. The 12 % disease reduction and 19 % ERR increase recorded with leaf surface antagonistic bacteria (Roy et al., 1998) where as 20 % improvement in the disease management over the control reported by Shashidaran et al. (2000). The results of adopted farmers during study period also showed improvement in mortality due to pathogen by 8%-25%.The results also indicated that LSM reduced mortality due to all the pathogenic diseases by 12-20 % which is quite significant. The plant leaf surface microbes with antagonistic property have been exploited commercially for the control of various diseases in agriculture (Blakeman, J.P and Brodie, I.D.S. 1976) and Brodie, 1976; Sasidharan, 2000; Roy et al., 2005, 2006). The microflora available on the surface of leaves of *T. tomentosa* and *T. arjuna* are *B. laterosporus* and *B. sphaericus* reduced the mortality by 19 % and 12% respectively over the control (Roy et al., 2006). Therefore, it can be opined that antagonistic bacteria on the leaf surface for feeding treatment influenced the surrounding micro flora towards inactivation of pathogens largely in controlling diseases and improve the cocoon production.

CONCLUSION

The results also indicated that LSM reduced mortality due to all the pathogenic diseases by 12-20 % which is quite significant. The plant leaf surface microbes with antagonistic property have been exploited commercially for the control of various diseases in agriculture. With the improved techniques, conservation of host plants and tasar silkworms would make an excellent example of healthy biological interaction between primary producer (*T. tomentosa*, *T. arjuna*) and cosumer (Silkworm *A. mylitta*) and forms are integral parts of the forest ecosystem. In the recent past, the natural populations of *A. mylitta* increasingly depleted and some of the races, Andra local, Bhandara local became endangered. Therefore, the conservation of floral diversity use as host plants of *A. mylitta* is necessary because decline in population size leads to low genetic variability, which reduces the adaptive potential of the different races and may cause to extinction of already depleting population.

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Study of Economical Fluctuations of Baramati Fish Market

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ABSTRACT

The fish fauna is an important aspect of fishes and having large number of economically important fish species in aquatic ecosystem and more work has been carried out by fish fauna. The Study of Identification of Indian freshwater fish fauna goes back to Hamilton (1822), who studied fish fauna found in the river Ganges and its tributaries and has published books and research articles investigations on the freshwater fish fauna of India,Hora especially initiated in the West-ern Ghats, (1921, 1937, 1941, 1949)and Hora and Mishra (1938),. The Basin of Bhima River is an important Geographic zone. Its tributaries like Mula and Mutha river, Nira river, Kukadi river etc are major source of water and fish fauna,Baramati fish market receives fish from Bhigwan it is located (between Latitude 180 N and longitude 74_0 45'E)in Pune District Bhigwan. Receives water from Bhima river a filled not in Monsoon but almost around the year due to backwater of Ujani dam. Not only considering .Density and Diversity of the fresh water carps study was carried out on the rate, consumption Variation in rates and mostly Consumable.The study forms a part to approach principle aspects of fish market and economy of Baramati

KEY WORDS: Diversity of Fishes, Density of Fishes, Tate of Carps Variation Survey from 3 Months.

INTRODUCTION

Icthyofauna, the fish fauna is an important aspects of fishery potential of water body considerable studies on fish Diversity from different fresh water bodies of India have been carried out during the last few decades fishes also form food from variety of animals and human being. Many researchers have studied on fish diversity on different geographical location of water bodies. Skyes (1839-1841) first time collected and scientifically studied the fresh water fishes from different localities in Pune.

Baramati fish market receives fish from Bhigwan which is about 30km from Baramati. Bhigwan is located between latitude 18 017'and mangitude74^{0}45' in Pune district state Maharashtra.

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During the present study of Baramati fish market, survey and collection were done in three different months from July, August and September. The parameters like Diversity of fish species and Density of fish from the market and economy were taken into consideration. Survey was done before July Shrawan the holy month of Hindu. When non-veg was consumed and Economy benefit of the fish market survey was also taken into consideration done in August Shrawan the holy month of Hindu. When non-vegetarian fish were not consumed by consumers and economy of fish market survey was done after the September Shrawan the holy month of Hindu. Immediately after the ending of Shrawan and economic parameters were also taken into consideration.

June is the Breeding season of fishes so survey was carried from the month of July. It was found that the rate and consumption from consumers was more .In the month of August peak period where the market economy completely declines as the no. Of consumers for fish decreases. In the month of September immediately after the end of Shrawan there was sudden rise in the market economy and increases in the consumers.Considering the fact August month can be utilized for rearing of the carps which may provide space for their development. It shows that mythology and science work hand together.

The authors are thankful to Baramati Nagarparishad for providing good and well equipped infrastructure and Cleanliness for Fish market and to the sellers and consumers

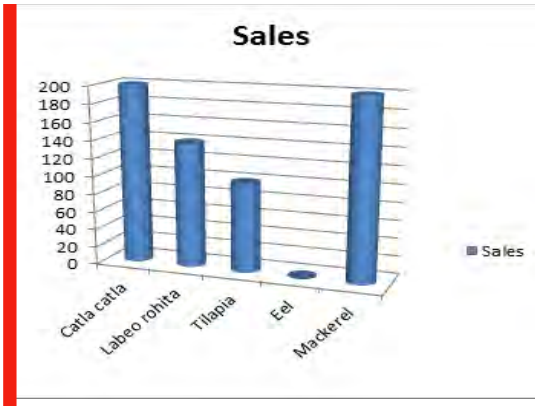
Baramati Fish Market

Table 1: Diversity of species found in Baramati fish market

Sr.no	Name of the Species	Common name
1	*Catla Catla*	*Catla*
2	*Labeo Rohita*	*Rohu*
3	*Tilapia*	*Tilapia*
4	*Eel*	Wham
5	*Pompret*	Pap let
6	*Mackerel*	Bangda
7	*Cat fish*	

Table 2: Rate of fishes before Shrawan month

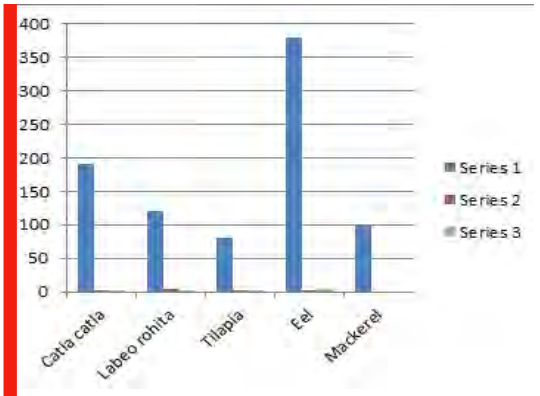
Sr.no	Name of the Species	Rate of fish/Kg	Sold in market
1	*Catla Catla*	200Rs/kg	95%
2	*Labeo Rohita*	140Rs/kg	95%
3	*Tilapia*	100Rs/kg	95%
4	Eel	400-480Rs/kg	95%
5	*Pompret*	750Rs/kg	95%
6	*Mackerel*	200Rs/kg	95%
	Cat fish	200Rs/kg	95%



Graph 1: Rate of fish in June –July month

Table 3: Rate of fishes in Shrawan month

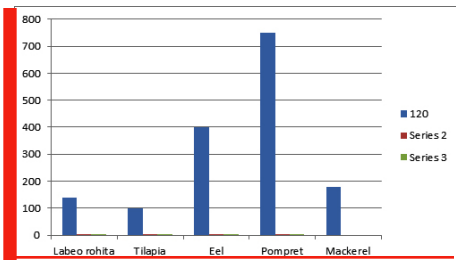
Sr.no	Name of the Species	Rate of fish/Kg	Sold in market
1	*Catla Catla*	190Rs/kg	50%
2	*Labeo Rohita*	120Rs/kg	50%
3	*Tilapia*	80Rs/kg	50%
4	*Eel*	380Rs/kg	50%
5	*Pompret*	700Rs/kg	50%
6	*Mackerel*	100Rs/kg	50%
7	*Cat fish*	100Rs/kg	50%



Graph 2: Rate of fishes in (August) Shrawan month

Table 4: Rate of fishes after Shrawan month

Sr.no	Name of the Species	Rate of fish/Kg	Sold in market
1	*Catla Catla*	280 Rs/kg	90%
2	*Labeo Rohita*	140 Rs/kg	90%
3	*Tilapia*	100 Rs/kg	90%
4	*Eel*	400 Rs/kg	90%
5	*Pompret*	750 Rs/kg	90%
6	*Mackerel*	180 Rs/kg	90%
8	*Cat fish*	120 Rs/kg	90%



Graph no.III Rate of fishes in Sept after (Shrawan) month

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Studies on Physical Parameters of Fresh Water Bodies Around Washim Region, Maharashtra, India

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ABSTRACT

Water is a chemical substance that is main constituent of earth's streams, lakes and oceans and fluids of most living organisms and that is vital for all known forms of life, even though it provides no calories or organic nutrients. The present work was carried out for the period of five months that is from August to December 2018 around Washim region. The various sampling sites were selected for the study of water quality of Washim region including Padmatirtha, Dev Talav, Narayan Baba Talav, Nagartas, Keli Dam and R.A. College, fish farm. Various physical parameters were studied, such as colour, temperature, pH, TDS, and Electrical conductivity.

KEY WORDS: Physical, Parameters, Washim.

INTRODUCTION

Human can live up to month without food but can only survive for about a week without water which is necessary for physiological processes in the human body. About two third of the human body is made up of water. It is transparent, tasteless, odorless and nearly colorless. Water moves continuously through the cycle of evaporation, transpiration, condensation, precipitation and run off usually reaching the sea. Water covers 71% of the earth's surface mostly in the form seas and oceans, small portion of water occurs as groundwater (1.7%), glaciers. Approximately 70% of freshwater used by humans goes to agriculture. Water is excellent solvent for a wide variety of chemical substances as such it is widely used in industrial processes and in cooking and washing. From a biological standpoint water has many distinct properties that are critical for the proliferation of life. All known forms of life depend on water. Water is fundamental to photosynthesis. An ecosystem is defined as community made up of living organisms and nonliving things that is divided into both biotic and abiotic components. Ecosystems are classified into two major group viz. aquatic ecosystem and terrestrial ecosystem. Aquatic ecosystem is the most diverse ecosystem, on the basis of water quality, aquatic ecosystem divided into two types such as fresh water ecosystem and marine water ecosystem. Fresh water ecosystem included rivers, streams, lakes, ponds, reservoirs and wetlands water type. Marine water system included seas and oceans that contain saline water. Water plays a significant role in maintaining human health and welfare. Clean drinking water is now recognized as a fundamental rights of human being, Rahmanianet et al.(2015).

Freshwater is any naturally occurring water except sea water and brackish water freshwater can be defined as water with less than 500 parts per million (ppm) of dissolved salts. Freshwater includes water in ice sheets, ice caps, glaciers, icebergs, bogs, ponds, lakes, rivers, streams and even underground water called groundwater Freshwater is generally characterized by having low concentration of dissolved solids. Freshwater is not the same as potable water (or drinking water). Renewable fresh water is an indispensible recourses for life. This is why it disserves special attention because it is very impaired and seriously treated by human activities, Togue et al. (2017) much of the earth's freshwater is unsuitable for drinking without some treatment.

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Freshwater habitats are divided into two systems:- Lentic system and Lotic system In lotic systems which are the still water including ponds, lakes, swamps and mires.In lentic or running water system and ground water flows in rocks and aquifers. Only 3% of all the water on earth is fresh water but even that is not all water can drink. Most of the fresh water on earth's is frozen. This fresh water is actually ice in the Polar Regions. Only 1% of all the water on earth is freshwater we can drink.Various researchers studied the Physical parameters of fresh water ecosystems Appavu et al. (2016) analyzed water quality parameters of Cauvery river water in erode region, the study focused on the determination of physico-chemical parameters from different sampling site. Rawat (2003) Physico-chemical parameters of tropical lake, Jodhpure, Rajasthan, India the results revealed that there was significant seasonal variation. Shukla et al. (2013) investigated that physico-chemical analysis of water from various sources and their comparative study. Industrial wastewater is produced as a result of industrial processes for example water used for cooling or washing or leachate from landfills. These are treatment to a lesser standard than potable water and to standards relevant to the country the water is to be disposed in, most likely a waterway. Water is one of our most important natural resources, which easily get polluted by various ways so it is essential to monitor our water bodies. The basic aim of present study is to investigate physical properties of water bodies of Washim and nearby area to evaluate the water quality.

Dev talav

Narayanbaba talav

Padmatirth

Nagartas

Keli dam

R.A.College, fish farm

MATERIAL AND METHODS

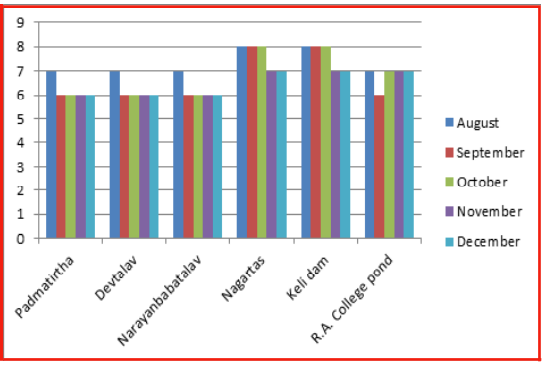
The study was conducted in six different sampling sites that is Padmatirtha, DevTalav, Narayan Baba Talav, Nagartas, Keli Dam and R.A. College, fish farm for the investigated these parameters such as colour, tempreture, pH, TDS, and EC all the parameters analyzed by using standard method of Clesceri (1998, 2006 and 2008) in APHA.

Table I: Comparative analysis of colour from six different sampling sites

Sampling sites	August	September	October	November	December
Padmatirthatalav	Olive Green	Olive Green	Olive Green	Olive Green	Olive Green
Devtalav	Olive Green	Olive Green	Olive Green	Pale Green	Pale Green
Narayanbabatalav	Dark Green	Olive Green	Dark Green	Olive Green	Olive Green
Nagartas	Olive Green	Olive Green	Olive Green	Olive Green	Olive Green
Keli dam	Olive Green	Olive Green	Olive Green	Olive Green	Olive Green
R.A. College pond	Olive Green	Olive Green	Olive Green	Olive Green	Olive Green

Table 2: Comparative analysis of pH from six different sampling sites

Sampling sites	Aug.	Sep.	Oct.	Nov.	Dec.
Padmatirtha	7	6	6	6	6
Devtalav	7	6	6	6	6
Narayanbabatalav	7	6	6	6	6
Nagartas	8	8	8	7	7
Keli dam	8	8	8	7	7
R.A. College pond	7	6	7	7	7



RESULTS AND DISCUSSION

The water qualities of six different water bodies were assessed during August to December 2018. The various physical parameters were investigated to understand the water health of present sampling sites. The parameters such as Colour, Temperature, pH, Electrical conductivity, TDS were estimated for the evaluation of water quality.

Temperature

The temperature of water affects some of the important physical and chemical properties of water; Thermal capacity, density, specific weight, viscosity, surface tension, conductivity, salinity and solubility of dissolved gases etc.temperature also affects on metabolic rates of aquatic organisms. The average value of temperature at Padmatirtha 21.8±4.32 at Dev Talav 22±4.60 at Narayan baba Talav 21.6±5.02 at Nagartas 23.8±25.11 at Keli dam 23.6±4.56 at R.A. College Fish Farm 23±5.43.The maximum value of temperature found in the month of August and minimum value of temperature found in month December.

Colour

The colour of the water has an aesthetic importance. It can also indicate the presence of organic substance, such as algae or humic compound. During the study period from August to December the following colors of the different sites were observed olive green, pale green, dark green and green.

pH

One of the simplest way to detect the good health of water quality. Can affected by chemicals in the water it is an important indicator of water that is changing chemically. The average value of pH at Padmatirtha 6.2±0.44 at Dev Talav 6.2±0.44 at Narayanbaba Talav 6.2±0.44 at Nagartas 7.6±0.54 at Keli dam 7.6±0.54 at R.A. College Fish Farm 6.8±0.44.The maximum value of pH found constant in three month August, September, October and minimum value of pH found in month November and December.

TDS

In general TDS is the sum of the cations and anions in water it is a important parameters for drinking water. A very low concentration of TDS produces undesirable taste of water. The average value TDS at Padmatirtha 394.22±1.11 at Devtalav 426.94±0.76 at Narayan baba talav 782.68±1.18 at Nagartas 1.66 at Keli dam 186.24±1.54 at R.A.college Fish Farm 186.64±1.36The maximum value of TDS found in month Auguest and minimum value of in month December.

Electrical conductivity

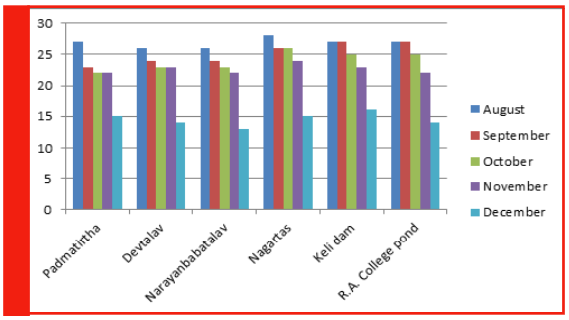
Electrical conductivity is the ability of water to conduct electricity. Higher conductivity value indicates that there are more chemicals dissolved in water ions increase the water ability to conduct electricity The average value of Electrical conductivity at Padmatirtha 434.82±2.58 at Dev Talav 469.72±1.44 at Narayan baba Talav 0.878±0.01 at Nagartas 276..18±2.62 at Keli dam202.52±4.46 R.A.

Table 3: Comparative analysis of temperature measured in^{0}c from six different sampling sites.

Sampling sites	Aug.	Sep.	Oct.	Nov.	Dec.
Padmatirtha	437.6 µs	436.6 µs	435.4µs	433.3µs	431.2µs
Devtalav	471.4µs	470.8µs	469.9µs	468.1 µs	468.4µs
Narayanbaba Talav	0.895µs	0.889µs	0.878µs	0.869µs	0.859µs
Nagartas	280.1µs	277.4µs	275.6µs	274µs	273.8µs
Keli dam	209.5µs	204.3µs	200.5µs	199.9µs	198.4µs
R.A. College pond	223.6µs	223.4µs	223.1µs	223.2µs	222.5µs

Table 4: Comparative analysis of Electrical Conductivity measured Inµsfrom six different sampling sites.

Sampling sites	Aug.	Sep.	Oct.	Nov.	Dec.
Padmatirtha	395.4	394.9	394.4	393.9	392.5
Devtalav	427.9	427.4	426.6	426.9	425.9
Narayanbabatalav	784.4	783.1	782.2	782.5	781.2
Nagartas	252.6	251.2	250.9	249.2	248.4
Keli dam	188.4	187.1	186.0	185.2	184.5
R.A. College pond	188.3	187.5	186.7	185.9	184.8



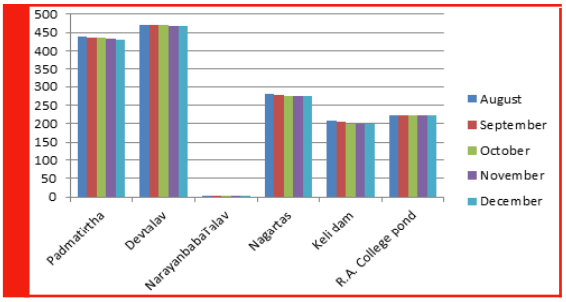
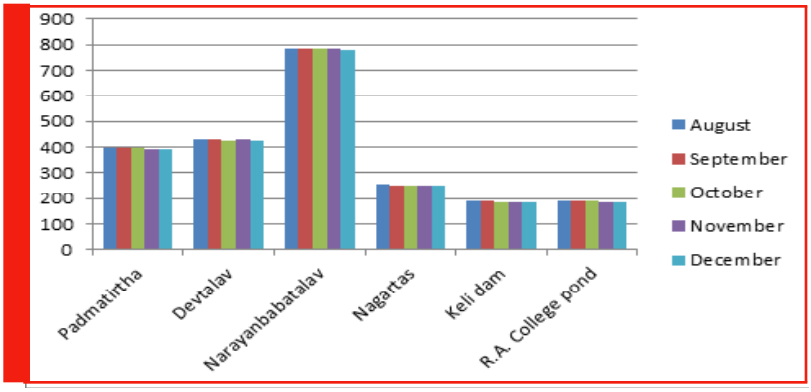


Table 5: Comparative analysis of TDS measured in ppm from six different sampling sites. Standard Deviation Chart

Sampling sites	Padmatirtha	Devtalav	Narayanbabatalav	Nagartas	Keli dam	R.A. College pond
pH	6.2±0.44	6.2±0.44	6.2±0.44	7.6±0.54	7.6±0.54	6.8±0.44
Temperature	21.8±4.32	22±4.60	21.6±5.02	23.8±5.11	23.6±4.56	23±5.43
TDS	394.22±1.11	426.94±0.76	782.68±1.18	250.46±1.66	186.24±1.54	186.64±1.36
Electrical conductivity	434.82±2.58	469.72±1.44	0.878±0.01	276.18±2.62	202.52±4.46	223.16±0.41



College Fish Farm 223.16±0.41.The maximum value of Electrical conductivity found in month August and minimum in month December.

The water temperature does not rise as quickly as water, the cooling time for water and air is different Togue et al. (2017). It was observed that thewater temperature was very high due to low water level and clear atmosphere and similar result was obtained in the research of Manjare et al.(2010).The minimum values being noted in winter the variation in water temperature found in the present investigation may be due to the normal climatic fluctuation and effects of seasons and also different times of collection or may be due to the effect of atmospheric temperature. Chhaba and Wanjari (2012). Colouration is a unique properties of lake water can determine the status and quality as well as roughly predicted the phytoplanktons and zooplanktons density of that lake. The lower values of pH may cause tuberculation and corrosion while the higher values may produce in crustation, sediment,deposition and difficulties in chlorination for disinfections of water in the present study. The pH values in all the collected sample ranges from 7.0 to 8.1 which are all within the limits. And TDS was reported at alkaline ponds were richer in solids than acidic ones. The quantity of TDS was proportional to the degree of pollution. The TDS were recorded more during rainy season .This is because of the addition of solids from ran off water. The value of TDS in the collected water samples varies from 233 mg/l to 490 mg/l Kalwale and Sawle (2012) Electrical conductivity of water is the ability of water to carry an electric current. Dissolved solids such as magnesium, calcium and chloride present in the water are responsible for carrying electric current through the water. Rahmanianet et al. (2015).

CONCLUSION

The present work was aimed at assessing physical parameters such as colour, temperature, TDS, electrical conductivity examined for assessing water quality. The analysis of water quality is important for the perfect and protect natural aquatic ecosystem.

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Antifungal Activity of *Kigelia pinnata* Aqueous and Ethanolic Fruit Extract on Infected *Clarias batrachus*.

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ABSTRACT

Kigelia pinnata belonging to family Bignoniaceae showed many medical uses. One of its main properties is antifungal activity of it. In the present paper, the antifungal activity of Kigelia pinnata extracts was observed. For test LC50/10 concentrations of aqueous (725.71 PPM) and ethanolic extracts (172.00 PPM) of fruit were used. The infected fish were exposed to these different extracts over a period of week. It was observed that the ethanolic extracts of fruit are more effective than aqueous extracts. Hence, the safe application of Kigelia pinnata extracts can be advocated to control the fungal infection in freshwater catfish, Clarias batrachus and similar catfish culture. Application of LC50/10 concentration of Kigelia pinnata, ethanolic and aqueous fruit extract showed the effective antifungal activities that help to reduce Aspergillus niger, Aspergillus flavus and Saprolegnia sp. infections in different duration of days.

KEY WORDS: *Aspergillus flavus*, *Aspergillus niger*, *Saprolegnia sp.*, *Clarias batrachus*, *Kigella pinnata* aqueous and ethanolic fruit extract.

INTRODUCTION

Kigella pinnata is a species of flowering plant belongs to the family Bignoniaceae also known as Sausage tree (Burkill, 2000). In central Kenya, kigelia is also used in a number of skin care products (Roodt, 1992; Kamau, L., 2016). It occurs all over India, found on riverbanks, along streams and on flood plains of India. (Ogbeche et al., 2002; Abioye et al., 2003). Kigella pinnata have naphthoquinones, iridoids, terpenes, flavonoids, tannins, steroids, coumarins, saponins and caffeic acid in the fruits, stem, leaves and roots (Saini et al., 2009). Commonly Kigella pinnata is used to treat skin ailments such as fungal infections, boils, psoriasis, eczema, and more serious disease like leprosy, syphilis and skin cancer (Houghton et al., 1994; Grace et al., 2002; Azu, 2013).

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MATERIAL AND METHODS

Collection of plant material

The fruit was collected in the month of February 2015, from university campus Sant Gadge Baba Amravati University, Amravati. Foreign matters and elements in the collected Kigella pinnata is were removed, rinsed twice with large quantity of de-ionized water, spread on a clean sack and cut into small pieces, placed under shade to air dry at ambient temperature. Sun dried for 1 hr and then fruit was ground into larger pieces using grinding machine. Fruit pieces were put in oven at 360 C temperature for 4-5 days till their weight remained constant and then ground into fine powder. The powder was stored in airtight container at room temperature.

Extraction

Aqueous and ethanolic extract: 25gm of Kigella pinnata is fruit powder in 200 ml distilled water and ethanol was added separately to obtain extracts by Soxhlet apparatus which was then stored in glass bottles and refrigerated at 4^0C prior to use.

Antifungal Activities

The differently infected C. batrachus of moderate length after collected from the Wadali Lake or market were used to determine the antifungal activity. As all the time infected fish were not

available, artificial infection of cultured molds of Saprolegnia sp., Aspergillus niger and Aspergillus flavus were used to infect the fish. Isolation and identification of fungus was carried out according to Alexopoulus and Mins (1979) key.

The Clarias batrachus was kept into aquarium and allowed to infect the fish by spreading the cultured spores of molds in aquarium, after 2 days the infected fish were used to study antifungal activity. The fish were exposed to $LC_{50}/_{10}$ for aqueous (725.71 PPM) and ethanol extract (172.00 PPM) of kigella pinnata fruit, for 7- 10 days to find out antifungal activities. The catfishes are commonly suffered from fungal infections. The infected specimen can be easily identified with uncommon erratic movement or sluggishness; loss of appetite, bulging eye with uncommon skin. The infected skin covers with white cotton like patches, excess mucus and reddish discolouration, visible tufts on skin, eyes and mouth. Such infected fish were collected and exposed to safe concentration of prepared extracts. The behavioural and morphometric characters were observed to analyse the antifungal activities of plant extracts to exposed infected fish. The Cultured molds Saprolegnia sp., Aspergillus niger and Aspergillus flavus were used to find antifungal activity on Clarias batrachus for this experiment according to Alexopoulus and Mins (1979) key.

Observation and Result

Antifungal activity of *Kigella pinnata is aqueous* and ethanol of fruit extract on infected Clarias batrachus against Aspergillus niger.

Aqueous fruit extract: Application of $LC_{50}/_{10}$ concentration of *Kigelia pinnata* aqueous fruit (KPAF) extract showed the effective antifungal activities that help to reduce the Aspergillus niger infections in 7- 8 days. Hence, the concentration of $LC_{50}/_{10}$ of *Kigelia pinnata* extracts can be advocated to control the fungal infection in freshwater catfish *C. batrachus* and similar catfish cultures.

Ethanolic fruit extract: Application of $LC_{50}/_{10}$ concentration of *Kigelia pinnata* ethanolic fruit (KPEF) extract showed the effective antifungal activities that help to reduce the Aspergillus niger infections in 6-7 days. Hence, the concentration of $LC_{50}/_{10}$ of *Kigelia pinnata* extracts can be advocated to control the fungal infection in freshwater catfish *C. batrachus* and similar catfish cultures.

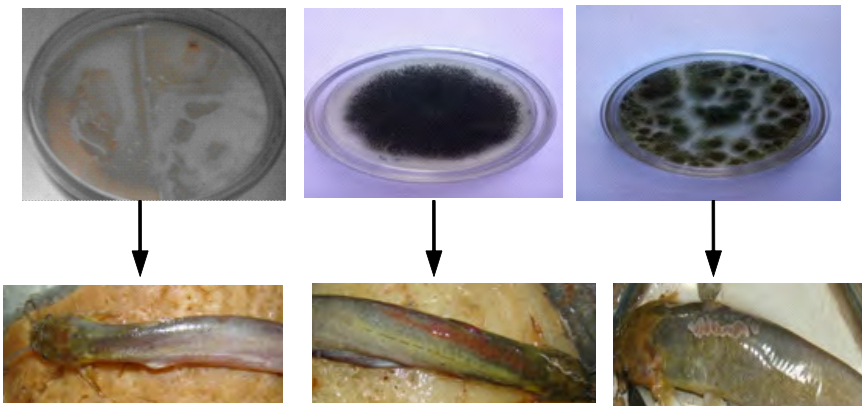
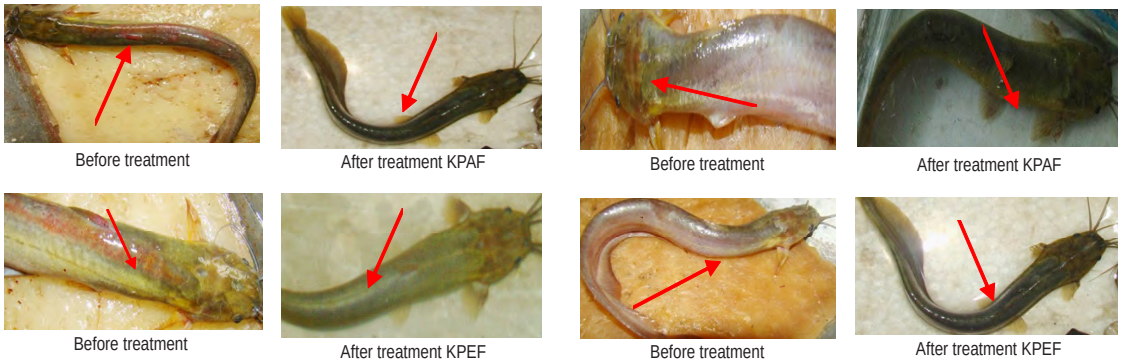
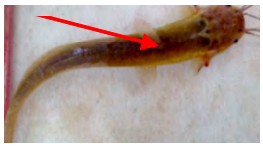


Fig. 1: Culture of (a) *Saprolegnia sp.* (b) *Aspergillus niger* (c) *Aspergillus flavus* and their respective infection in *Clarias batrachus*.





Before treatment

After treatment KPAF

Before treatment

After treatment KPEF

Antifungal activity of Kigelia pinnata fruit and leaves, aqueous and ethanol of fruit extract on infected Clarias batrachus against Saprolegnia sp.

Aqueous fruit extract: Application of $LC_{50}/_{10}$ concentration of *Kigelia pinnata aqueous* fruit (KPAF) extract showed the effective antifungal activities that help to reduce the Saprolegnia sp. infections in 4-5 days. Hence, the concentration of $LC_{50}/_{10}$ of *Kigelia pinnata* extracts can be advocated to control the fungal infection in freshwater catfish *C. batrachus* and similar catfish cultures.

Ehanolic fruit extract: Application of $LC_{50}/_{10}$ concentration of *Kigelia pinnata* ethanolic fruit (KPEF) extract showed the effective antifungal activities that help to reduce the Saprolegnia sp. infections in 3- 4 days. Hence, the concentration of $LC_{50}/_{10}$ of *Kigelia pinnata* extracts can be advocated to control the fungal infection in freshwater catfish *C. batrachus* and similar catfish cultures.

Antifungal activity of Kigelia pinnata aqueous and ethanol of fruit extract on infected Clarias batrachus against Aspergillus flavus.

Aqueous fruit extract: Application of $LC_{50}/_{10}$ concentration of *Kigelia pinnnata* aqueous fruit (KPAF) extract showed the effective antifungal activities that help to reduce the Aspergillus flavus infections in 8-9 days. Hence, the concentration of $LC_{50}/_{10}$ of Kigelia pinnata extracts can be advocated to control the fungal infection in freshwater catfish *C. batrachus* and similar catfish cultures.

Ethanolic fruit extract: Application of $LC_{50}/_{10}$ concentration of Kigelia pinnnata ethanolic of fruit (KPEF) extract showed the effective antifungal activities that help to reduce the Aspergillus flavus infections in 6-7 days. Hence, the concentration of $LC_{50}/_{10}$of *Kigelia pinnata* extracts can be advocated to control the fungal infection in freshwater catfish *C. batrachus* and similar catfish cultures.

DISCUSSION

Udomkusonsri et al., (2007) evaluated that crude ethanol extract of betel vine leaves, *R. nastus* Linn. Leaf and *K. galanga* Linn. roots had antifungal activity against fish water mold, S. parasitica H2. MIC of betal vine leaves and *K. galanga* Linn. roots against *S. parasitica* H2 were 500 and 125 µg/ml, respectively. Therefore, these two plant crude ethanol extracts may be alternative antifungal activity against fish water mold and it is needed to further investigation in fish toxicity tests. The ethanolic extracts are more effective than aqueous extracts. In developing countries plants play a major role as therapeutic remedies in primary health care and the use of aqueous extracts are most common for the population around the world (McDonald et al., 2001).

CONCLUSION

The antifungal effect of Kigelia pinnata extracts was observed. For test safe concentrations of aqueous and ethanolic extracts of fruit were used. The infected fish were exposed to these different extracts over a period of week. It was observed that the ethanolic extracts are more effective than aqueous extracts. But the application of safe concentration showed the effective antifungal activities that helped to reduce the Saprolegnia, Aspergillus niger and Aspergillus flavus infection in the fresh water catfish, Clarias batrachus. Hence, the safe application of Kigelia pinnata extracts can be advocated to control the fungal infection in freshwater catfish, Clarias batrachus and similar catfish culture without causing side effects.

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ABBERVATION

KPAF- kigelia pinnnata aqueous fruit extract
KPEF- - kigelia pinnnata ethanolic fruit extract
MIC- Minimum inhibitory concentration

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Animal Bioprospecting: New Avenue in Drug Discovery and Development

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Abstract

Traditional way of drug discovery and development takes many years to develop a new drug. Self medications lead to bacterial resistance to the drugs, ultimately failure of these drugs to fight with the diseases. Development of new drugs is very expensive process. Even synthetic drugs come with some side effects too. By using traditional knowledge of indigenous people to treat diseases either by plant and animal source drug development process can be shorten along very fewer side effects. While using of animal and plant database of traditional folk medicine opens it wide range.

KEY WORDS: Animal, Bioprospecting, Diseases, Drugs and Plants.

INTRODUCTION

Bioprospecting can be defined as identification and exploration of potential plants, microorganism, and animals as a resource for commercially valuable genetic, biological, and biochemical product for the benefits of human by the process of drug discovery and development. Most of the Indian traditional medicinal system has been evolved by using medicinal properties of plants. 10-18 % from total medicinal plant biodiversity has been developed into herbal product with minimal side effects as compared to the allopathic system (Sharma et al., 2014).

Ethnic groups from Indian sub-continent such as Gond, Govaris, Korku, Great Andmanese etc., rely on their traditional knowledge for treatment of various diseases. A person who searches for plants and animal species from which new drug can be derived for its commercial value is called as bioprospector. Most of the bioprospector focus on plants source, however, some animal's bioprospecting has also been reported, but there is huge scope of exploration in animal world promising new drugs (Alves et al., 2013).

Past literature suggest use of animals in treating the illness (Coasta-Neto, 2005). Honey collected from honey bees is useful in treating many gastric disorders such as acidity, ulcers, anorexia, and wound healing process etc. *Tabanus* genus of biting horseflies of Tabanidae family is used for extracting anticoagulant protein (TAP) from the whole body of tabanus (Ahn et al. 2006). Crustacean shells use in calcium deficiency. Application of Camel manure in arthritic condition, treating abdominal pain by fats of tiger and hyena. Use of animal by-product by Nigerian farmers such as tusks of hippo as an aphrodisiacs and ornaments. Use of leeches in Ayurvedic system for impure blood and related disorders. In animal assisted therapy like petting of dogs and cats, horse riding, aquarium helps in treating with psychological disorders and physical disabilities. Out of 252 essential chemicals selected by World Health Organization 8.7% have animal origin (Marques, 1997). Charak sahita one of the oldest Indian Auyrvedic systems 380 types of animal substances in curing disease. In recent studies marine organism has got prime importance in bioprospecting due to varieties and quantities of metabolites. Studies with marine worms indicate that chemical defence mechanism is more strong compared to temperate areas

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(Beattie et al., 2011).

Method Of Bioprospecting From Animal Sources

Indian Perspective

India comes in top 12 biodiversity countries in the world. In India Biodiversity act regulates animal resource, benefits sharing process, biopiracy. However animal bioprospecting by the use of modern drug development technology has not been reported. There is huge scope of research in this area with special consideration to geographical location where Adivasi communities resides such as Melghat region, Western Ghats from Maharashtra. Animal bioprospecting could be proved as major tool in solving the food security problem in India.

Fig. 1

Table 1: List of ten species used in traditional medicinal system which are threatened and endangered.

Sr. No	Common Name
1	Rhinoceros
2	Water Buffalo
3	Chinese Alligator
4	Asian Elephant
5	Musk Deer
6	Sun Bear
7	Grevy's Zebra
8	Tiger
9	Banteng
10	Hawksbill Sea Turtle

Limitations To Animal Bioprospecting: Ecological Approach

Use of animal source in bioprospecting has significant impact on ecological disturbance and also sustainability. Uncontrolled use of animals for therapeutic purpose can lead to overexploitation of it ultimately results in to species extinction. Also these can lead to unethical treading of animals used in medicines. This is happening with some invertebrates which are used in treating the ailments. Continually expanding global market for modern medicine can add more threat to this problem. Rio declaration insists use of 27 principals which majorly aimed at conservation of biodiversity with sustainability and sharing benefits to the indigenous people. However, traditional knowledge holders due to their integration in world trade economy also loosing attachment towards sustainable use of animal biodiversity (Alves et al., 2013).

CONCLUSION

Collateral evolution of indigenous people and their remedial therapy in Indian system has been strongly developed. Use of this knowledge will be very significant in reducing the time required for drug discovery and development with fewer side effects. However there is strong need of developing the database of Indian traditional remedial therapy system where animal source is use. In the strategic planning of conserving tropical ecosystem bioprospecting can be proved as a viable tool (Barrett and Lybbert, 2000).

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CONFLICT of INTEREST

The authors declare no conflict of interest.

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L-ascorbate Effect on Arsenic Induced Histopathological Changes in the Hepatopancreas of the Freshwater Bivalve, *Lamellidens marginalis* (Lamarck)

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ABSTRACT

Impact of L-ascorbate as non - enzymatic antioxidant was successfully tested against arsenic provoked histopathological changes in the hepatopancreas of the fresh water bivalve, Lamellidens marginalis. Along with control group of bivalves, there were groups treate with sub-lethal dose of arsenic trioxide (0.227 PPM) followed by L-ascorbate (50mg/Lit) and same sub-lethal dose of arsenic trioxide all for three consecutive weeks after acclimatization. Group of arsenic treated animals were allowed to cure naturally and also with the treatment of ascorbic acid. Bivalves have shown better recovery when exposed to L-ascorbate as compared to natural water. L- ascorbate is found to be strong non - enzymatic antioxidant against arsenic intoxication.

KEY WORDS: Arsenic, Histopathology, *Lamellidens* Marginalis and L-ascorbate,

INTRODUCTION

Today, heavy metal pollution has become a universal problem. It is increasing due to the human activities. Metals form almost two third of the chemical elements listed in the periodic table. Typically, elemental metals have near luster (reflected light glow), are solid at room temperature, can lose electrons to form a positive ion and readily conduct heat and electricity. The highly toxic heavy metals such as arsenic, cadmium and lead get circulated into the body of living organism including man through food chains and drinking water and also concentrate in the vital organs. Dhar and Biswas (1997) surveyed 45 arsenic affected villages of 18 districts of Bangladesh and random examination elicited that 1630 people including children, 57.5% have arsenical skin lesions. In comparison with West Bengal, Bangladesh arsenic calamity may be more severe.

Xenobiotics like heavy metals cause toxic effects to metabolism, cellular structures and molecular biology of normal tissues. It is well known fact that heavy metals are known to interfere with functional groups of various biomolecules, the presence of ionic heavy metal beyond tolerance results in irreparable changes in the microenvironment of the cell, thus resulting in its morphological changes towards deterioration. Many chemicals including pesticides, heavy metals, environmental contaminants etc. can bring about such changes. There have been such changes reported at tissue level caused due to toxicity of heavy metals in animals. (Khalid Shareef et. al., 1980; Shastry and Sunita, 1984; Singh and Sahai, 1984; Shrivastava and Maurya, 1991.)

Ascorbic acid

L-ascorbate is an excellent anti-oxidant, playing key role in in oxidation-reduction system at cell level and in binding of oxygen species formed inside the cells. (Laurence et. al., 1997).

Vitamin C: (Ascorbic acid) is derived from hexoses and its acidic nature is due to the enolic hydroxyl group. It is strong reducing agent.

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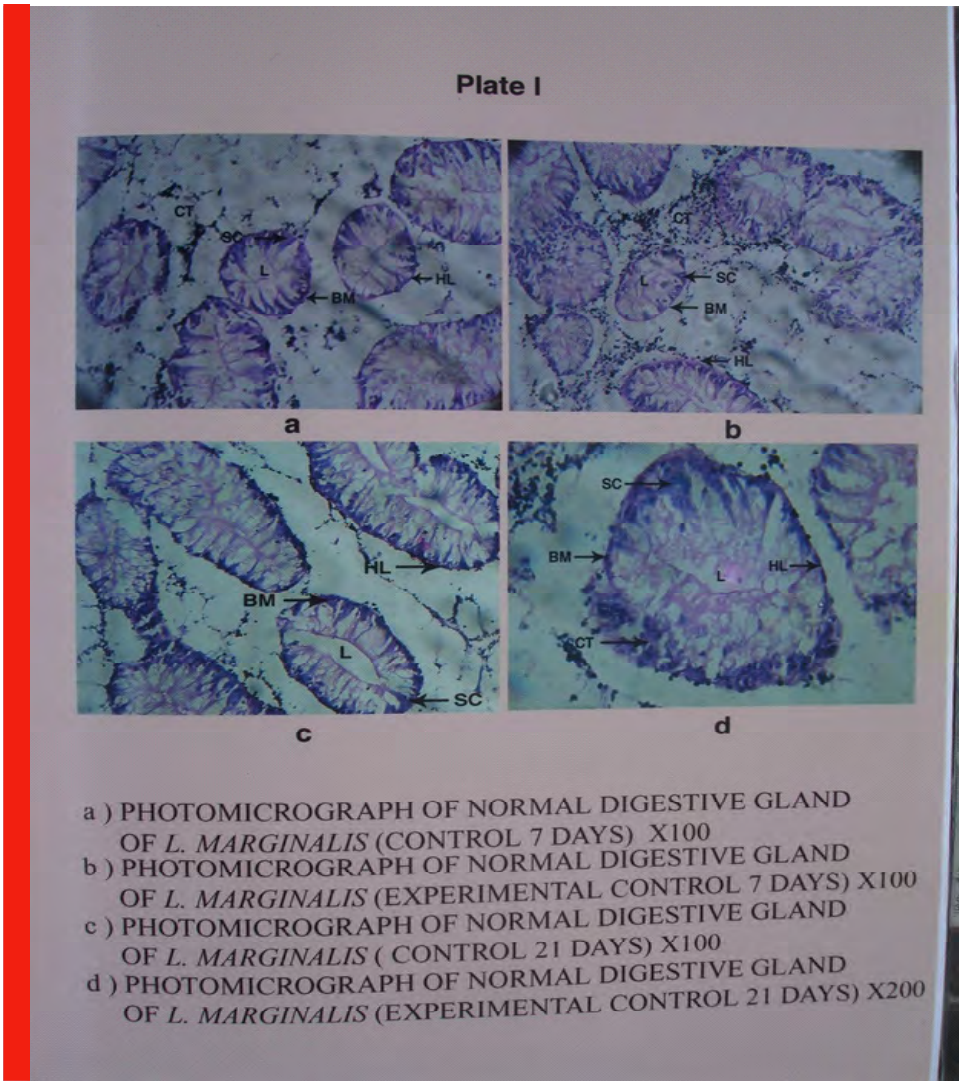
Histology is a useful technique for investigating the toxic effect of various pollutants. Such a study also offers opportunity to locate the effect of pollutants in the various organs and system of animals. It is the most valuable tool for assessing the action of toxicants at tissue level providing data to manifests structural and functional changes (Sprague, 1971) in tissues and organs. It has been reliable technique to understand the pathological conditions of the animal when exposed to toxic stress of heavy metals.

Arsenic:- Arsenic poisoning is difficult to diagnose. This type of poisoning can make people tired, depressed, and develops the skin problems which may lead to cancer. Arsenic can occur naturally

PLATE : I	PLATE : II	PLATE : III
BM =Basement membrane	BM = Basement membrane	BM = Basement membrane
CT=Connective tissue	CT = Connective tissue	CT = Connective tissue
HL = Hepatic lobule	HL = Hepatic lobule	HL = Hepatic lobule
L = Lumen	L = Lumen	L = Lumen
SC = Secretory cell	SC = Secretory cell	SC = Secretory cell
	DE = Damaged epithelium	DLE = Delaminated epithelium
	DLE = Delaminated epithelium	



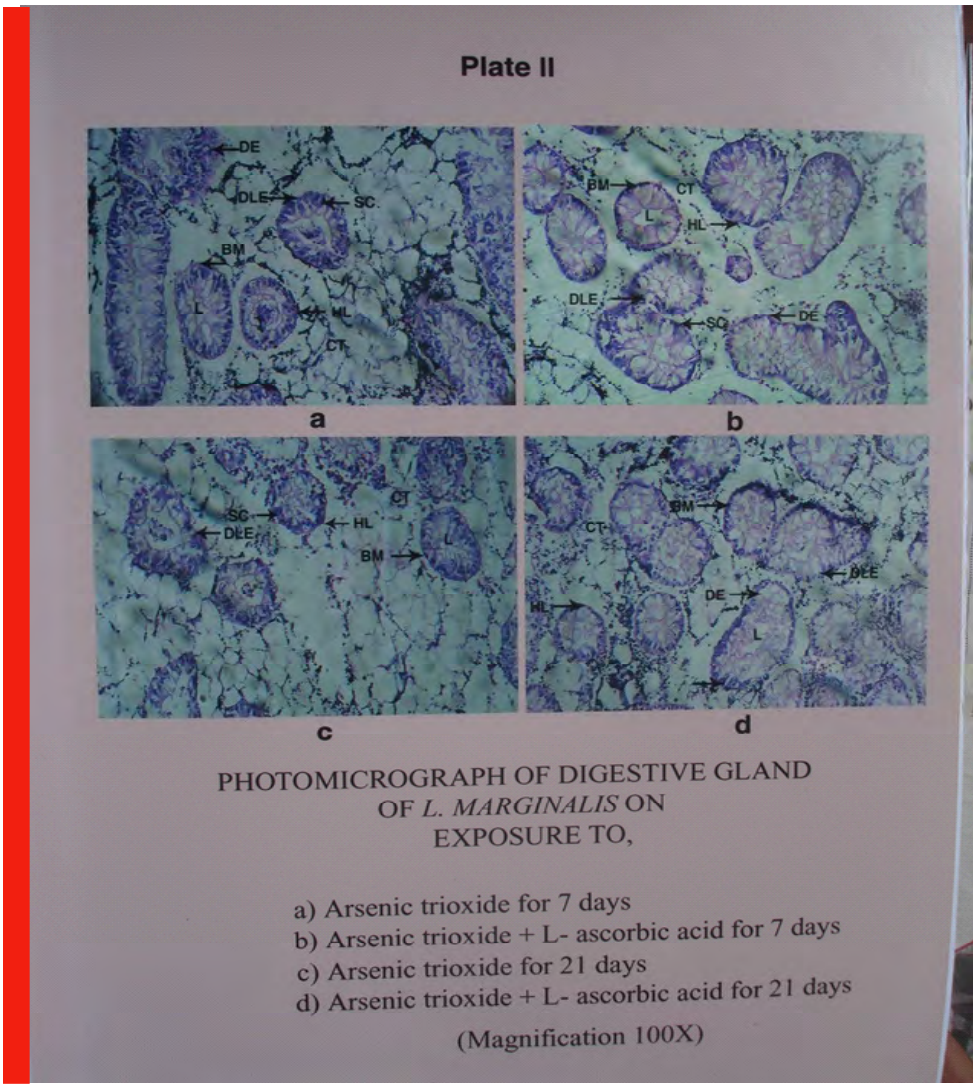
a) PHOTOMICROGRAPH OF NORMAL DIGESTIVE GLAND OF *L. MARGINALIS* (CONTROL 7 DAYS) X100
b) PHOTOMICROGRAPH OF NORMAL DIGESTIVE GLAND OF *L. MARGINALIS* (EXPERIMENTAL CONTROL 7 DAYS) X100
c) PHOTOMICROGRAPH OF NORMAL DIGESTIVE GLAND OF *L. MARGINALIS* (CONTROL 21 DAYS) X100
d) PHOTOMICROGRAPH OF NORMAL DIGESTIVE GLAND OF *L. MARGINALIS* (EXPERIMENTAL CONTROL 21 DAYS) X200

as is found in underground water in West Bengal and Bangladesh. Increase of high level of arsenic in drinking water increases the risk of cancer of lung, skin, liver. Arsenic is known to produce severe cell injuries. Symptoms of 'arsenicosis' include tiredness, depressed and lethargic behavior and finally death. Arsenic ingestion can cause severe toxicity through ingestion of contaminated food and water causing, vomiting, diarrhoea and cardiac abnormalities (Dubois et. al., 1959). Mercury, arsenic and lead exhibit lethal effects on the fresh water gastropod snail, *Bellamya bengalensis*. (Mahajan 2005).

MATERIAL AND METHODS

Bivalves were collected from the Ulhas River basin, Titwala, Taluka : Kalyan Dist. Thane (M.S). They were individually cleaned to remove mud and algal growth on shells and then were successfully acclimatized in the laboratory condition at room temperature for three days. Bivalves of average size i.e 6.0 cms length were selected for chronic treatment.While testing bivalves, they were categorized into three groups such as control, treated with arsenic trioxide sub lethal dose (0.227 PPM)) for 21 days and simultaneous sub-lethal dose of arsenic trioxide and ascorbic acid (50 mg/lit) for 21 days.

Bivalves from treated group were divided into two sub-groups after 21 days chronic exposure to arsenic trioxide. First sub-group bivalves pre-exposed to chronic sub-lethal dose of arsenic trioxide were allowed for natural cure in normal water while second sub-group bivalves pre-exposed to chronic sub-lethal dose of arsenic trioxide were exposed to ascorbic acid (50mg/lit.) for recovery from tissue damage. All three groups of bivalves were studied after seven days and twenty one days and from both first and second sub-groups of recovery after three days and six days. Their



hepatopancreas were fixed in Bouin's fluid, for 24 hrs, washed and dehydrated in alcohol grades, cleared in toluene and embedded in Paraffin wax (58-60oC). Prepared blocks of tissues were cut at the thickness of 5µ and stained with Heamatoxyline and eosine stain. Stained sections of digestive glands of bivalves from all groups i.e. control, exposed and recovery were screened to study the effect and the effect is presented through the Photomicroplates I to III for comparison.

RESULTS AND DISCUSSION

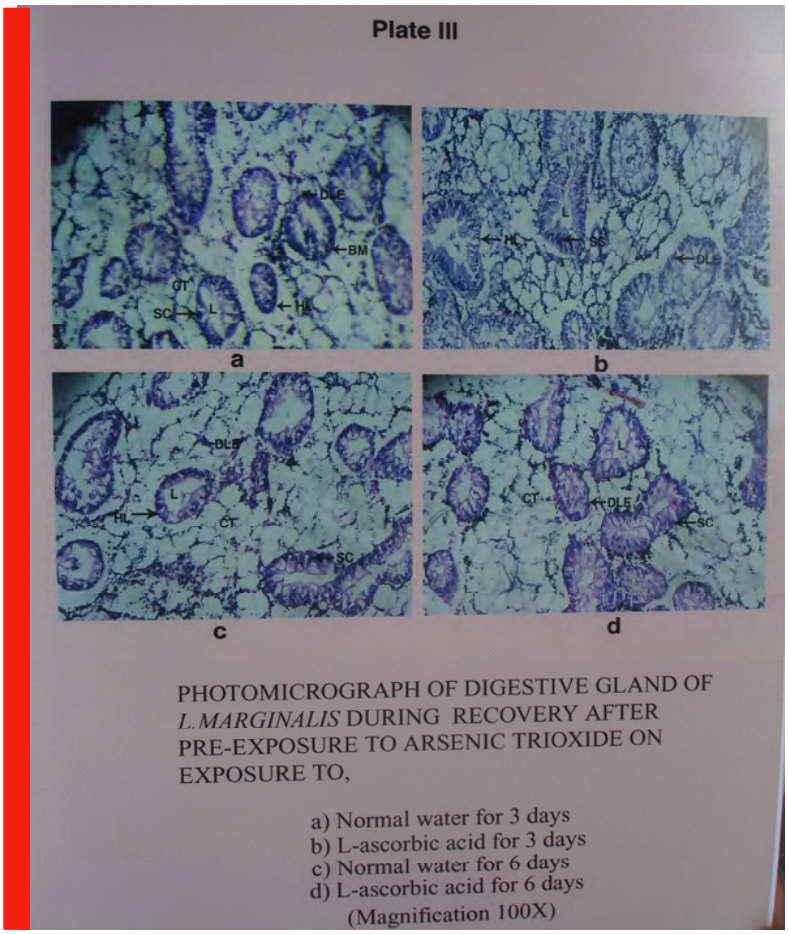
The histopathological effect due to chronic treatment of heavy metal ions arsenic with and without ascorbic acid and during recovery was studied on the hepatopancreas of the freshwater bivalve, Lamellidens marginalis. The photomicrographs are given on the plate No. I to III.Hepatopancreas is forming site of detoxification and food storage organ in addition to secretion of digestive juices. It has hepatic lobules, with columnar cells and secretory cells, both resting on basement membrane. The lobules of the gland are bound together by the thin connective tissue layer as shown in photomicroplate No. I to III.

Histology of the normal hepatopancreas of Lamellidens marginalis:

Hepatopancreas, also known as the digestive or the mid gut gland, is composed of tubules of different shapes and sizes. In between the hepatic tubules there is connective tissue with some muscles, collagen fibres and amoebocytes. The epithelium of tubule is based on a basement membrane. (Plate-I).The epithelial cells have basal nuclei. Tubular epithelium possesses digestive and secretory cells. The digestive cells are elongated type with more vacuoles and distinct spherical nucleus at the base. The secretory cells may be triangular with a conspicuous nucleus and homogenously distributed cytoplasm. The cytological staining of calcium form the brown pellets thereby pushing nucleus aside to the basal part of most of the cells. These calcium spherules occupy a basal position in the cells.

Hepatopancreas under arsenic intoxication

As compared to control animal's hepatopancreas of bivalve, *Lamellidens marginalis* after chronic exposure to arsenic trioxide (0.227 PPM) induced marked histopathological changes. This



exhibited an initial reaction of epithelial damage, together with necrotic changes in basement membrane and inter-tubular connective tissue. In present study, epithelial necrosis; rupture of epithelial layer and sloughing of the epithelium was noted after 21days exposure (Fig. c, Plate II). Rupture and discharge of secretory products from secretary cells and flattening of the epithelial cells along with displacement of nuclei and widening of tubule lumen is visible. The nuclei are enlarged than the normal ones. Necrosis of the tubular epithelium and basement membrane at some places is observed. The cellular identity is lost at some places. Fig. (b) & (d) of Plate II shows the effect of ascorbic acid protection against the simultaneous exposure to arsenic. The damage induced in the structure of hepatic lobule is less and tissue structure is maintained to normal level, lumen is not very wide, and the cellular integrity is maintained. Fig. (a) & (c) of Plate III shows the recovery after 21 days exposure to arsenic in the histological structure of hepatopancreas in normal de-chlorinated water after three and six days. In comparison with the structure of arsenic exposed hepatopancreas, there seems to be the slow and progressive improvement in the recovery of the structures with respect to cellular integrity, basement membrane, restoration of the lumen and linings of the hepatic lobules. Fig (b) and (d) of plate III of plate shows the recovery after 21 days exposure to arsenic in the histological structure in 50 mg ascorbic acid per liter de-chlorinated water after three and six days. In comparison with the structure of arsenic exposed hepatopancreas, there seems to be fast and progressive improvement in the recovery of the structures with respect to cellular integrity, basement membrane, restoration of the lumen and linings of the hepatic lobules. As compared to the structure of hepatic lobule during the recovery in normal water, the improvement is rapid and the structure is fully recovered on the sixth day with normal cellular integrity, lumen basement membrane, epithelial cells etc.It is studied that almost 10% genes expressed invariably due to arsenic intoxication of human liver in comparison with control. (Tong Lu et al., 2001). Such genetic expression leads to apoptosis. Fugare S. H. (2003) showed that there is drastic reduction in the concentration of L-ascorbate of digestive gland when given acute exposure of copper, zinc and mercury salts to freshwater bivalve, *Parreysia cylindrica* in comparison with control group of bivalves.

Gulbhile and Zambare (2013) proved that caffeine is the strong antioxidant as the amount of DNA considerably increased in simultaneous caffeine and arsenic treated damaged gills, digestive gland and gonadal tissues of freshwater bivalve, Lamellidens corrianus. It elicits that caffeine protects and repairs the damage caused to DNA due to arsenic intoxication. Likewise, L- ascorbate as an excellent antioxidant must have reduced the probable damage to digestive gland of bivalve, *L. marginalis*. Kaur et al., (2018) found that content of toxic heavy metals like As, Cd, Cr, Mn and Pb which elevates beyond the permissible limits (WHO) in water bodies leads to variations in histo-architecture of liver and kidney of fresh water fish, *Labeo rohita* (Hamilton).

CONCLUSION

The effects of heavy metals, arsenic trioxide, without and with ascorbic acid and during the recovery on histology of digestive glands of freshwater bivalve, Lamellidens marginalis were studied and the observations were recorded.

1. After chronic treatment of arsenic trioxide the histomorphology of digestive glands showed that the hepatic lobules were badly affected in proportion to the period of exposure.
2. After chronic treatment of arsenic trioxide along with ascorbic acid, the change in the cytoarchitacture of digestive glands were less severe as compared to the digestive glands of those exposed to only heavy metals.
3. After 21 days exposure to heavy metals, in the ascorbic acid digestive glands of bivalves recovered faster as compared to those of normal water.

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Study of Diversity and Seasonal Variation in Ostracoda Species (Zooplankton) in Upper Morna reservoir, Medshi, in Washim District, (M.S.)

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ABSTRACT

In Washim district of Maharashtra, the Upper Morna Reservoir located at small village Medshi. Zooplanktons were studied from this reservoir like Rotifer, Copepods, cladocerons and Ostracods. In the two years study period 2012 and 2013 total 53 species and 29 genera of zooplankton are recorded. Total 5 species of Ostracoda were found in 3 genera. The method used for collection of zooplankton from reservoir was the collection of samples done from by using plankton Net having mesh size 25u from particular selected sample sites for qualitative analysis and method used for quantitative analysis of zooplankton is by filtering 200 liters of water through the plankton net, for the collection of sample monthly. These collected samples were stored separate sampling bottles of 30ml capacity with proper indication of name, site date and time related to sampling. Ostracods were placed in 95% of alcohol and observed in compound microscope. In these species of Ostracoda Paracondona euplectella, Chlamydoltheca speciosa speciosa and Cyclocypris forbesi, were found abundant among them. Ostracodes were recorded more in number in the month of April and May and less in the month of August; it might be less water content and availability of food source in summer.

KEY WORDS: Crustacean, diversity, ostracoda, reservoir, zooplankton.

INTRODUCTION

This reservoir is use mostly for irrigation and fishery purposes which is located in village Medshi. Some people in the village used water of that reservoir for drinking and domestic use, therefore it is necessary to study zooplankton which is use as pollution indicator. Most important biotic components in water is zooplankton because it affecting food chain, food webs, energy flow and cycling of mater of aquatic ecosystem, they also helps for the energy conservation (Park and Shin, 2007 and Kabra et al 2016).

There are near about 1700 species of Ostracoda are known of which one third found in fresh water. The Ostracoda are small, bivalve crustacean which are found in both fresh and marine water. The fresh water ostracods ranges from 0.35 mm to 7 mm in length but they show average size about 1mm. They inhabit a wide variety of environments therefore they found everywhere in the fresh water resources like lakes ponds, streams, cave water and heavily polluted areas etc. Some commensal forms of Ostracoda are found in intestinal tracts of fish and amphibian. All these zooplankton are found in fresh water and mostly free living (Edmonson, 1959).

In the Ostracoda morphometric features mostly stress on size and shape of the shell, The general shape of fresh-water ostracods is somewhat similar to that of the marine species and Shell shape is commonly regular doesn't show any ornamentation on shell surface with any projections and the surface of valves is comparatively smooth. Colors are shows changing pattern like greenish, yellowish, or whitish hues; some forms are brown and others tend toward a bluish green. Character of shell surface is present and length of the natatory setae of the second antennae with segmentation, form and number of spines of the maxillary process, armature of the third thoracic leg and armature of the caudal furca. The character of hairiness is often a specific importance. The valve margins found particularly at the extremities and many forms, exhibit short radiating canals, called as "pore canals." Valve surfaces may have striations or complex patterns of anastomosing lines, pits, or tubercles and edges are frequently tuberculated, or less frequently serrated. These features were useful for identification of ostracoda in freshwater.

Material and Methods: During two study period 2012 and 2013, for qualitative analysis of Ostracoda, samples were collected from four different sites of reservoir that is S1, S2, S3, and S4 monthly. Samples of zooplankton were collected from 8.00 a.m. to 12.00

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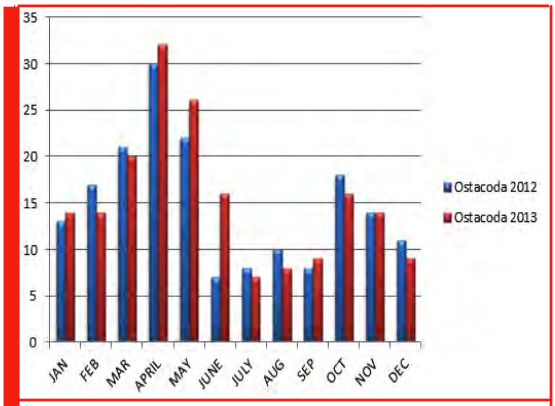


Fig. 1: Seasonal variation number of Species of Ostracoda in 2012-2013

Graph plate I: Pie diagram shows dominancy and abundance of Ostracoda Species

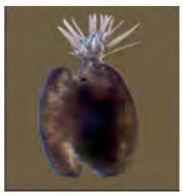
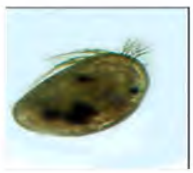
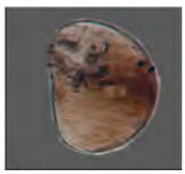
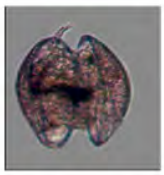
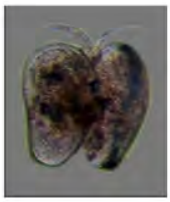
		
Paracondona euplectella.	*Paracondona euplectella.(dorsal)*	*Paracondona euplectella.*
		
Chlamydoltheca speciosa speciosa	*Chlamydoltheca speciosa speciosa*	*Physocypria gibbera*
		
Cyclocypris forbesi	*Cyclocypris forbesi*	*Chlamydotheca texasiensis*

Table 1: Photoplate- (Ostracoda)

noon that is in early morning shift (APHA 1998). Sample collected in bottle or test tube by towing Nylon plankton Net (mesh size 25u). To get concentrated samples this net used repeatedly operated in given sites of reservoir. A bore cut wide syringe without piston is used which fits on mouth of fine mesh size net to get more concentrated sample. By using forceps the large aquatic organisms like crustacean larva, tadpole larva and insect were removed. These concentrated samples were collected in sampling bottles of 30ml capacity with proper labeling the sample site, time and date. Quantitative analysis is the another method used for calculating number of zooplankton in water body for that 200 liters of water are filtered through the plankton net with selected sites. These

samples were stored in 30ml water samples bottle with proper labeling. An eye may be present either single or double and will be visible through the valves.

The living species of Ostracods were placed in 95% of alcohol containing valves for killing, when they die, the supernatant liquid was poured off and the mixture of about one seventh glycerins to six seventh 95 % alcohol is store ostracoda in vial is corked tightly. For purpose of identification the specimen were placed in a drop of glycerin. The valves and the appendages were removed systematically from the body and spread out in the glycerin. Then the cell is covered with cover slip and sealed and observed under compound microscope. By using ocular and stage micrometer scale, measurement of length, height and thickness of the specimen was taken. Camera Lucida drawing is used for outlines of an organism. Zooplanktons were observed under Olympus Phase Contrast Microscope and photographed with the Coslab digital camera DC 10+.

RESULTS AND DISCUSSION

In ostracoda total 5 species was obtained in 3 genera these are Chlamydotheca texasiensis, Paracondona euplectella. (dorsal), Chlamydoltheca speciosa speciosa, Physocypria gibbera, Cyclocypris forbesi in which Paracondona euplectella, Chlamydoltheca speciosa speciosa and Cyclocypris forbesi, were found abundant among them. Ostracods were recorded less in August and more in the month of April and May similar result found in Kagzipura Lake in which the highest population of Ostracoda found in summer (Sontakke and Mokashe 2014). Biotic component shows high metabolic activities and Ostracoda population might be increases due to less water content in summer, similar result recorded in river kayadhu located near Hingoli city in Hingoli district, Maharashtra (Jayebhaye 2010). Ostracoda shows minimum population as compared to other zooplankton according to them due to the feeding pressure of fishes Ostracoda population is less (Lahane and Jaybhaye 2013). For identification of water quality Ostracods used as important food chain. Diversity of Ostracoda species shown in given Photo plate and Seasonal variation number of Species of ostracoda in 2012-2013 shown in fig-1, number of species of Ostracoda showing seasonal fluctuation in Graphplate I.

Ostracoda were abundant in summer it might be due to availability of food in abundance due to less water content, which may favors the growth of Ostracoda. Similar results obtained by (Gadekar et al., 2014, Sundal and patil, 2004) in Pagdi lake, Gondia (M.S.) and fort lake of Belgaun, Karnataka respectively.

CONCLUSION

Among zooplankton Ostracoda shows less population in upper morna reservoir, but in certain season abundancy of Ostracoda are increases like in summer, it might be less water content and availability of food source.

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A New Species of the Genus *Phyllobothrium sangmeshwarensis* From a Marine Water Fish *Trygon Sephen*

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ABSTRACT

The present paper deals with the new species of the cestode from the genus Phyllobothrium sangmeshwarensis this genus is erected by gracile, weld, in 1855, viz of Phyllobothrium n.sp. collected from the Sangmeshwar of Ratnagiri District. The present species of the genus is having scolex is globular or rounded, scolex consist of four bothridia which are folded petal like. Each bothridia is having a single accessary sucker. Testes are pre-ovarian, 25 and 30 in no, cirrus pounch is oval, ovary bilobed, vitellaria is follicular (2 or 3 rows).

KEY WORDS: Marine Water Fish Cestode, *Phyllobothrium Sangmeshwarensis.*

INTRODUCTION

The genus Phyllobothrium are collected from the spiral valve of intestine of Trygon Sephen (cuvier,1871) of Sangmeshwarensis., Ratnagiri Dist. West coast of India. The present worm come closer to phyllobothrium gracile, wedl,1855 in the shape of the scolex globular and ovary U shaped where as it differs from the same with the following characters. 1) Cirrus straight Vs thin and curve. 2) The number of testes 75-80Vs 91-95 in number. 3)The arrangement of vagina posterior to cirrus pouch Vs anterior to cirrus.

MATERIAL AND METHODS

The worms were collected from Sangmeshwar, Rathnagiri District from marine water fish Trygon Sephen fixed in 4 % formalin stained with harries hematoxylin, dehydrated, cleared in xylene, mounted in D.P.X. Drawings were made with the aid of camera lucida. Identification carried out with the help of system Helminthum vol.II Yamaguti, all measurements are in millimeters.

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RESULTS

The scolex is globular or rounded measure 0.2326 (0.873-.3785) in length & 0.5533 (0.5824 X 0.1164) in length & 0.922 (0.3398x.5824) in breadth. The scolex is consists of four bothridia which are folded, petal like with curved frilled borders, bothridia are overlapping to each other measure 0.3494 (0.5824 x 0.1164) in length & 0.9222 (0.3398 x 0.5824) in breadth. Each bothridia is having a single accessary sucker which are rounded in shape and small in size measure 0.3155 (0.1456-.1699) in length and 0.8252 (0.04854-0.03398) in breadth. Scolex is followed by a short, cylindrical neck, broad anteriorly & narrow posteriorly measure 0.578 (0.9222-0.1934) in length & 0.4368 (0.2912-0.5824) in breadth.

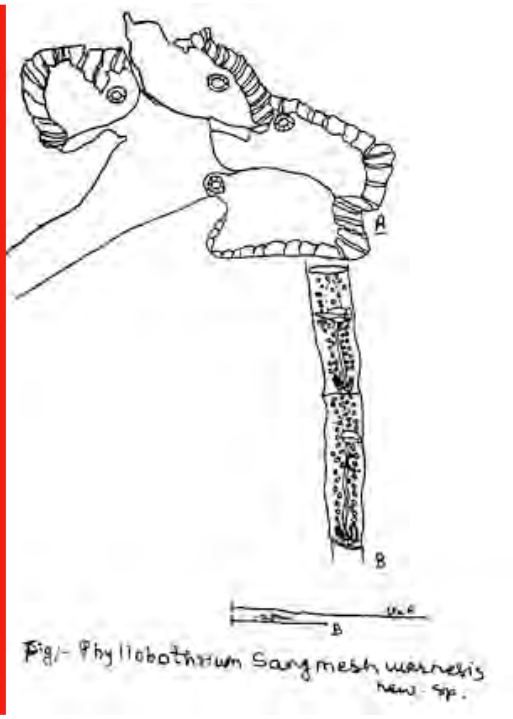
The mature segment are longer than broad measures 0.9771 (0.4394-.5378) in length & 0.6287 (0.2651-0.3636) in breadth. Testes are preovarian, medium in size, oval in shape (91-95) in number, measure 0.1844 (0.08737-0.09708) in length and 0.5825 (0.02427-0.3398) in breadth. The cirrus pouch is oval, marginal, placed near to the anterior side of the segment measure 0.4923 (0.2272-0.2651) in length & 0.05302 (0.0378-0.1515) in breadth. The cirrus is thin & curved measure 0.4165 (0.1893-.2272) in length and 0.9090 (0.007575-0.1515) in breadth. Vas deferens which is short, reaches in the center of the segment measure 0.6059 (0.22-0.3787) in length and 0.3787 (0.7575-0.01515) in breadth.

The vagina is a thin tube, runs posteriorly from the cirrus pouch, start from the genital pore measure 0.2317 (.3030-.3787) in length

& 0.3787 (0.01515-0.2272) in breadth. Vagina takes a turn and form receptaculam seminis in the center of the segment measure 0.3257 (0.6439-0.6818) in lenth & 0.3787 (0.01515-0.2272) in breadth & open into the ootype. Ovary is situated near the posterior region of the segment, bilobed, 'U' shaped measure 0.3640 (0.1699-0.1941) in length & 0.7381 (0.02427-0.4854) in breadth. The ovary consists of small, ovarian follicles. The two ovarian lobe, it consists of small, rounded fifteen acini on each lobe 0.3030 in diameter.The uterus is long, runs in middle of the segment, originated near the ovary or from the ootype, reaches up to the side of the segment 0.5755 (0.2120-0.3635) in length & 0.16.66 (0.5303-0.1136) in breadth. The vitellaria are follicular arrange in a line, cortically placed, except the cirrus pouch region and preovarian.

DISCUSSION

The present parasite Phyllobothrium sangmeshwarensis differs from the Phyllobothrium gracile wedl,1855. The shape of the scolex globular & rounded Vs globular, ovary U shaped & bilobed, situated near the posterior region of the segment Vs ovary U shaped. oval & bilobed differs from Phyllobothrium van Ben which is having the shape of the scolex (globular or rounded, it consist of four bothridia vs anteriorly cone shaped), no. of testis (91-95 in number vs. 80-85 in number) cirrus pouch oval marginal vs. Elongateal, situated posteriorly differs from Acanthobothrium which are folded petal like vs. five bothridia which are folded petal like vs five bothridia rounded in shape), mature segment are (longer than broad vs.borader than long) Vas deferens (short reaches in the center of the segment vs. Elongated & placed Pasteriorly) cirrus pouch oval marginal vs. rounded centrally placed differs from Phyllobothrium trygoni scolex (consist of four bothridia is having single accessory sucker vs. three bothridia having single accessory sucker) uterus (long, runs arrange in a line vs. granular 2 or 3 rounds) differs from Phyllobothrium Bender scolex (globular or rounded vs. oval) cirrus (thin & curved vs. broad & Elongated) Vagina (thin tube runs posteriorly vs. reaches up to the seminal receptaculumn) Vitellaria (follicular arrange in a line vs. globular arrange 2 or 3 line) differs from Phyllobuthrium kingane scolex followed by (short, cylindrical neck broad anteriorly & narrow posteriorly vs. long & Elongated) Mature Segment (longer than broad vs. Elongated) Testis are (91-95 in number vs.70-75 in number differs from Phyllobothrium radioduchum cirus thin & curved vs. broad & Elongated), the two ovarian lobe. consists of (15 acini vs.20 acini) vitellaria (follicular arrange in a line vs. granular arrange in 2 or 3 rows) differs from Phyllobothrium ridae vagine, takes a turn & from receptaculum seminis in the center of the segment vs. posterior side of the segment) testes (Preovarian,oval in shape 91-95) in number vs. preovarian, rounded in shape 60-65 in number. Phyllobothrium pirigi differs from shape of the scoler (globular or rounded). Testis (91-95 in number vs. 89-90 in no., Vitellaria (follicular vs. granular).



Fig/- Phyllobothrium Sangmeshwarensis new sp.

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Variation in Catalase Activity in the Silk Worm, Bombyx Mori During, Infection with Bacterial Flacherie

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ABSTRACT

The silkworm is a caterpillar of the domesticated silk moth, Bombyx mori. It is a well known economically significant insect as it is a producer of valuable silk. Bacterial Flacherie is a syndrome associated with bacterial Infection, which is the major cause for the affected production of silk in India. Bacterial Flacherie is caused primarily bySerretiamarcesens, Streptococcus sp, and Staphylococcus sp of bacteria. In the present study healthy and bacterial Flacherie infected mulberry silkworm larvae were collected from the local sericulture units, carried and reared in the laboratory. The analysis for the intensity of catalase activity in both controlled and Flacherie infected larval samples were done. We reported, decrease Catalase activity in larvae suffering from Flacherie in comparison with control ones. The observed variation in Catalase activity can be measured of marker for identification of local mulberry silkworm Crops infected with Flacherie pathogen.

KEY WORDS: Bombyx Mori, Catalase, Flacherie, Serretia, Streptococcus, Staphylococcus.

INTRODUCTION

From last 4,500 years, Silkworm, Bombyx mori is known as domesticated insect but like other domesticated animals it is also easily susceptible to a number of diseases, results in great economic loss. Diseases like Grasserie and Flacherie are regular and fluctuate season wise in Maharashtra. It is the high temperature and dry climatic conditions of the region, which are conducive to the occurrence of these infections. In Bombyx mori, the worms become infected by both bacteria and viruses resulting in bacterial Flacherie and viral. Both Viral and Bacterial Flacherie are frequent and tend to develop in the hot and humid summer and autumn seasons (Lu Yup-Lian and Liu-Fuan, 1991 Mahesha et.al., 2009: Mahalingam et.al., 2010: Mahesha et.al., 2013: Li et.al., 2018).

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The prominent pathogens are Streptococci species and Staphylococci species which are responsible for bacterial Flacherie; along with there are Streptococcus faecalis, Streptococcus faecium as well as Bacillus thuringiensis. The bacteria usually go in through mouth along with the contaminated food into the gut and penetrate mid gut wall and make their way to body tissue and haemolymph. Once attacked the bacteria progressively multiplies in the host system causing specific metabolic changes together with related biochemical alteration in the affected body tissues. Such infections are reported to induce variety of biomolecular and physiological changes in insect tissues (Maratignoni, 1964: Shigematsu, 1969). Earlier studies (Kadoya et.al., 1984: Adolkar, 1990: Aboul-Ela, et al., 1991: Gillespie et al., 1997: Doreswamy, et al., 2004: Manohar Reddy 2004: Mahesha et.al., 2009: Mahalingam et.al., 2010: Mahesha et.al., 2013: Recently, Li et.al., 2018 too reported that infected diseases causing great many effects on bimolecular and physiological functioning of the diseased larvae of silkworm they also emphasized the importance of study of these diseases especially the effects are related to, the biochemical composition of body tissues, fluids and enzyme systems. Among antioxidant enzymes, Catalase (EC 1.11.1.6, CAT) is a ubiquitous antioxidant enzyme catalyses the breakdown of hydrogen peroxide into water and oxygen (Switala and Loewen, 2002).

Several organisms in addition to oxidative stress releases catalase to defend themselves against attacks by hydrogen peroxide which forms the host's immune system. Earlier studies demonstrated that a Catalase-deficient mutant infective organism was more susceptible than its wild-type strain to the oxidative stress promoted by H2O2 and immune cell attacks (which involve H2O2). Thus it may prove helpful in analysing the activity of Catalase of a pathogen,

and also to get a better knowledge of the basic mechanisms of their pathogenic actions, together with their resistance against oxidative stress. Catalase is known as a sole enzyme only accountable for the scavenger of Reactive Oxygen Species (ROS), playing an important part in the insect's innate immunity system.

Kumar and Nabizadeh et.al.,2010 studied the importance and level of changes in catalase activity in silkworm Bombyx mori under thermal stress condition. It triggers signal transduction and mediates variety of responses like cell growth and apoptosis. Reports (Felton and Summers, 1995) bring to light the function of Catalase activity in insects defence mechanisms. In the present paper we analysed the intensity of Catalase activity in non infected control silkworms Bombyx mori in comparison to infected silkworms Bombyx mori and will gain additional understanding about bacterial Flacherie-Silkworm relations.

MATERIAL AND METHODS

Larvae in their early infections with bacterial Flacherie collected from various local sericulture units in Akola district (Maharashtra) and rear on mulberry leaves in laboratory at standard ambient conditions. Infected larvae of 48, 72, 96, 120 and 144 hours after post collection, were homogenised and proceeded for estimation of Catalase enzyme activity by the method of Samuel and Bernard (1950) judge by the decrease if any in absorbance of Catalase enzyme at 240 nm subsequent to the decomposition of H2O2. 0.1g larva was extracted in pre-chilled pestle and mortar by using phosphate buffer (0.1M, pH 7.0). The sample was then centrifuged at 4oC at 10,000 rpm for 10 min. The reaction mixture was taken in the spectrophotometer sample cuvette with addition of 40µl of hydrogen peroxide substrate. The reaction was read on spectrophotometer at 240 nm. unit's mg-1 protein-1m1 was used for expression of Catalase activity (Havir and Mettale, 1987). Each time three replicates were used. Data were statically analysed for variance (ANOVA).

Table. 1: Temporal changes of Catalase activity inhealthy and Flacherie infected silkworm larvae.

Sr.No	Time Intervals	Control	Infected
1	At the time of collection	3.36 ±0.12c	2.33 ±8.8c
2	48h after collection	3.1 ±5.7d	2.1 ±5.7d
3	72h after collection	2.7 ±8.8e	1.83 ±6.0e
4	96h after collection	2.6 ± 2.0e	1.77 ±1.52ef
5	120h after collection	1.92 ±3.1f	1.61 ±4.0f
6	144h after collection	1.76 ±2.8g	0.57 ±5.5m

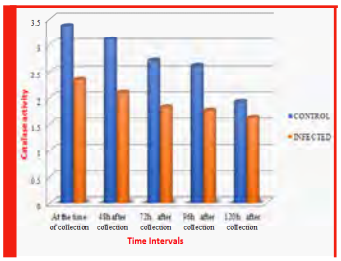

Fig. 1: Graphpical variation in Catalase activity during Flacherie infection in Silkworm

RESULTS AND DISCUSSION

Sluggish soft bodied larvae were identified as infected with Flacherie and are used to measure Catalase. Sohal et al., (1990): Orr and Sohal, (1992): Dudas and Arking (1995); Seslija et al., (1999): Nicolosi et al., (2013) reported that Catalase activity amplified with age and lowered during growth, in a many of insects. According to Nicolás et al., (1973) peroxisomal Catalase play a role in adaptation to oxidative stress developed during attack with pathogenic fungus. We however reported a lowering trends in infected groups at 24 and 48th hours post larval collection compared to control, whereas in the case of 72nd hours a marked decrease in Catalase activity reported as compared to control groups (Fig. 1 and Table I).

Shobha et al., (2015) too observed significant decreased activities of Catalase from haemolymph of a fungal infected silkworm as compared to control and supported what we reported during infection with pathogenic bacteria, causing Flacherie. Shobha et al., (2015) further documented that reduced Catalase activity may be responsible for gathering of H2O2 which is cytotoxic, and thus causing oxidative stress developed during pathogenic growth. The role of Catalase activity in defence mechanisms in insects was well documented by Xiaofeng et al., (1998) and has also been explained by Felton and Summers (1995). Jagadeesh Kumar and Nabizadeh (2010) too found alteration in level of Catalase activity in silkworm Bombyx mori L, under stress. Changes in Catalase activities during pathogenic infections as reported by these earlier reports and in the present findings, thus indicated that levels of Catalase enzyme might be used as a marker enzyme to study the stress caused by pathogenic organism in silkworm Bombyx mori in the sericulture rearing centres, at local level.

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Qualitative Analysis of Copepod In Fresh Water Ecosystem of Washim Region, Maharashtra, India.

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ABSTRACT

Zooplanktons are small, microscopic, free swimming animals in the freshwater column of oceans lakes and fresh water bodies. They act as a good source of food for many fishes. Zooplankton occurrence and distribution influence pelagic fishery potential. Copepods are small crustaceans living in the aquatic ecosystem. The present analysis carried out to understand the copepod community structure in Washim district, Maharashtra, India. The present work was carried out for the period of the five months that is from August 2018 to December 2018 around in Washim region. Four sampling sites were selected to study the copepod of Washim region which include Padmatirtha Talav, Dev Talav, Adol Dam and Narayan baba Talav. During the study 9 species of copepods were identified belonging to 2 different classes that are Maxillopoda and Hexanauplia, 5 orders and 5 families. Copepods are the indicator of water quality and form a major part of natural diet for different aquatic organisms. Nine different species of Copepods were identified during the present study, a more detailed account of it is important to study the diverse fauna of copepods in fresh water bodies of Washim region.

KEY WORDS: Copepod, Qualitative, Washim, Water.

INTRODUCTION

Plankton are organisms found in sea, oceans and fresh water bodies.The term “plankton is a microscopic, free floating organism with the oceanic current and many other bodies of water.The zooplankton are small microscopic organisms that act as primary and secondary links in the food webs of all aquatic ecosystems. Zooplanktons are main significant indicator of water potential. Zooplankton diversity is one of the most important ecological parameters in water quality assessment, Singh and Talpade (2018). Copepods constitute the most important zooplankton species. It is originated in the marine environment. Copepods have a larval form, some species are a planktonic, benthic and some continental species may live in aquatic habitats. Copepods are the most numerous metazoans on the earth, Turner (2004). Most freshwater copepods are free-living, but they have adopted parasitism in numerous independent lineages and Defaye (2008). They have also successfully colonized all salinity regimes from marine, freshwater and hypersaline inland water, Boxshell and Jaume (2000 Abbasi et al 2017).They commonly resides in still water habitats such as lakes, pond, river and wetland.Copepods feed mostly on algae, small particles of detritus and bacteria. However, some large species consume other zooplankton as well. The feeding mechanism of the nauplius larva differs considerably from that of the adult copepod, Singh and Talpade (2018).

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Copepod develops into an adult stage by passing through a series of nauplius. They found in almost all freshwater habitats. Copepods vary in size from 0.3 mm to 18.0mm. The anterior part of the body is broad and bears jointed appendages whereas the posterior part ends in a fork. Almost all marine copepods have largely or entirely vitreous body while alive, Huys and Boxshell (1991).Body of copepod is short and cylindrical in shape. Head is usually rounded though a few species have a rostrum.It is composed of head, thorax and abdomen. The thorax is divided into about six segments, each segment is connected to two appendages. Copepods have a single median compound eye. It is ecologically importance copepods have been used for the bioassay of toxins in water. They are a diverse

assemblage dominating meso-zooplankton community (Strickler et al., (1982). Copepods occupy main significant intermediate position in an aquatic food chains are usually omnivorous in habitat.It is wind variety of food have been found in the copepod such as algae, bacteria, pollen and detritus.

Lin et al. (2013) studied the copepod community growth rates in relation to body size, temperature, and food availability in the East China Sea a test of metabolic theory of ecology. Hsieh et al. (2004) worked on copepods variety and composition from North Taiwan and they carried out during the waning of the north monsoonat. Abdal-Aziz et al. (2007) studied the qualitative and quantitative study of copepods in demietta harbor, Egypt and the cluster analysis demonstrated different types of association between copepods species, while Shannon-Weaver Diversity index reflects relativelypronounced changes in biodiversity of the copepodcommunity.Ravichandran and Jeyam (2014) analyzed copepods from few freshwater bodies of peri-urban area of South Chennai, carried out to study the occurrence of copepods on per with our regular field survey. Few freshwater bodies have been identified as the source of collection initiated from December 2013onwards.

Abbasi et al. (2017) conducted the quantity, distribution and other characteristics of the copepods in Monora and they investigated two major groups of zooplanktons that is Herpact and cyclopoid. Heuschele and Selander (2014) noticed the ecological importance of copepods in lake. They suggested the importance of copepods in pelagic ecosystem.Copepods are economically and ecologically important group of zooplankton. And the free living copepodsare intensively studied because of their impact as key players in the marine pelagic environment. Zooplanktons play a most important role in aquatic food webs, as a resource for consumer on higher trophic level. Present study was carried out to investigate the copepods fauna of some water bodies around Washim region.


PadmatirthaTalav


DevTalav


Narayan Baba Talav


Adol Dam

Photo-plate I: Copepods Sampling sites of Washim region

MATERIAL AND METHODS

Sites: Following sites in the Washim district were studied for the qualitative analysis of copepods. The sites included were PadmatirthaTalav, DevTalav, Narayan Baba Talav, Adol Dam, Nagartas, Keli Dam and R.A. College Pond.

For the qualitative estimation of zooplankton, a proper collection method was necessary. For this purpose, standard methods given by Clesceriet al.(1998, 2006, 2008)in APHAwere used. The sampling was carried out during the August 2018 to December 2018. Different method sampling collection of zooplankton copepod such as net method. During present study towing method was used to collect copepod from the sampling sites.The zooplankton collection primarily involves the filtration by net, collecting the water in bottles. The sample collection largely depends upon the selection of a suitable gear, mesh size of netting material, time of collection, water depth of the study area and sampling strategy. The samples were collected from only those directions which were possible for collection. Net with a mesh size of 25µ was used for sample collection. The netting was done for about for 10 minutes for qualitative analysis. The sample were added with 4% formalin and 2-3 drops of glycerin and detergent.The labels included name of the site, site of the sampling location, date of sampling and the time of sampling.

Identification was carried out by studying PhD thesis of Solanke (2015).The identification was done by comparing photographs with the help of identification keysthat, fresh water zooplankton copepods, https://www.reserchagate.net and research paper of Datta S. (2009). Identification of zooplankton species was carried


Tropocyclops Prassinusmexicanus


Cyclops strennus


Bryocamptushutchisoni


Mesocyclops inversus


Diaptomus minutus


Calanoid copepod


Harpacticoida


Egrasilous Chautauquaensis


Nauplius Cyclops

PhotoplateII: Copepods species around Washim region

Table 1: Record of Copepods in Washim Region

Sr no.	Phylum	Class	Order	Family	Genus	Species
1	Arthropoda	Maxillopoda	Cyclopoida	Cyclopidae	*Tropocyclops*	*Tropocyclops prasinus*
2	Arthropoda	Maxillopoda	Cyclopoida	Cyclopidae	*Cyclops*	*Cyclops Strenuus*
3	Arthropoda	Maxillopoda	Harpacticoida	Canthocamptidae	*Bryocamptus*	*Bryocamptushutchinsoni*
4	Arthropoda	Maxillopoda	Cyclapoida	Cyclopidae	*Mesocyclops*	*Mesocyclopsinvaersus*
5	Arthropoda	Maxillopoda	Calanoida	Diaptomidae	*Diaptomus*	*Diaptomusminutus*
6	Arthropoda	Maxillopoda	Cyclopoida	Cyclopidae	*Cyclops*	*Cyclops*
7	Arthropoda	Hexanauplia	Harpacticoida	Harpacticidae	-	*Harpacticoid*
8	Arthropoda	Maxillopoda	Poecilostomatoida	Ergasilidae	*Ergasilus*	*Ergasilus Chautauquaensis*
9	Arthropoda	Maxillopoda	Calanoida	Calanidae	*Calanus*	-

out by standard literature of Dhanpati (2000) with the help of taxonomic keys of Adbus and Altaff (1995).

RESULTS AND DISCUSSION

The present study was carried out on qualitative analysis of zooplankton copepod around washim district Maharashtra, for the period of five month that is from August 2018 to December 2018.The present work was carried out on four sites in the Washim district of Maharashtra, India namely Padmatirtha Talav, Dev Talav, Narayan Baba Talav and Adol Dam. These sites were studied for the diversity of copepod species. Thecopepods observed in the study region of washim district were presented in the photo-plate I with their detail taxonomy table I. A total of 9 copepods belonging to 2 different classes, 5 families and 5 orders were observed during the study period. The detail classification of copepod species is mentioned in table I. Zooplankton play an important role in secondary production of aquatic ecosystem and occupy an intermediated position in the food chain by transferring energy from lower trophic level to higher trophic level. Many factors affect the population dynamics of zooplankton such as light, intensity, food availability, dissolved oxygen level and predations.

Solanke and Dabhade (2016) studied the copepod communities in the Upper Morna reservoir, Medshi of taluka Malegaon, district Washim, Maharashtra, India Boxshall and Defaye (2008) Studied the zoogeographical distribution of the 2,814 species copepods reported from freshwater are analysed. Hedayati et. al., (2017) Conducted their work to study seasonal variations in abundance diversity of copepod in mond River estuary, Bushehr, Persian Gulf. In their result they observed that copepod assemblages were comprise of 4 orders 13 families, and 10 genera. Order were included, Calanoid, Cyclopoida, Poecilostomatoid, Harpacticoida and Genera were included. Krsinic and Grbec (2012) studied the spatial distribution of copepod abundance in the epipelagic layer of the south Adriatic Sea. Ingole et. al., (2016) Carried out their work on seasonal study of zooplanktons qualitative and quantitative analysis in Bhiwapur Lake district Nagpur M. S India. The result shows that it is good source for aquaculture.

CONCLUSION

The small copepods are most important link in fresh water bodies' food webs. The result of the present study highlighted that the copepods are found in Washim region are nine species belonging to eight genera.

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Isolation of Microbes Associated with Biofilm Formation on Removable Partial Denture (RPD) and Oral Hygiene Regimen for RPD Patients

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ABSTRACT

Biofilm microorganisms are associated with intermittent persistent oral infections and are substantially resistant to antimicrobial agent. It has been noted that more than 600 different types of bacteria are present in oral cavity which causes biofilm formation. Some are S. mutans, P. aeruginosa, S.aureus, E.coli, B.subtilis. These bacteria encounter foremost troubles such as dental caries and loss of teeth. Biofilm formed swab sample was collected of 30 patients by using swabbing technique and bacteriological examination was carried out. The isolates were recognized by standard microbiological procedure. By TM and CRA method, Biofilm detection was carried out. By Kirby-Bauer disc diffusion technique, antibiotic susceptibility was performed. TM method shows biofilm formation inside the tube and on CRA medium black colored colonies were observed by biofilm producing organism. We can conclude that S.mutans, P.aeruginosa is highly, S.aureus is moderately and E.coli is weakly responsible for biofilm formation while B. subtilis is non – biofilm producer. These organisms show susceptibility to various antibiotics.

KEY WORDS: Oral Flora, Biofilm, Antibiotic Susceptibility Test

INTRODUCTION

The Microbial multiplicity in buccal cavity is among the biggest surface as characterized in human body. By precise attention is the dental biofilm, which forms initial selective adsorption of bacteria from saliva onto tooth surface.The aggregate of microorganisms reside on the surface and in deep layers of skin, saliva, oral mucosa as well as in conjunctiva and in gastrointestinal tracts. The microflora existing in oral cavity is called oral micro flora. One of the commonly encountered problems in dentistry is loss of teeth and consequential replacement. Along with the restoration of function and aesthetic, removable prosthesis may change the oral ecology either qualitatively or quantitatively, such as increasing the total amount of oral microorganisms, (Azizah AL Mobereek, 2003 Heller et al, 2015).

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Oral microbiology is the study of microorganism of the oral cavity and their interaction between oral microorganisms or with the host (Stewart et al, 2001). The environment present in mouth allows the organism to grow there. The health of our mouth mirrors the condition of our whole body. For example, if our mouth is healthy, chances of our overall health is good too. On the other hand destitute oral health may lead to many oral problems such as formation of biofilm, dental caries, oral and facial pain, problems with the heart and other major organs, digestion problems and periodontal diseases. Oral cavity is a great habitat with a stable induction and removal of microbes with nutrients. These opportunistic human pathogens colonize at several anatomically distinct surface of human body, mainly in warm and moist areas such as oral cavity. As these are opportunistic pathogens they cause various dental problems such as formation of biofilm, dental plaque, dental caries and periodontal diseases (Marsh 2006). Periodontitis is frequent health difficulty caused by pathogenic biofilm forming bacteria that accelerates inflammation resulting in either reversible gingivitis or severe periodontal damage, leading to loss of healthy tooth, (Gutt et al, 2018).

Biofilm have been concerned as the main source of etiopathogenesis of dental caries and associated diseases. However biofilm can

be removed by regular oral hygiene aids or specialized dental instruments, they have the capacity to set into dental calculus making their taking away too difficult. Consequently, these biofilms establish a great challenge to the dental practitioner in the control and suppression of biofilm associated periodontal diseases.Biofilms are totally well known concept. In the prior decades of evolutionary microbiology, Antony Von Leeuwenhoek who invented microscope was the first to observe microbial aggregates, which are now known as Biofilms, in scrapings of plaque from his own teeth. The term 'Biofilm' was coined by Bill Costerton in 1978. Wilderer & Charaklis (1989) discussed about the reasonably vague microbial community linked with a tooth surface or any other hard non-shedding material, erratically scattered in a shaped matrix or glycocalyx (Socransky 2002). Biofilm is classified into two groups on the basis of the position, mainly Supragingival- which show aggregation lying on coronal to the gingival margin and Sub gingival-which is present apical to the gingival margin (Ximenez-Fyvie 2000). Whereas, on the basis of pathogenicity it is divided into Cariogenic- which generally includes acidogenic and gram positive type of microbial flora and Periopathogenic- commonly includes basophilic and gram negative type of microbial flora.

Dental caries is the localized destruction of dental hard tissue by acidic by products from dental plaque containing acid producing bacteria. Establishment of a biofilm is a multifaceted progression that follows more than a few distinctive phases, commencing with adsorption on to the tooth surface of a habituation film derived from bacterial and host molecules finally results into tooth outbreak or tooth cleanout. This aggregation is followed by passive transport of bacteria regulated by feeble long-range forces of attraction. Irreversible attachment occurs due to strong and weak forces created by covalent and hydrogen bonds. Biofilms possess several properties like they are ubiquitous and form on almost all surfaces engrossed in ordinary aqueous environments. Biofilm confers assured properties to bacteria that are not usually found in the planktonic condition, this justifies credit of dental plaque as a biofilm, (Yu O et al, 2017).

Antibiotic resistance is one of the principal intimidations to worldwide health food security and development. By alterations of bacterial genes in response to use excess medicine or antibiotic drug, antibiotic resistivity get occurred finally resistant get developed and these bacteria possibly will infect human and resistant bacteria infection caused which are difficult to treat than sensitive bacteria (Guidelines by WHO). Day by day Antibiotic resistance is emerges rapidly at very high level in all parts of world. For that reason to avoid and manage the extend antibiotic resistance in diverse species of microbes, health professional can only distribute to local antibiotic in specific cases, by following the guideline given by WHO. Hence the scope of present study is to cure oral infection that arises due to RPD/CD those are treated with application of oral depositors (antibiotic) RPD in wearer patients.Causes of Biofilm Formation:- There are several causes of biofilm formation which are, due to improper oral hygiene, due to deposition of food particles onto the teeth.Biofilm Associated Infectious Diseases:-Biofilms are associated with various microbial infections (by one estimate 80% of all infections). These commonly include dental caries, necrotizing fasciitis, biliary tract infection, osteomyelitis, bacterial prostatitis, native valve endocarditis, periodontal disease, otitis media, musculoskeletal infections, meloidosis, cystic fibrosis pneumonia and peri- implantitis. Significant characteristics of these infections are perseverance and chronicity (Socransky et al, 2002).

Periodontal Biofilms and treatment aids:-In dentistry, for particular disease there is appropriate treatment that facilities for every spot in each patient. Individually we must focus on treatment planning. There is a need to focus on biofilm control which is essential for the repair of oral healthiness and for avoidance of dental caries, gingivitis and periodontitis. Oral Biofilms and potential controlling aids:-One can control biofilm formation by inhibiting bacterial colonization, by changing of plaque biochemistry and Alteration of plaque natural balance by controlling bacterial growth and metabolism, Interruption of recognized plaque.

Clinical Approaches

- Involuntary Plaque controlling methods: - We should clean our tooth by dental floss, wooden tips, various perio-aids, fine brushes, Rubber tip, Oral irrigation devices, Tooth brushes- Manual as well as Electrical.
- Chemically Plaque Controlling method:-
- We can use various enzymes like Mucinase, Dehydrated pancrease, Lactoperoxidase, hypothiocyanate.
- And Antibiotics can applied whenever necessary like Penicillin, Vancomycin, Erythromycin, augmentin, (Quiryen et al, 2006).

Removable Partial Denture (RPD):A removable partial denture (RPD) is predominantly used in a partially edentulous patient who needs to have replacement teeth for functional or artistic reasons and who cannot have a bridge (a fixed partial denture) for any reason, such as a lack of required teeth to serve as support for a bridge (i.e. distal abutments) or financial limitations. This type of prosthesis is referred to as a removable partial denture because patients can remove and reinsert it when required without professional help. Conversely, a "fixed" prosthesis can and should be removed only by a dental professional.

Role of RPD in protection of teeth

It allows more rapid placement of denture and allows natural tooth position to be duplicated. It also allows teeth position to be altered and permits a test period for change in the tooth position before definitive RPD are made like its appearance, space maintenance, as a vehicle for tissue treatment material. Diseases related to oral

cavity:-Dental caries, Gingivitis, Periodontitis, Thrush, Chipped tooth, Teeth grinding, Darkened teeth, Dental plaque. Oral hygiene regimen for patients who wear an RPD:-Taking measures to keep your mouth clean is essential for excellent dental health. A daily oral hygiene regimen is needed to remove the dental plaque that causes tooth decay and gum diseases. A good oral hygiene not only helps to prevent cavities, but it is necessary to battle bad breath. Practicing good oral hygiene can reduce the chances of developing complications or illness from dental diseases and could prevent the need for a costly gum diseases treatment by brushing, flossing, mouth wash, diet, professional techniques. Control of biofilm formation on RPD:-Brushin teeth and all mouth prosthesis or appliances to mechanically disrupts the biofilm. Choosing toothpaste containing antibacterial ingredients such as triclosan and rinsing ones mouth with a mouthwash containing antibacterial ingredients, such as chlorohexidine, celytpiridoinium chloride, or mixture of essential oils in alcohol works better. Soaking the prosthesis with a commercially available cleaner and if the denture line is cracked, porous or peeling, getting it repaired helps to eliminate unwanted organisms.

MATERIAL AND METHODS

This study was a laboratory based experiment which was done to isolate and identify biofilm forming bacteria and evaluates different methods of detection of biofilm formation on the removable partial denture (RPD)This experiment was carried out adopting the following materials and methods. Sample Inoculation:-The samples of 30 patients were collected from prosthodontics clinic of Akola city. Complete history and examination was performed for the study of common oral micro flora and further study of oral depositors. All patients with denture RPD/CD was subjected to bacteriological examination. Biofilm formed swab samples were collected in sterilized test tubes and the bacteria were isolated and identified in laboratory.

Media: Nutrient broth, Nutrient agar, Baired -Parker agar, EMB agar, MacConkey agar, Pseudomonas agar were used as a culture media for all the bacterial species used in this study. Biochemical studies of all isolates were carried out using media such as Trypton broth, Glucose- Phosphate broth, Citrate agar for IMViC classification and various sugars for sugar fermentation. Biofilm detection was carried out using Trypticase -Soy broth, Congo red agar medium, Brain heart infusion agar. Antibiotic susceptibility was done by using Mueller- Hinton agar.

Morphological Studies:The color of colonies were observed directly with naked eye, Gram characteristics were observed by performing Gram staining and morphological characteristics were observed under microscope.Isolation of Microorganism from Oral Cavity:-As mentioned earlier the samples of 30 patients were collected from prosthodontics clinic of Akola city. Complete history and examination was performed for the study of common oral micro flora and further study of oral depositors. All patients with denture RPD/CD was subjected to bacteriological examination. The biofilm formed swab samples were inoculated on petri plate containing different media's and incubated at 37 °c for 24 hrs. Biochemical Test:-Isolated organism was confirmed by studying their biochemical characteristics. For this IMViC classification was done and sugar fermentation was studied. Methods of Detection of Biofilm Formation:-It was complete by using various methods such as Tube method(TM), Congo red agar medium (CRA) test.

Tube Method

Christensen et al (1982) described that this is a qualitative method for biofilm detection. In 10 ml trypticase soy broth a loopful of test organism is gets inoculated with 1 % glucose solution in test tube. Then tubes were incubated at 37 °c for 24 hrs. After incubation tubes were decanted and washed with phosphate saline buffer (pH 7.3) and allow to air dry more over tubes were stained with Crystal Violates (0.1%) And excess stain was washed with deionized water. Tubes were dried in inverted position and biofilm formation was observed by observing a film lined on the wall as well as to the bottom of test tube.

Congo Red Agar Medium (CRA) Test

Freeman et al (1989) have described a simple qualitative method by using CRA. By preparing Congo red stain in a concentrated aqueous solution and allow to autoclaved at 121°c for 15 min separately from the other constituent. Then autoclaved Brain heart infusion agar was added to it with sucrose at 55°c. After proper mixing CRA plates were prepared and inoculated with test organism and incubated at 37°c for 24 hrs. aerobically. After incubation period black colonies with dry crystalline consistency were found which indicated production of biofilm. Antibiotics Susceptibility Test Was Performed By Using Kirby- Baur Disc Diffusion Method: Preparation of Plates:-Freshly prepared nutrient broth was used in which inoculation of test organism was done and incubated at 37°c for 3 hrs. Mueller Hinton agar plates were prepared and inoculated with test organisms by uniform swabbing method with the help of sterile swab and then octadisc of antibiotics is kept onto the inoculated MHA plates. The plates were inoculated at 37 °c for 24 hrs. in straight position(Baur et al 1966).

RESULTS AND DISCUSSION

The present study was conducted in the period of September 2017 to March 2018. Total 30 biofilm formed swab sample were collected from different RPD patients of different age groups from the prosthodontics clinics of Akola city. The purpose of this present investigation deals with the evaluation of biofilm forming bacteria from the removable partial denture (RPD) patients and evaluation of different methods for the detection of biofilm formation by the organisms.

Sample Characteristics:- Table 1.1 illustrates the distribution of sample according to Age, Sex, and And Type of Prosthesis. Age range of patients was 31-80 years. Mean age was 50.70 years and mode was 40 years. It was found that 76.7% females and 23.3% males were carrier of prosthesis. Almost 70% of the patients were receiving Removable Partial Denture (RPD), while, 30% of the patients were receiving Complete Denture (CD). There was age range majority of patients 41-60 was 60.1% while 31-40 years and above 80 was nearly 40%.

Microbiological Findings

Table 1.2 illustrates the distribution of predominantly cultured oral flora by the type of prosthesis. The microorganisms isolated from the samples were *Streptococcus mutans, Pseudomonas aeruginosa, Staphylococcus aureus, Escherichia coli, Bacillus subtilis. The streptococcus mutans (26.7%) was the most cultivated* microorganism particularly among the partial dentures. A wide variety of the predominantly cultured bacterial strain were found among females some strain were mostly cultured from female including *Streptococcus mutans and Staphylococcus aureus*.The results of this study revealed highest load of *S.mutans followed by S. aureus, P. aeruginosa, E. coli and B. subtilis* present in the biofilm formed on the surface of RPD/ CD patient. From the above observation it was observed that from these samples we have isolated these bacteria which were responsible for the biofilm formation on Removable Partial Denture. These bacteria were confirmed by studying their cultural and morphological characteristics.

After identifying the bacteria we had checked for their biofilm forming ability. Biofilm formation was checked out by using two different methods which are Tube method(TM) and Congo red agar media (CRA). These two methods showed the qualitative estimation of bacteria responsible for the formation of biofilm onto the surface of RPD/CD patients. Table 1.4 showed that except B.subtilis all bacteria were responsible for biofilm formation on the surface of RPD/CD patients. From these the tube methods shows the dark or thick layer of biofilm formed inside the tube by the bacteria which were biofilm producer and it was stained by using 0.1% crystal violet stain, while the organisms which were non biofilm producer formed the light or thin layer inside the tubes. From these tube method we can qualitatively estimates the bacteria those were biofilm producer and non- biofilm producer.

Table. 1.1: Distribution of sample according to Age, Sex, and Type of Prosthesis

Age Group of Patients	Sex		Type		Total %
	Female No	Male No	RPD	CD	
31-40	4(13.3)	3(10)	5(16.7)	2(6.6)	7(23.3)
41-50	8(26.7)	2(6.7)	7(23.3)	3(10)	10(33.4)
51-60	8(26.7)	--	5(16.7)	3(10)	8(26.7)
61-70	3(10)	1(3.3)	3(10)	1(3.3)	4(13.3)
71-80	--	1(3.3)	1(3.33)	-	1(3.3)
TOTAL	23(76.7)	7(23.3)	21(70)	9(30)	30(100)

Further Table 1.4 illustrate that S.mutansis strongly biofilm producer as it produces thick biofilm layer inside the tube followed by S.aureus, P.aeruginosa. While E.coli is weakly biofilm producer and B.subtilisis non biofilm producer as it does not formed any layer inside the tube. It was further confirmed by another method i.e is congo red agar method which gives qualitative estimation of biofilm formation by showing the black coloured colonies onto the congo red agar medium if the bacteria was biofilm producer and it showed red color colonies if the bacteria was non biofilm producer. Table 4.1showed the bacteria that strongly responsible for biofilm formation were S. mutants > P. aeruginosa > S. aureus > E.coli. while B. subtilis was non biofilm producer.

On Mueller Hinton Agar the antibiotic susceptibility test of biofilm producing bacteria was done using the variety of antibiotic. By using Kirby-Bauer disc diffusion technique, an antibiotic susceptibility test was performed according to CLSI guidelines. Microorganisms developing in a biofilm are fundamentally more resistant to antimicrobial agents than planktonic cells. To inactivate organisms growing in a biofilm high antimicrobial concentration are necessary, as antibiotic resistance can enhance 1,000 times (Socransky & Haffajee, 2002). Higher antibiotics resistance in biofilm producing bacteria than non- biofilm producers were observed during study. Maintenance of good oral hygiene is the key to the prevention of dental diseases. The primary etiological factor for dental diseases is dental plaque. The formation of plaque on the tooth surface is characterized by the progression from a limited number of microbial species to the complex flora of mature dental plaque. This progression involves initial adherence of bacteria to the salivary pellicle and subsequent accumulation by growth and interbacterial adherence. Ultimately, that ends up in the destruction of hard enamel tissue.Biofilm producing bacteria are accountable for numerous unmanageable infections and are disreputably complicated to eliminate. Various methods for biofilm detection is there. In this study we evaluated 30 isolates by three screening methods for their capability to developed biofilms. The TM method and CRA method were used for the detection of biofilm formation. The result of this study showed that TM cannot be compulsory for general screening test to recognize biofilm forming bacteria.

In another study (Freeman et al 1989), distinguished that out of 147 isolates of S. epidermidis, by TM method ,79 (53.7%) biofilm

Table 1.3: Distribution of predominantly cultured oral flora by age

Microorganism	Age of Patients					Total
	31-40	41-50	51-60	61-70	71-80	
Streptococcus mutans	3	4	2	-	1	10
Pseudomonas aeruginosa	-	2	2	1	-	5
Staphylococcus aureus	1	3	1	2	1	8
Escherichia coli	-	2	1	-	1	4
Bacillus subtilis	-	-	2	1	-	3
Total	4	11	8	4	3	30

formation is detected and 64 (43.5%) was detected by CRA method. They found that TM is superior for biofilm recognition than CRA. TM is used to detect biofilm formation among uropathogens (Baqai et al 2008). According to their findings, 75% of the isolates exhibited biofilm formation (Ruzicka et al 2004). The CRA method showed minute association with the other methods as well as parameters of sensitivity (11%), specificity (92%) and accuracy (41%) were very low. Three isolates were found to be false positive and 62 were false negative11 by this method, therefore CRA method for biofilm detection in their study did not suggested. CRA detected only 3.8% out of 128 isolates of S. aureus as biofilm producers as compared to TCP which detected 57.1%.

Biomechanical factors are considered for dental treatment, in prior to give values like firmness and preservation. On the other hand, RPD planning cannot be paying attention simply on mechanical concerns, since this will not assured an unbeaten result. The journalism undoubtedly emphasizes the necessity to judge basic ethics of RPD design and conserve the oral structures; to enhance the stability uses of bars and connectors can be done. On the other hand, the RPD design should keep away from food accumulation and biofilm formation. At what time successful biomechanical values can be recognized some bars and connectors can be detached or customized with the purpose of avoid minute retentive places close to abutment teeth.

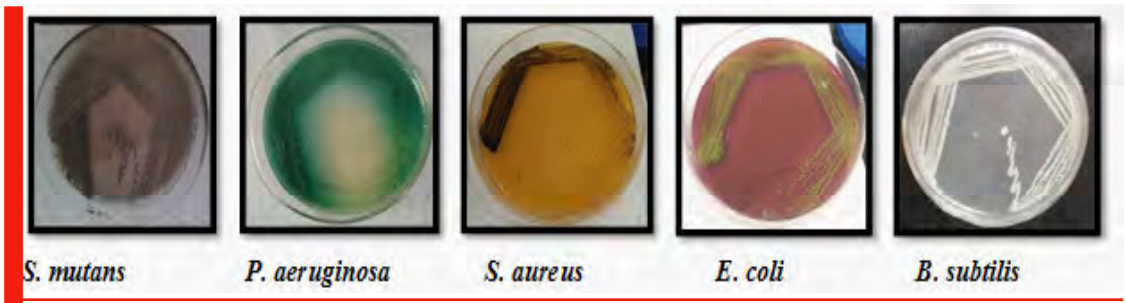

Fig. 1.1: Colonies on Selective Media

(a): Tube Method

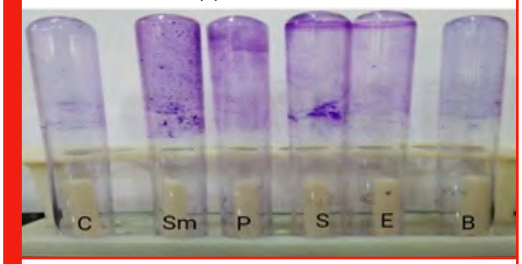

Fig. 1.2: Methods for Detection Of Biofilm Formation

Prevention must be integrated into the patient's daily routine. By taking into consideration that the tough involvement between the use of RPDs with biofilm accumulation and caries. Oral sanitation concerns must be included into the action plan. It is obvious that notice to the protective aspect of RPD treatment must contain

(b): Congo Red Agar Method

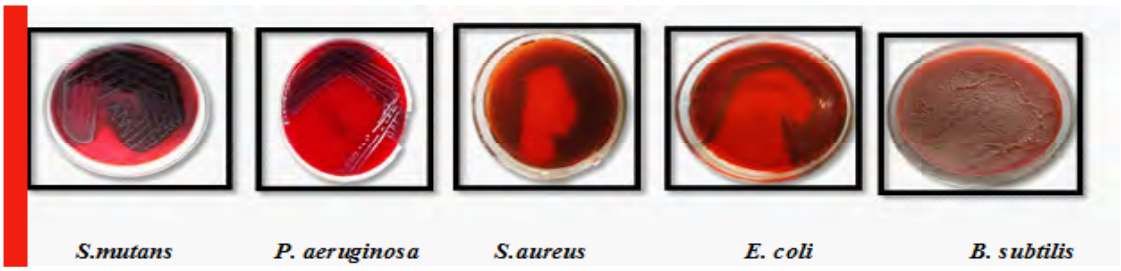

Table 1.4: Inspection of Bacteria for Biofilm Formation By Tube Method And Congo Red Agar Medium and their antibiotic susceptibility test

Organism	Biofilm producer	Tube Method	Congo Red Agar Medium	Sensitivity To Antibiotics
S.mutans	Biofilm producer	+ ve	Black colonies formed	Chloramphenicol, Ciprofloxacin, Norfloxacin Gentamycin
P.aeruginosa	Biofilm producer	+ ve	Black colonies formed	Colistin, Gentamycin
S.aureus	Biofilm producer	+ ve	Black colonies formed	Norfloxacin, Nitrofurantoin, Co- trimoxazole, Doxycycline, Vancomycine, Azithromycin
E. coli	Biofilm producer	+ ve	Black colonies formed	Nitrofurantoin, Ampicillin, Gentamycin, Cephalexin Trimethoprin, Nalidixic acid, Ciprofloxacin, Augmentin
B.subtilis	Non - Biofilm producer	--ve	Red colonies formed	Colistin, Gentamycin, Cephradine, Co-Trimoxazole, Tetracycline, Ampicillin, Ceftriaxone

more than periodic check-ups. It was confirmed in a study that S.mutans levels in saliva increased drastically 48 days after prosthesis placement, with levels above 106 CUF/mL of saliva. RPD users repeatedly have complexity removing the biofilm, even under instruction and after being instructed in the accurate use of a toothbrush and dental floss. Even if the importance of an effective oral hygiene regimen is stressed, certain RPD patients remain at risk for biofilm buildup and the progress of caries and periodontal disease. Included there are those who are ill or physically weakened. For those patients, the assistance of a second person home health aide may be needed.

The biofilm buildup and caries index are directed by the addition to in hard surfaces in the mouth subsequent placement of an RPD. As illustrious formerly, there is an enhancement in microorganism-retentive areas with the attendance of an oral prosthesis, purposely the acrylic resin base and metallic structure of the RPD. Additionaly, the high intake of fermentable carbohydrates can direct to an increased caries occurrence. By means of a diet diary, it is observed that RPD patients had greater sugar uptake in addition that improper consumption of meals can make it complicated to control biofilm a accretion by standard methods(Quirynen et al 2006, pp134-69).The results of this study revealed that a fairly considerable change in oral flora does occur following the insertion of a removable prosthesis. This is very well acknowledged in the literature, and is of a particular concern since oral ecology preservation is essential to maintain oral health. This change however is not universal; rather it occurs among some of the patients. Host and properties of the mouth are all internal factors that may cause changes in the oral ecology. Those factors may include susceptibility to a particular bacterial strain, pH and nutrients available, material, type and design of the prosthesis and oral hygiene. Changes in oral ecology may affect oral health adversely. Thus it is imperative that factors such as the effect of the introduction of any appliances is investigated and

evaluated. This is to assure and maintain a healthy oral function and environment. Clinically, one should attempt to monitor such changes. Further studies are indicated to ascertain the changes and assist its clinical effects, management and prevention (Addy & Bates 1979).

CONCLUSION

Dental biofilm is a complex, organized microbial community that is the primary etiologic factor for the most frequently occurring oral diseases, dental caries, biofilm formation and periodontal diseases. Although the dental biofilm cannot be eliminated, it can be controlled with comprehensive mechanical and chemotherapeutic oral hygiene practices. Although additional research is needed, there is the possibility that these cost-effective, preventive strategies may minimize the effect of periodontal diseases on specific systemic conditions. Within the limitation of this study, it is concluded that the ecology may encounter some changes after the introduction of a removable prosthesis. These changes though minimal but may provoke some clinivcal changes such as denture stomatitis. Follow up visits, together with other factors such as elimination of surface roughness; trauma and dietary advices may assist in the elimination of some clinical complications after prosthesis insertion. RPD users can be measured at high jeopardy for enlargement of caries and related periodontal disease. Dental professionals must educate these patients and encourage them to maintain periodic recalls. RPD patients may possibly not be capable to keep appropriate oral hygiene due to higher age, physical disabilities or poor motivation. Additionaly, prophylactic measures including the submission of a chlorhexidine gel should be adopted by RPD patients in order to maintain a hale and hearty mouth.From the 30 different sample it was found that the bacteria which were qualitatively enumerates as strongly responsible for the biofilm formation on RPD were S.mutans>P.aeruginosa>S.aureus>E.coli>B.subtilis.These organisms get accumulated onto the tooth surface and formed the yellowish color layer on the surface of tooth which is known as biofilm. This is due to improper oral hygiene. From the study we can conclude that to avoid biofilm formation and diseases related to oral cavity one must maintain proper oral hygiene. By this study we can conclude that TM and CRA were the two methods which are used for the qualitative estimation of biofilm formation. Also we can conclude that there were changes in the number of microbial flora present before and after the insertion of prosthesis. We have experiential higher antibiotics resistance in biofilm forming bacteria than in non-biofilm producers.

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Impact of Zinc Sulphate on Gills of Fish *Ophiocephalus punctatus*

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ABSTRACT

Due to the fast industrialization and urbanization, the river pollution in India has reached to peak of threshold limits. The continuous discharge of effluent containing heavy metals and their compounds at an unprecedented and constantly increasing rate, even below permissible level from various industries into aquatic bodies may result in accumulation and subsequent magnification up to dangerous level due to their toxicity, non- degradable nature and solubility in water. Heavy metals enter in the organism through food chain. It causes disorder in the aquatic ecosystem which leads to effect on aquatic life. In the present paper investigation was undertaken to study the effect of zinc sulphate on gills of the fresh water fish Ophiocephalus punctatus. The toxicity of zinc even at sublethal level causes drastic changes in the gill histology. The estimated protein concentration increased, whereas, glycogen and lipid content were found to be reduced in the gills during the exposure periods.

KEY WORDS: Gills, Glycogen, Lipid, Protein, Zinc.

INTRODUCTION

Zinc enters in aquatic habitats through various ways. Zinc is one of the essential elements required by aquatic animal like fish. But, if enters in body more than requirement, it becomes harmful and may adversely affect the behaviour and physiology of organism (Kumar 2015). Zinc is an essential and beneficial element in human metabolism. Zinc in traces is essential to sustain biological processes such as optimum body growth, development, reproduction and as immune stimulant. It's presence is essential for smooth working of various important enzymes like DNA and RNA polymerase, reverse transcriptase, alcohol dehydrogenase, sarbitol dehydrogenase, glucose -6- dehydrogenase etc. Its deficiency leads to retardation of growth, chronic renal disease, oligospermia, cessation of estrous and menstrual cycle in mammals (Sawarkar 2017).

It is required in very little quantity for normal growth and functioning of the aquatic organisms like fish. But, if consumed in excess amount, Zinc starts to accumulate in different organs of fish (Nussey 2000). Toxicity of the heavy metals causes morphological and biochemical alterations in the aquatic organisms (Elaiyaraja 2018). The excessive zinc from the environment may enter into the fish body through nutrients, general body surface and gills. Gills are first organs which are affected by this toxicant. Zinc is mostly found in nature as the sulphide.

MATERIAL AND METHODS

The fish, *Ophiocephalus punctatus*, common air breathing fresh water teleost, which are locally priced as food fish and abundant in various lakes near Amravati (Maharashtra state in India) were used in the present study. Fish weighing 20-25 gm and between 10-12 cm in length were purchased from local fish market. The fish were treated with 0.1% solution for 1 to 2 minutes to clear any dermal infection. They were maintained under laboratory condition in aquarium for acclimatizing them for seven days. They were fed with commercial feed. The water in the aquarium is changed daily to remove detritus.

a) Water used - Water used throughout experiment was aged tap water. The physiochemical parameters of aged tap water were determined periodically (Table 1) as per standard method for

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examination of water and waste water (APHA, 1998). The same water also served a control medium throughout the experiment.
b) Test Toxicant - Zinc sulphate, a salt of zinc was used as toxicant for present study.

c)Bio assay study - To study effect of toxicant on gills LC50 was determined for 24 hours, it was found to be 20.5 mg / l. The sub lethal concentration of 6 mg of $ZnSO_4$ /l of water was selected. For histopathological and biochemical study fish were taken at 7 days, 14 days, 21 days and 28 days.

d)Histopathological Studies -For histopathological study gills were fixed in aqueous Bouin's fluid. After proper fixation tissue were washed with running tap water and then dehydrated in different grades of alcohol. Clean in xylene and finally paraffin blocks were prepared. Sections cut at 6 u were stained with haematoxylin, eosin stain.

e)Biochemical Studies - Protein, glycogen and lipids contents of gills were estimated in 7, 14, 21 and 28 days exposed fishes.

Table 1: Physiochemical properties of water used to keep fish, *Ophiocephalus punctatus*

Sr. No.	Parameter	Range
1	PH	7.4 0.5
2	Temperature	25^{0}C 20^{0}C
3	Dissolved oxygen	6.3
4	Total hardness	65 – 90

RESULTS AND DISCUSSION

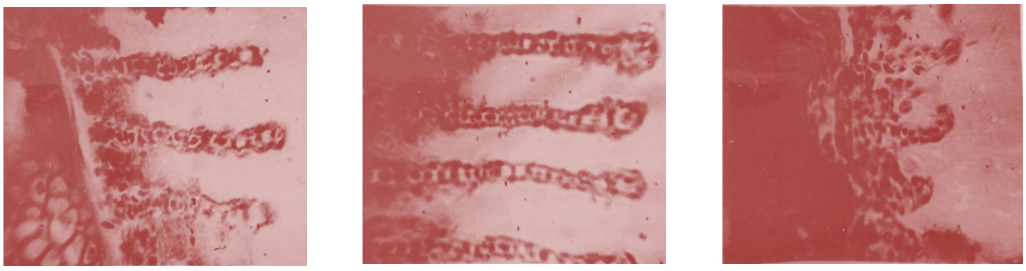
In fish, gills are considered to be the first and main organ to be affected by action of toxicant. In freshwater fish, the large surface area of gill is exposed to environmental water which is having very thin barrier between external and internal media of the animal (Murugan 2008). This may lead to higher zinc uptake by gill tissue. Gills are seat of gaseous exchange. The gill lamella of control fish shows respiratory epithelial cells, pilaster cells situated in between blood capillaries and chloride cells located at the base of the two adjacent lamellae (Fig. - 1a).

The first change in zinc sulphate treated fish after 7 days is swelling at the tip of secondary lamellae followed by hypertrophy and mild hyperplasia (Fig. -1b). As the exposure continued further for 21 days, the increased hyperplasia is accompanied by fusion of

Table 2: The results of biochemical estimation of protein, glycogen and lipid in gill tissue of the *Ophiocephalus punctatus*

Biochemical estimation	Control	Experimental			
		7 days	14 days	21 days	28 days
Protein	141.35 ± 4.2	149 ± 2.8	154.08 ± 2.6	168.85 ± 1.6	174.15 ± 2.2
Glycogen	60.00 ± 0.8	55.85 ± 1.00	54.25 ± 1.5	50.08 ± 1.8	48.41 ± 1.6
lipid	0.12 ± 0.02	0.10 ± 0.03	0.10 ± 0.01	0.08 ± 0.02	0.11 ± 0.01

Each value (μg / mg wet tissue) is the mean of 5 estimations ($\pm SD$)



A B C

Fig. 1: Histological section of gill. a) Normal gill b) Infected gill after 7 days c) Infected gill after 28 days

adjacent lamellae and the epithelium was lined by several layers of cells instead of single layer as observed in the control. As exposure continues for 28 days, desquamation of the hyperplasic epithelium was observed (Fig. -1c). There was cytoplasmic vacuolation and the nuclei became pycnotic. The lamellae were also seen shortened and were covered by mucous layer. The pillar cells were hypertrophied and the blood vessel between two rows of pillar cells was dilated.

Histopathological investigations can be used as biomonitoring tools or indicators of health in toxicity studies because they show preliminary symptoms of disease caused due to toxic response (Meyers and Hendricks, 1985). Because of drastic changes in the gill histology after treatment of sublethal concentration of zinc sulphate, disorder and imbalance in the metabolic state of fish might have caused and hence that reflected in biochemical changes. The results of biochemical estimation of protein, glycogen and lipid in gill tissue of Ophiocephalus punctatus are shown in Table 2.

Increase in protein content was observed in gills of experimental fish. It might be due to stimulation of protein synthesis to form detoxification enzymes. Glycogen content was decreased due to increased glycogenolysis after zinc intoxication and there is slight decrease in lipid content of gill tissue.

CONCLUSION

Gills remain in close contact with the external environment, hence, are the primary target of the toxicant. The toxicity of ZnSO4 even at sub lethal level may cause severe damage to gill tissue and reduce nutritive value of the fish significantly.

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Preliminary Study of Aquatic Macroinvertebrates in Washim Region of Maharashta

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ABSTRACT

Aquatic macroinvertebrates play a key role in nutrient cycling in aquatic ecosystem because they are the primary processors of organic materials. The present works were approved from August to December 2018 in Washim region, Maharashtra. The various sampling sites were selected to study the macroinvertebrate fauna of Washim region which include Padmatirtha, Dev Talav, Borala Dam (Adol Dam), Narayan Baba Talav, Nagartas, Keli Dam and R.A. College, Fish Farm. During the study 20 species of aquatic macroinvertebrates were identified belonging to four classes that is Archinida, Gastropoda, Insecta and Malacostraca, seven orders that is Acarina, Hemiptera, Coleoptera, Diptera, Odonata, Decapoda and Isopoda. The present research work is a preliminary attempt to study the aquatic macroinvertebrates around Washim region, further detail research is required to evaluate the diversity of macroinvertebrates of this region.

KEY WORDS: Aquatic, Macroinvertebrates, Washim.

INTRODUCTION

Aquatic macroinvertebrates are small organisms which have no internal skeletal system and live part andall of their lives in water. They are ubiquitous in freshwater ecosystems around the world and they are found in both lotic systems (systems of flowing water) such as streams, rivers and springs as well as in lentic systems (systems with standing or still waters) such as lakes and ponds. They comprise a rich and diverse group of organisms which includes insect larvae, worms, snails, crayfish, and other crustaceans, such as clam shrimp, fairy shrimp and water fleas. It also include many invertebrate species which are typically associated with terrestrial habitats but spend some portion of their life as aquatic organisms. According to Boulton et al. (1992), some aquatic macroinvertebrates live in the region of saturated soil like ostracodes, amphibians, etc. Many streams, especially those in the Southwest, are controlled mainly by allochthonous inputs of energy Cummins (1974) and Fisher (1995). Aquatic macroinvertebrates are responsible for the processing up to 73% of the riparian leaf litter and that enters a stream Covich et al. (1999).

Aquatic macroinvertebrates are fascinating creature and they play key role in maintaining healthy ecosystem. They are consumers of algae and other organic matter and help to maintain nutrient flow in the aquatic ecosystem. It is most excellent indicator of aquatic health and pollution. These qualities of the macroinvertebrate made them important in the aquatic research. The present research was carried out to study different types of macroinvertebrates around Washim region andidentify them up to lower possible taxa. To learn about the life cycle of aquatic macroinvertebratesand understand the role of macroinvertebrates as an indicator of aquatic ecosystem health. Balachandran and Ramachandra (2014) studied aquatic macroinvertebrate diversity and water quality of Bangalore lakes. The monitoring and assessment of water health quality and macroinvertebrates indices in the Tajan River, studied by Aazami et al. (2015) and they found low quality of water. The study of Preliminary biotic integrity of freshwater ecosystem with reference to taxa tolerance values, and, Matrices, was studied by Desai and Kumar et al. (2016). Boets et al. (2016) studied the alien macroinvertebrates in Flanders (Belgium). Efficiency of Pollution Tolerance Index (PTI) of macroinvertebrates in detecting aquatic

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pollution at oxbow lake in India, Ghosh and Biswas et al. (2017). The biological assessment of the Tang Sorkh River (Iran) using benthic macroinvertebrates was analyzed by Abbaspour et al. (2017). Variety and profusion of aquatic macroinvertebrates was noticed by Freimark et al. (2017).

MATERIAL AND METHODS

Study area:- Different sites were selected for the sampling in


Hydrachna sp (water mite)


Lymnaea stagnalis(Pond snail)


Pleuroceridae (Gilled snail)


Nepa cinerea (Water scorpion)


Notonecta enithras (Back swimmer)


Planobarius corneus (Orb snail)

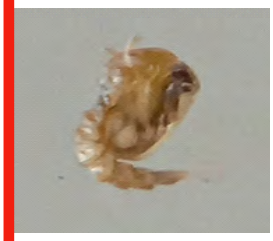

Tropisternus lateralis (Scavenger beetle)


*Coenagrionidae (*Damselfly larva)


Sympetrum flaveolum (Dragonfly- Yellow winged darter)


Trepobates subnitidus (Water strider)


Mosquito larva


Mosquito pupa


Psephenidae (Water penny)


Gerris incurvatus (Water strider)


Libellulidae Dragonfly nymph


Copelatus haemorrhoidalis (Diving beetle)


(Potamonmontios) Crab


AsellideaCaecidotea (pillbug)


Belostomatidae (water bug nymph)


Naucoridae (creeping water bug nymph)

Photo plate II: Aquatic Macroinvertebrates around Washim region of Maharashtra

Washim district, such as Padmatirtha, DevTalav, Borala Dam (Adol Dam), Narayan Baba Talav, Nagartas, Keli Dam and R.A. College, Fish Farm.

The sampling was carried out during the period August to December. During present study hand picking and hand net method was used to collect aquatic macroinvertebrates from water body. After collection the captured macroinvertebrates were photographed in live condition and then released into the water body. The identification was carried out by comparing photographs with the help of identification keys that is Dichotomous key, Macroinvertebrate Survey, 2007 Minnessota DNR, CT DEEP Riffle Bioassessment by Volunteers (RBV) Program and SWAN River Trust, identification manual that is EDM Aquatic Insecta, https://en.m.wikipedia.org and Tonde et al.(2018).

RESULTS AND DISCUSSION

The present work was carried out on aquatic macroinvertebrate around Washim district Maharashtra, for the period of five months that is from August 2018 to December 2018. The aquatic environment is specific habitat for aquatic macroinvertebrate. The aquatic macroinvertebrate observed in the study region of Washim district were presented in the photo plate II with their detail taxonomy Table I. A total of 20 macroinvertebrates belonging to 4 different class, 7 orders, 15 families were observed during the study period. Macroinvertebrates belonging to Insecta class, Hemiptera order, Notonectidae, Libellulidae, Gerridae and Culicidae family were found in maximum numbers whereas macroinvertebrates of Arachnida and Crustacea class, Acarina and Isopoda order, Hydiachenellae, Lymnaeidae, Nepidae, Planorbidae, Hydrophilidae, Coenagrionidae, Psephenidae, Dytiscidae, Rhyparochromidae, Belostomatidae and Naucoridae family were observed in minimum numbers.

During the study 20 species of aquatic macroinvertebrates were identified belonging to four class that is Archinidae, Gastropoda, Insecta and Malacostraca, seven order that is Acarina, Hemiptera, Coleoptera, Diptera, Odonata, Decapoda and Isopoda, seventeen family that is Hydiachenellae, Lymnaeidae, Nepidae, Notonectidae, Hydrophilidae, Gerridae, Culicidae, Psephenidae, Libellulidae, Dytiscidae,Pleuroceridae, Planorbidae, Coenagrionidae, Potamidea, Belostomatidae, Asellidea and Naucoridae, twelve genus that is Hydrichna, Lymnaea, Nepa, Notonecta, Planorbarius, Tropiternus, Gerris, Copelatus, Potamon, Caecidotea, Sympetrum, and Trepobates, twelve species that is Hydrichna sp, L. stagnalis, N. cinerea, N. enithras, P. corneus, T. lateralis, S. flaveolum, A. Caecidotea, P. potamios, G. incurvatus, C. haemorrhoidalis and T. subnitidus.

Curent results are supported by following authors given as follows, Principe (2008) carried out research on structural classification of aquatic macroinvertebrates and they identified

Table 1: - the taxonomic summery of different aquatic macroinvertebrates around Washim region of Maharashtra

Sr. No.	Common name	Class	Order	Family	Genus	Species
1.	Water mite	Arachnida	Acarina	Hydrachenellae	*Hydrichna*	Hydrichnasp
2.	Pond snail	Gastropoda	-	Lymnaeidae	*Lymnaea*	L. stagnalis
3.	Gilled snail	Gastropoda	-	Pleuroceridae	-	-
4.	Water Scorpion	Insecta	Hemiptera	Nepidae	*Nepa*	N. cinerea
5.	Back swimmer	Insecta	Hemiptera	Notonectidae	*Notonecta*	N. enithras
6.	Orb snail	Gastropoda		Planorbidae	*Planorbarius*	P. corneus
7.	Scavenger beetle	Insecta	Coleoptera	Hydrophilidae	*Tropisternus*	T. lateralis
8.	Damselfly larva	Insecta	Odonata	Coenagrionidae	-	-
9.	Yellow winged darter	Insecta	Odonata	Libellulidae	*Sympetrum*	S. flaveolum
10.	Water strider	Insecta	Hemiptera	Gerridae	*Trepobates*	T.subnitidus
11.	Mosquito larva	Insecta	Diptera	Culicidae	-	-
12.	Mosquito pupa	Insecta	Diptera	Culicidae	-	-
13.	Water penny	Insecta	Coleoptera	Psephenidae	-	-
14.	Water strider	Insecta	Hemiptera	Gerridae	*Gerris*	G. incurvatus
15.	Dragonfly nymph	Insecta	Odonata	Libellulidae	-	-
16.	Diving beetle	Insecta	Coleoptera	Dytiscidae	*Copelatus*	C. haemorrhoidalis
17.	Crab	Malacostraca	Decapoda	Potamidea	*Potamon*	P. potamios
18.	Pill bug	Malacostraca	Isopoda	Asellidea	*Caecidotea*	A.Caecidotea
19.	Water bug nymph	Insecta	Hemiptera	Belostomatidae	-	-
20.	Creeping water bug nymph	Insecta	Hemiptera	Naucoridae	-	-

36 macroinvertebrates. Elias et al. (2014) studied freshwater macroinvertebrates of some Tanzanian Rivers as a basis for developing biomonitoring index for assessing pollution in tropical African Regions. They found near about twelfth thousand species of benthic organisms. Balachandran and Ramachandra (2014) studied aquatic macroinvertebrate diversity and water quality of Bangalore lakes. They noticed 1055 species of invertebrates of 21 genuses. Markovicv et al. (2015) worked on Macroinvertebrate community along the Velika Morava River. During their investigations, they identified 84 macroinvertebrate taxa. Orwa et al. (2014) investigated quantity and quality of aquatic macroinvertebrates in Keniya. Trichkova (2013) worked on aquatic macroinvertebrates range in water bodies of Bulgaria. A total of 75 macrozoobenthic taxa was record in the reservoirs. They belonged mostly to Oligochaeta, Ephemeroptera, Chironomidae, and Mollusca. Benthic invertebrates division and plenty were carried out by Ho et al. (2018). They noticed total of 82 macroinvertebrates species belonging to 76 families. Arthropoda and Insecta are found in maximum number. Benthic macroinvertebrates community of a fourth order stream in Kashmir Himalaya, India and investigated 22 species of macrozoobanthos among which Arthropoda was found to be the most dominant group, comprising of 21 species followed by Annelida with 1 species. The farmer was represented by class insect (5 order) and crustacea (1 order), by Habib and Yusuf (2014).

Each aquatic macroinvertebrate comprises its specific function in aquatic environment and in human life. Some species of Scavenger beetle (Tropisternus lateralis) are consumers of mosquito larvea and have potential as biological indicator by Tonde et al. (2018). Water strider (Gerridea Trepobates) and (Gerris incuvaratus) capture insects that fall onto the water surface with their short front legs and self cleaning surface by Tonde et al. (2018). Dragonfly- Yellow winged darter (Sympetrum) are used in the traditional medicines in Japan, China and caught for food in Indonesia. The presence of water penny (Psephenidae) in a stream can be used as a test for the quality of the water, as they are pollution sensitive. Orb snail (Planobarius corneus) mouth has a filter so it can filter the decayed plants and the algae growing on the rocks. Water mite (Hydrachna sp) larvae have been considered as a potential biological control agents by Goldschmidt (2016). Water snail (Lymnaea stagnalis) is widely used for the study of learning, memory and neurobiology. Also they play an important role in aquatic food chain.

Dragonfly nymph (Libellulidae) eats harmful aquatic organisms such as mosquito larvae. Mosquito larvae and pupa are reliable and neccessory food for creatures ranging from fish to birds by Vassou et al. (2017). These are feed on waste products present in water. Diving beetle (Copelatus haemorrhoidalis) advantage over other invertebrates protecting the beetles from predators and mechanical damage, Isopod (Asellidea caecidotea)are benificial and essential component of a healthy ecosystem. In most ecosystem, isopods participate in the process of decomposition, they reproduce quickly, they do not spread odor. Gilled snails (Pleuroceridae) serve an important role in the ecosystem they eat very low on the food web, as most land snails will consume rotting vegetation like moist leaf litter, and also fungi and sometimes eat soil directly by Johnson P. D et al. (2009). Water scorpion (Nepa cinerea) carry a submerged air bubbles that serve as a renewable air supply. Damselfly larva (Coenagrionidae) on a water body indicates that it is relatively unpolluted. Otherwise, all the aquatic macroinvertebrates are benificial for ecosystem.

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Zoological Communication

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Study on Diversity of Aquatic Weeds of Washim (M.S.) India

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ABSTRACT

Aquatic weeds are unwanted and undesirable vegetation that reproduce and grow in water. The paper is based on diversity of aquatic weeds; work conducted in Washim region Maharashtra India, during August 2018 to December 2018. The area was surveyed in order to collect and identify aquatic weeds. Aquatic weeds are collected and identify from different sites name as Dev talav, padmirtha, Borala dam, Adol Dam, Keli Dam, Nagartas and Narayan baba talav in Washim region. From the study area ten species of aquatic weeds are identified. There are many more species present in Washim region but because of ignorance and lot of avoidance those species are unidentified hence there is need to study aquatic weeds in scientific manner for betterment of mankind.

KEY WORDS: Words: Aquatic, Diversity, Washim, Weed.

INTRODUCTION

The diversity within the fresh water ecosystem has a great importance in terms of the livelihood and the economic importance of the people living around it. Weeds are plants which grow out of their place, interfere with the utilization of natural Resources, prolific, persistent, resistant, competitive, harmful and even poisonous in nature and can grow under adverse climatic conditions. Sometimes economical plants may also grow out their proper places which are termed as rouge and not weeds. Aquatic plants are important part of natural systems and form the basis of the water bodies' health. Harney (2014). Aquatic weeds are those unabated plants which grow and complete their life cycle in water, Lancer and Krake (2002). Plants are an important part of healthy, diverse aquatic ecosystems. Aquatic plants play a major role in maintaining the integrity of lakes, ponds, streams, and rivers for fish, wildlife, other organisms, and human enjoyment.

Aquatic weeds involves wide populations of aquatic vegetation in different aquatic ecosystem broadly based on type of eco-environment which are effected by aquatic vegetation. The aquatic weed varieties are broadly classified as Algae and flowering plants. Out of 160 aquatic weeds Ipomoea aquatic, Typhaangustata, Eichhorniacrassipes, Nelumbonucifera, Alternantheraphiloxeroides, Vallisnariaspiralis, Chara, Potamogeton, Hydrilla, Ceratophyllum, and Salvia are spread in different wetlands. Aquatic plants when in limited quantity, are useful and necessary for the ecology of the pond. Adhikari and Babu (2008) investigated floral diversity of Baanganga wetland, Uttarakhand, India A total of one hundred seventy eight species were recorded. Aquatic Weeds and Their Management for Fisheries at CIFE Centre, Salt Lake City, and Kolkata, India was studied by Datta (2014). Harney (2014) studied macrophytes biodiversity of Dudhala Lake of Bhadrawati, District-Chandrapur (M.S.), India from January 2013 to December 2013 in which he found 16 species representing 15 families. Idhole, et. al., (2016) observed the biodiversity of aquatic weeds in Washim region of Maharashtra, India. Eight species of aquatic weeds were recorded. The diversity and impact of aquatic weeds were studied by Joshi (2012) in Yavatmal district Maharashtra India. Study of aquatic plants revel that it adds oxygen by the process of photosynthesis in the water body which is useful for aquatic fauna such as zooplankton and micro inverterbrate. The main goal of this research is to study the diversity of aquatic weed in Washim

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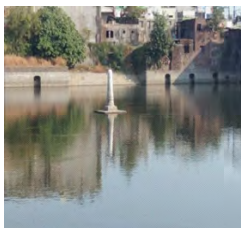
region the objective of this report is to give importance to aquatic plant and to their conservation.

MATERIAL AND METHODS

Study area:-The research area was surveyed from August 2018 to December 2018 .The plant specimens were collected from the different sites of Washim district comprising of Padmatirth, DeoTalav, Borala Dam (Adol Dam), Narayan Baba Talav, Nagartas, Keli Dam and R.A. College, Washim, Fish Farm.The sampling was made during the period August 2018 to December 2018.There are different methods of collection of aquatic weed such as, Hand picking method, hand net method. During sampling hand picking and hand net method was used to collect aquatic weed from water body. After that aquatic weed were photographed. The identification was done by comparing photographs with the help of internet and by analyzing the research paper, previous literature of same area published by Idhole, et. al., (2016), Solanke (2015).

Padmatirtha



DevTalav

Borala Dam (Adol Dam)

Narayan Baba Talav

Nagartas

Keli Dam

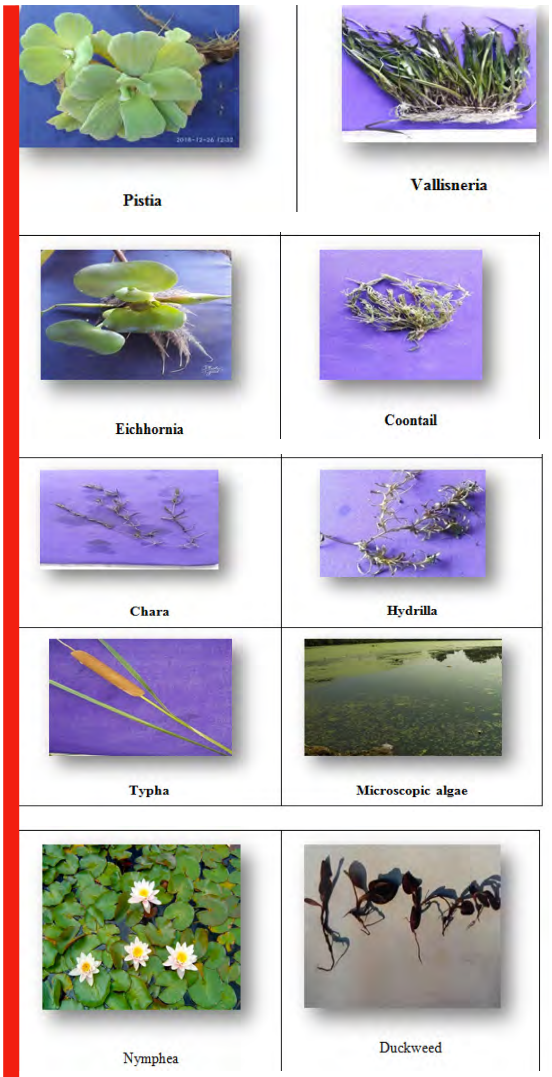
R.A. College, Washim, Fish Farm

Photo plate I: Sampling Sites of Washim Region

RESULTS AND DISCUSSION

The present work was carried out on aquatic weeds in Washim region, Maharashtra, from August 2018 to December 2018. The aquatic weeds were observed in the study of Washim region is presented in the photo plate II. There are 10 species of aquatic weed were observed belonging to two class that is angiosperm, charophyceae six order that is Alismatales, commelinales, charales, poales, nymphaeales, ceratophyllales seven family that is Hydrocharitaceae, Araceae, Pontederiaceae, Characeae, Typhaceae, Nymphaceae, Ceratophyllaceae ten genus that is *Hydrilla, Pistia, Lemna, Vallisneria, Eicchornia, Chara, Typha, Nymphea, Ceratophyllum*. Plants are an essential part of aquatic ecosystems.

The survival of native aquatic species is threatened and hence attention has to give to the aquatic resources. Hydrilla plant is



Photoplate II: Aquatic weeds of Washim (M.S.)

Table 1: Taxonomic summary of aquatic weeds

No	Common name	Scientific name	Class	Order	family	Genus	Species	Site of collection
1	Waterthyme	Hydrilla	Angiosperm	Alismatales	Hydrocharitaceae	*Hydrilla*	*H.Verticillata*	Narayan baba talav, Keli dam
2	Bayroot	Pistia	Angiosperm	Alismatales	Araceae	*Pistia*	*P.Stratiotes*	Adol dam
3	Jalkumbhi	Duckweed	Angiosperm	Alismatales	Araceae	*Lemna*	*L.minor*	Nagartas
4	Eel grass	Vallisneria	Angiosperm	Alismatales	Hydrocharitaceae	*Vallisneria*		Padmatirtha talav, Dev talav
5	Water hycinth	Eicchornia	Angiosperm	Commelinales	Pontederiaceae	*Eicchornia*	*E.crassipes*	Padmatirtha talav
6	Stonewords	Chara	Charophyceae	Charales	Characeae	*Chara*	*C.globularis*	Adol dam
7	Punks	Typha	Angiosperm	Poales	Typhaceae	*Typha*	*T.angustifolia*	Adol dam, Keli dam, water body near Nagartas
8	Water lilies	Nymphea	Angiosperm	Nymphaeales	Nymphaceae	*Nymphea*	*N.nouchali*	Dev talav
9	Coontail	Ceratophyllum	Angiosperm	Ceratophyllales	Ceratophyllaceae	*Ceratophyllum*	*C.demersum*	Adol dam
10		Algae						Keli dam

processed by harvesting sterilization with purified water and ozone treatment, then is dried at low temperatures. Almost all its parts like steams, leaves, flowers and tubers are employed for food and medicinal purposes and can be used in the form of powder, tablets. The Vallisneria plant is used in the treatment of leucorrhoea and is made into a tea with sesame (*Sesamum indicum*) to improve the appetite. The edible part of the eal grass is young leaves. Due the abundant growth of the plant Eichornia is used as an excellent source of biogas. Bengali farmers collect and pile up these plants to dry at the onset of the cold season, they then use the dry water hyacinth as a fuel. Coontail plays very important role in the ecosystem it may include increasing species diversity, limiting unwanted fishing, creating fish habitat , improving water clarity. Chara plant may be involved in fixing nitrogen , which is important to plant nutrition .Hydrilla contains otteliones A and B which are anti- tumor agents. It also improves blood circulation and helps in detoxification. Good for neurological health and cardiovascular function as it has high value of vitamin B-12, iron and calcium. Nymphea is used for the treatment of diabetes, inflammation, liver disorders, and urinary disorders, menstruation problems, as an aphrodisiac and as a bitter tonic.

Duckweed is a good candidate as a bio-fuel because it grows rapidly, produces five to six times as much starch as corn per unit of area, and does not contribute to global warming. Legal protection is a need to conserve the aquatic biodiversity. Aquatic weeds are very good source of energy. It can be use for Mushroom cultivation so it is the need of time to identify many more species in Washim region and to conduct more study on the aquatic weed. There are many more species present in Washim region but because of ignorance and lot of avoidance those species are unidentified hence for that purpose this is small step to identify aquatic weeds.

Adhikari and Babu (2008) studied on the biodiversity Baanganga wetland, Uttarakhand India and recorded one hundred seventy eight plant species. 15 different varieties of aquatic plants were reported by Dhore and Lachure (2014) and concluded that the Chara spp. was found dominated in local water bodies. Harney (2014) studied Macrophytes Biodiversity of Dudhala Lake of Bhadrawati, District-Chandrapur (M.S.), India from January to December in which he found 16 species Kolet, et.al., (2013) studied on the biodiversity of weeds from V.P.M. College and nearby area in thane, Maharashtra India in this earmarked ten locations within the college campus in which fifty one species were found of that quantity of weeds having broad leaves is more. The Macrophytes diversity in twenty two fresh water resources was studied during the year 2009-2010. Total twenty species of Macrophytes belonging to sixteen families were reported by Joshi (2012) in which Hydrilla and Vallisneria were found to be dominated

CONCLUSION

An impressive total of ten weeds belonging to ten genera were documented in the current investigation. Aquatic weeds infestation in Washim region is increasing geometrically. Utilization of aquatic weeds is the only option which will ensure the control of aquatic weeds. Therefore better knowledge of aquatic weed is needed. The Biodiversity of aquatic weeds calls for further studies.

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Biochemical Characteristic Study of Isolated Bacterial Colonies from Bat Guano

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ABSTRACT

The purpose of present work was to study the biochemical characteristic of isolated bacterial colonies from bat guano. The morphological characteristic were also carried out. Isolated colonies from yellow and green moist guano were biochemically tested for formulation of sugar. Colonies of yellow and green moist guano showed that micro-organism fermented all the four sugar viz lactose, sucrose, manitol and glucose with the production of acid and gas. IMVIC test was performed and the result depicted presence of indole and methyl red. Neither of the colony produced acetyl methyl carbinol and thus all were VP negative.

KEY WORDS: Batgauno, Isolated Colonies.

INTRODUCTION

Bats guano are important reservoirs of many bacteria. Bat guano was used as a fertilizer with farmer. A marvelous symbiosis exists between the microorganism and bats. Countless microbes are regularly excreted along with waste products and together with soil organisms. They constitute the microbial population of a bat guano deposit and work as decomposer. Their main function is to accelerate the process of breaking down organic matter in guano. This beneficial bacterial population works to increase the guano's wealth of essential nutrients and can provide their own benefit to gardener's as soil inoculants. Bat guano is 100% organic and natural[6].In the present study, an attempt is made to isolate the bacteria from the bat guano and study their morphological and biochemical characteristic .

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MATERIAL AND METHODS

Bat guano samples were collected from the roosting sites of bats from the Urban area of Amravati City. The yellow and green guano were collected separately. Isolation of bacteria was performed by making serial dilution. Morphological characteristic of bacterial isolates from bat guano were performed by using gram staining and biochemical characteristic were carried out by sugar fermentation test and IMVIC test.The reagents such as Crystal violet solution ,Lugol's iodinesolution ,Safranin solution and 95 % alcohol were used for gram staining. IMVIC tests is a set of four different biochemical characteristics namely indole ,methyl red,Voges-Praskauer and citrate utilization test . Identification of bacteria was made by MTTCC Chandigarh.

RESULTS AND DISCUSSION

In the present study, the colonies obtained from green moist and yellow moist guano were transferred to nutrient agar slants. The isolated colonies from nutrient agar slants were used for gram reaction(table 1). *Serratia marcescencs* and *Bacillus pantothenticus* are the two bacteria which were identified by MTTC ,Chandigarh. The result obtained from the present study indicate that bat guano contain both gram positive and negative bacteria which was supported by several authors[1] which need to be identified further Literature reveals that not much work has been carried out on the present topic. Bacterial studies of the stool samples from insect eater bats Chaerophan pumila were performed and 115 bacterial strain of Enterobacteriacea family were identified[2]. Faecal bacteria are isolated and identified from swine[8]. Bacterides multiacidus

,Bifidobacterium suis and Lactobacillus acidophilus have been identified from pig faeces[4]. A similar type of studies was carried out for identification of enterococcal ,streptococcal and Weissella species in the faecal flora of individually owned dogs[5]. Biochemical

Fig 1: Nutrient agar slants showing isolated colonies of bat guano

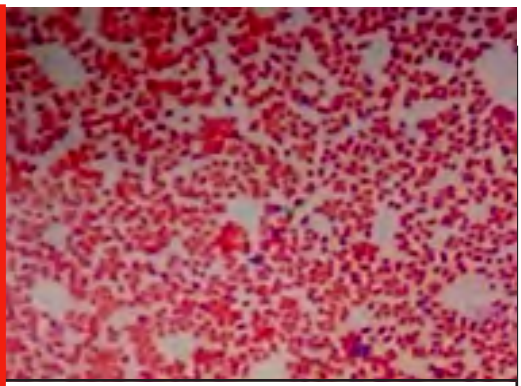

Fig. 2: Gram - ve bacteria

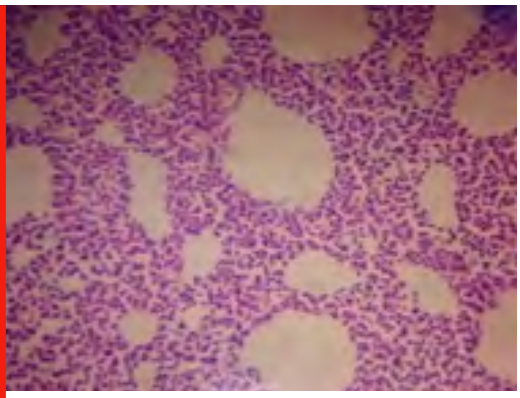

Fig. 3: Gram +ve bacteria Identified Bacteria by MTTCC Chandigarh
1.Serratia marcescencs
2.Bacillus pantothenticus

Table 1: Gram reaction observed of the bacterial isolates from bat guano

	guano Colony type	Colour	Shape	Gram reaction
Green moist gauno	C-1	Pink	Short rods	Gram –ve
	C-2	Violet	Short rods (coccobacilli)	Gram +ve
	C-3	Violet	Cocci in bunches	Gram +ve
Yellow moist guano	C-1	Pink	Small rods	Gram –ve
	C-2	Violet	Long rods	Gram +ve
	C-3	Violet	Short rods	Gram +ve

Biochemical test Table 2: To study the formation of various sugar by micro-organism

Name of Colonies	Lactose Acid	Sucrose Gas	Manitol Acid	Glucose Gas	Acid	Gas	Acid	Gas
1)Yellow moist gauno	-	-	+	-	+	+	+	+
Colony 1	+	+	+	+	-	-	+	+
Colony 2								
Colony 3	+	+	+	+	+	+	+	+
2)Green moist gauno								
Colony 1	-	-	-	-	+	-	+	-
Colony 2	+	+	+	+	+	+	+	+
Colony 3	-	-	-	-	-	-	-	-

Table 3: IMVIC test

Name of the colonies Yellow moist gauno	Indole	M-R test	VP test	Citrate
Colony 1	-	Cherry red colour appears	-	Turbidity
Colony 2	-	Cherry red colour appears	-	No turbidity
Colony 3	-	-		No turbidity
Green moist				
Colony 1	-	Cherry red colour appears	-	No turbidity
Colony 2	Cherry red colour appears on the top	-	-	No turbidity
Colony 3	-	-	-	No turbidity

test of isolated colonies from green moist and yellow moist bat guano are summarized in (Table -2 and 3).

In the present study isolated colonies of yellow and green moist guano showed that micro-organism fermented all the four sugar viz lactose, sucrose, manitol and glucose. Acid production is detected by formation of yellow colour while gas production is detected by accumulation of gas in Durham tube. IMVIC test showed that one of the colony of green moist guano produced indole positive and methyl red positive. Neither of the colony produced acetyl methyl carbinol and thus all were VP negative. These results agree with that of isolates of E.coli from the short nosed fruit bat in Malysia[3]. Five strains of Lactobacillus thermotolerant lactic acid bacteria (G12,G22,G35T,G43 and G44) were isolated from chicken faeces. These strains were characterized[7].

CONCLUSION

The result obtained in the present study indicate that bat guano contain both gram positive and gram negative bacteria which need to be identified further.The biochemical characteristic study of isolated bacterial colonies from bat guano showed that microorganism from this colony fermented all four sugars and produced indole and methyl red, but they were VP negative Bat guano can be used as a good manure and as a fertilizer. An attempt should be made to identify further the bacterial flora of bat guano, so that it can be used as a soil cleanser.

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Study of Ichthyofaunal Diversity from Lakes Nearby Nawargaontah. Sindewahi, Dist. Chandrapur (M.S.) India.

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ABSTRACT

Lake supports to the commercial fisheries providing a rich variety of fish species. In world near about 20,000 fish species are contain in the fresh water sources like tanks, dams, and lakes. In South Asian countries fish occupies a significant position in the socio-economical fabric due to its proteinous contains. In the world India is one of the twelve mega diversity nation which provide its rich biological heritage. Though contribute 2,546 species of fish, study of the fishes of inland water bodies in Indian subcontinent still in progress. Dearth of knowledge on the ichthyofauna affects tremendously on popularizing of unpopular varieties of fish. To increase their production and effectiveness it is needful to survey fish fauna of different water habitats. The research exposes the ichthyofauna in the particular ecosystem which hardly studied about little known fish variety. The investigation resulted on observation of 14 species of fishes belonging to 6 orders and 9 families. The present research is about diversity of fishes carrying the study of four lakes which are 0.5 – 1 km away from the Nawargaon region during the period 2017-18.

KEY WORDS: Ichthyofauna, Diversity, Lake, Nawargaon

INTRODUCTION

Fish is important source of food and provide high nutrition to human being. Fish contains protein, mineral, vitamins and oil which grasp imminent position in the socio-economical fabric. Fish species richness is important to determine the maintenance of water bodies. According to the study that fishes have been recorded in the world about 21,730 species of which about 11.7% are found in Indian water. (Lonkar and Kedar, 2013) In India out of 2500 species of fish only 930 occur in freshwater which are used as bio indicators for the assessment of water quality. Inland aquatic systems occurs great diversity in its form and function like river, flood plains and natural lakes providing a wide range of habitats for fish. Environmental factors are always changed by either natural causes or human activity. At present, most lakes and rivers in India are used by people for multiple purposes such as waste disposal, industrial processes, fisheries, recreation, etc. Which polluted the water sources. Thomas (1994) suggested in the artical that habitat alteration and destruction as the major cause of most extinctions of freshwater fishes. Individual freshwater systems produce different fish communities; hence site-specific management plays an important role in fishery biology and fish biodiversity conservation. Therefore the abundance and community composition of freshwater fishes have long been subjects of interest in fishery ecology (Marshall & Ryan 1987, Evans et al. 1987).

The study of Icthyofaunal diversity is issued by only numbers of researchers in Maharashtra among them are (Sakhare & Joshi 2003, Rathod 2008, Tijare 2008, Harney 2009, Lonkar and Kedar 2013 and Paliwal 2013,Tijare and Shastrakar 2016,Telkhade and Jambhule 2017) are noticeable. Therefore very less information is available about fish diversity of lake on this topic. The present investigation is undertaken to study the occurrence and complete scenario of fish diversity of Lakes nearby Nawargaon from district Chandrapur.

MATERIAL AND METHODS

Sampling

To the proposed research various types of fishes collected through the help of local fishermen. For that we used gill nets of standardized

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dimensions with several mesh size and different types of nets such as cast net, drag net and often used Bhorjal. At night Gill net was installed and cast net during day time. Fish sampling was performed in 100 meter reach of all the three sampling sites. During every catch, fishes were bringing out at shoreline area for taxonomic study. After taking photographs for proper identification, fish characteristics were distinguished between formula and morphometry. The fishes were identified up to species by referring standard literature of Day (1875), Jayaram (1994) and Talwar and Jhingran (1991). Fishes were released into the lake water after identification. To investigate the Ichthyofaunal diversity, relative species abundance and aspects of inland fisheries of Lakes from Nawargaon was selected as a case study in chandrapur district from Maharashtra state.

RESULTS AND DISCUSSION

14 species of fishes belonging to 6 orders and 9 families were observed in the present investigation. Out of 6 orders the Cypriniformes was observed dominant with 7 different species followed by Siluriforms with 3 different species. Order Anabantiformes shows two different species while Clupeiformes, Synbranchiformes and Perciformes shows 1 species of fishes. Family wise distribution showed dominance of Cyprinidae with 6 species followed by Channidae with 02, Cobitidae, Bagridae, Pangasiidae, Mastacembelidae, Notopteridae and Cichlidae with 1 species. Among the different species *Labeo* and *Catla* were observed dominant in Order Cypriniformes and least appearance Siluriformes species.

During last few decades many researchers have studied on ichthyofaunal diversity from different fresh water bodies of India among them some are here noticeable such as Alikunhi et al., (1955), Patil et al. (2014) and Saronia (2014) which have reviewed the freshwater fish diversity of Maharashtra. These reviews also were confirmed by various authors and recorded 165 species belonging 9 orders, 26 families and 82 genera in Maharashtra during 2000-2004. Bobdey (2014) studied fishes diversity and conservation aspects in a lake and river ecosystems in Bhandara district of Maharashtra, India. He reported 63 species of 8 orders and 17 families. In the present study 14 species of fishes belonging to 6 orders and 9 families were observed. Out of 6 orders the Cypriniformes was observed dominant with 7 different species followed by Siluriforms with 3 different species. Order Anabantiformes shows two different species while Clupeiformes, Synbranchiformes and Perciformes shows 1 species of fishes. 23 fish species belonging to 6 orders recorded by Kadam and Gayakwad (2006) in Masooli reservoir district Parabhani, Maharashtra. A total of 27 fish species belong to 6 families were recorded in Pong reservoir (Singh, 2001). According to Jhingran 1992, the species were varying considerably in shape, size and their life span. The Maximum size, shape and the age are specific for every species. The growth of particular fish species is dependent on its nutrition and environment factor. Sakhare and Joshi (2003) reported the ichthyofauna diversity of Bori reservoir in Maharashtra.

Table 1: Diversity of Ichtyofauna in lakes nearby Nawargaon during year 2017-18

Sr. No.	Scientific name	Order	Family
1	*Catla catla*	Cypriniformes	Cyprinidae
2	*Labeorohita*	Cypriniformes,	Cyprinidae
3	*Cyprinuscarpiocommunis* (Scale carp)	Cypriniformes	Cyprinidae
4	*Hypophthalmichthysmolitrix* (Silver carp)	Cypriniformes	Cyprinidae
5	*Puntiussophore*	Cypriniformes	Cyprinidae
6	*Salmostomabacaila*	Cypriniformes	Cyprinidae
7	*Lepidocephalichthysguntea*	Cypriniformes	Cobitidae
8	*Mystuscavassius*	Siluriformes	Bagridae
9	*Pangasianodonhypophthalmus*	Siluriformes	Pangasiidae
10	*Ophiocephalusmarulius*	Anabantiformes	Channidae
11	*Ophiocephalusstraitus*	Anabantiformes	Channidae
12	*Notopterusnotopterus*	Clupeformes	Notopteridae
13	*Mastacembelusarmatus*	Synbranchiformes	Mastacembelidae
14	*Oreochromismossambicus*	Perciformis	Cichlidae

Parith Bhanu and Deepak (2015) suggested and concluded that, mainly human activity in lakes and rivers were responsible for the less diversity of fishes. Investigated areas are paddy field region and farmer uses indiscriminate chemical fertilizer which affected the growth and distribution of fishes. Careless management of some lakes and use of certain manures and insecticides in the lake water also harmed the fish fauna. In present investigation, family wise distribution showed dominance of Cyprinidae with 6 species followed by Channidae with 02, Cobitidae, Bagridae, Pangasiidae, Mastacembelidae, Notopteridae and Cichlidae with 1 species, some species found abundant and some species each of less abundant and rarely found in the lake. All fishes are use as food fishes. Lakes reservoir contributed the single largest inland fishery resources both in terms of size and production potential (Kamble et al., 2011). Fish species were the important indicator of aquatic floral and faunal diversity. The abundance fishes reflect the health of water bodies (Hamzah, 2007). Therefore it is necessary to suggest that the fisherman's should make aware about fishing and scientific training methods which may help in high yield of fish production in the lakes nearby Nawargaon .

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