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***EMERGING RESEARCH TRENDS  
IN LIFE SCIENCES***



**Editors**  
**Dr. Sagar A. Vhanalakar**  
**Dr. Sharadrao A. Vanalakar**



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# EMERGING RESEARCH TRENDS IN LIFE SCIENCES

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## ***PREFACE***

We are delighted to write about our first book entitled “**Emerging Research Trends in Life Sciences**”. This book is the compilation of esteemed articles written by experts in the various fields of life science including Botany, Zoology, Microbiology, Biodiversity, Environmental Conservation etc. providing a sufficient depth of the subject to satisfy the need of a level which will be comprehensive and interesting. It is an assemblage of up to date information of rapid advances and developments taking place in the field of science. With its application oriented and interdisciplinary approach, we hope that the students, teachers, researchers, scientists and policy makers in India and abroad will find this book much more useful.

The articles in the book have been contributed by academicians, researchers and young scholars from various parts of India. We express our sincere gratitude to Hon. Satej alias Bunty D. Patil, President, Shri Mouni Vidyapeeth, Gargoti, Kolhapur who has been source of constant inspiration. We are especially thankful to Prof. Dr. D. V. Muley, Registrar, Shivaji University, Kolhapur and Prof. Dr. Pramod S. Patil, Coordinator, School of Nanoscience and Technology, Shivaji University, Kolhapur for the encouragement. We thank our publisher Bhumi Publishing, Nigave Khalasa for taking pains in bringing out the book. Our special thanks and appreciation goes to experts and research workers whose contributions have enriched this book.

Finally, we will always remain a debtor to all our well-wishers for their blessings, without which this book would not have come into existence.

*Dr. Sagar A. Vhanalakar*

*Dr. Sharadrao A. Vanalakar*



# CHAPTER 1

## SOME BEHAVIOURAL ALTERATIONS IN ESTUARINE CLAM *KATELYSIA OPIMA* UNDER OSMOTIC STRESS ALONG BHATYE ESTUARY, RATNAGIRI (M.S.) INDIA

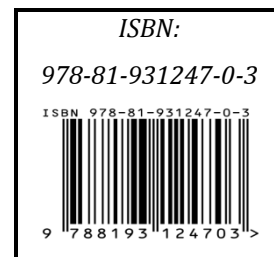
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### ABSTRACT

The behavioural response of estuarine clam *Katelysia opima* under osmotic stress was studied by exposing average sized clams to various lower salinity ranges (control to 10% salinity) for the period of 8 days. Behaviour of clams like shell valve closure, siphon and mantle activity and mortality during 8 days exposure period were taken as a measures of behavioural alterations in osmotic stress. After exposure of different lower salinity, the behaviour patterns in clams have been affected significantly. From the results of shell valve closing behaviour of clams of *K. opima*, it was clear that initial period of lower salinity exposure during post-monsoon season is more stressful, as compared to winter and summer season. Mantle and siphon activity of clam *K. opima* showed positive correlation with salinity, but degree of change in response varies from season to season.

**KEYWORDS:** Salinity ranges, *Katelysia opima*, Behavioural patterns, etc.

### INTRODUCTION

The distribution and abundance of the invertebrate fauna in marine environment is co-related with various important environmental parameters like temperature, salinity and oxygen, which are all directly related with the seasonal changes and inflow of water in the estuary. Water quality can be described in terms of physico-chemical and biological characteristics. Artificial or natural changes in the physical and chemical nature of freshwaters can produce diverse biological effects ranging from the severe to the subtle. The responses of biological communities or individual organisms can be monitored in a variety of ways to indicate effects on the ecosystem. The reactions of individual organisms, such as behavioural, physiological or morphological changes, can also be studied as responses to stress or adverse stimuli. Some approaches are

suitable for field use and some have been developed specifically for use in the laboratory (UNEP and WHO, 1996).

Alterations in environmental conditions adversely affects an organisms in natural conditions, therefore studies on physiological mechanisms of organisms towards such conditions becomes important. Comparative biologist and ecologist paying attention towards determination of physiological condition of organisms in a natural context (Hofmann and Somero, 1995; Wagner *et al.*, 1998). Among the factors in the marine environment, temperature and salinity are the most important and relevant variables in the study of physiology. These variables determine the metabolism rate of the organisms and consequently, the extent of distribution of the species (Vernberg and Vernberg, 1972).

As compared to marine environment, estuarine environment showed much variation in salinity, temperature, pH and other environmental parameters. There are great fluctuations in the salinity owing to the tidal oscillations and river discharge. Due to the differences in environmental conditions animal inhabiting in marine conditions were not exposed to fluctuating environment as compared to estuarine animals. During monsoon, the salinity of water over the clam bed may remain low for considerably long period. The clams in such areas therefore have to adapt themselves in order to overcome these fluctuations. Growth, mortality and behaviour of early stage *Pecten maximus* affected by rearing conditions of lower salinity and higher temperature in shallow coastal system (Christophersen and Strand, 2003). Larvae of *Paphia malabarica* shown higher survival and growth rate at higher salinity (25 - 33‰) and pH (8 - 8.5) (Gireesh and Gopinathan, 2004). Salinity is a key abiotic factor influencing small and large scale biotic interaction in intertidal ecosystems (Berger and Kharazova 1997; Ingole and Parulekar 1998). It determines the distribution (Crain *et al.*, 2004), physiological performance (Pequeux 1995; Shock *et al.*, 2009) and reproductive success (Deschaseaux *et al.*, 2010) of wide range of organisms living on mudflats or rocky shores.

The baby clam *Marcia opima*, has so far been indicated as *Katelysia opima* in Indian waters. Considering the deteriorating global environmental scenario and work done by previous workers from different parts of the world, present investigation is undertaken. In this study, alterations in the physiological processes like behaviour of estuarine clam *K. opima* exposed to different ranges of low salinity (one of the most important environmental variable) is studied to understand the current status of their fitness.

## **MATERIALS AND METHODS**

### **Animal collection and maintenance:**

The estuarine clam, *Katelysia opima* was collected from Bhatye estuary during low tide by hand picking and digging with knife method. The clams were cleaned and washed with the sea water. After cleaning, the medium size clams (30 - 35 mm) were selected and acclimatize for 48 hours under laboratory conditions. In all selected seasons viz. summer (March - May), post-monsoon (August - October) and winter

(November - January), the same procedure was followed for animal collection and their maintenance in the laboratory. For experimental work only healthy clams were selected and tested.

**Experimental design:**

For experiment 30 individual clams were exposed to ten lower salinity ranges (100%, 90%, 80%, 70%, 60%, 50%, 40%, 30%, 20%, 10%) for 08 days, here 100% saline water was normal water of estuary collected during high tide, therefore it was considered as control range in all the seasons. These salinity ranges were maintained throughout experiment by adding freshwater. Daily changes in double filtered sea water of the respective salinity range were made with 6 hour interval.

**Table 1: Seasonal salinity variations in estuary and experimental set.**

Salinity Ranges		L.T.	H. T.	Salinity in %									
				Contro l/ 100	90	80	70	60	50	40	30	20	10
Seasonal salinity in ‰	Summer	36 ± 0.55	38 ± 0.78	38± 1	35 ±1	33 ±1	30 ±1	27 ±1	23 ±1	19 ±1	14 ±1	10 ±1	06 ±1
	Post- monsoon	22 ± 4	29 ± 2	29± 1	26 ±1	23 ±1	20 ±1	17 ±1	14 ±1	11 ±1	08 ±1	06 ±1	03 ±1
	Winter	28 ± 0.36	36 ± 0.55	36±1	33 ±1	29 ±1	26 ±1	22 ±1	19 ±1	16 ±1	12 ±1	08 ±1	04 ±1

All the values are mean ± S.D.

Behavioural assessment of the clam was performed by selecting few behavioural patterns such as shell valve closure, mantle and siphon activity. All these behavioural patterns were observed for 08 days period of exposure to various salinity ranges during all three selected seasons. Along with these behavioural assessments, mortality of the clams during exposure period was also recorded for 08 days. Mortality observations were presented as % mortality of clam exposed to the respective salinity range in that experimental set.

**RESULT AND DISCUSSION**

In present study, Behaviour like shell valve closing/opening, mantle and siphon activities of clams were presented by different groups indicating percent individuals of clams i.e. A (more than 75% individuals), B (more than 50% individuals), C (more than 25% individuals) and D (up to 25% individuals). Salinity induced Behaviour and mortality pattern of clams during summer, post-monsoon and winter season were represented in table no. 2,4,6 and 3,5,7 respectively.

The ability of estuarine animals to bear rapid changes in the external environment is linked with the ability to regulate their internal environment. Therefore, it is necessary to become a successful estuarine

dweller, that to attain a significant rate of acclimation to ever fluctuating estuarine salinity. The speed of salinity change rather than the magnitude was found to induce short-term stress responses in juvenile spat (Moser and Miller, 1994). Clams have the ability to close their shell valves in response to unfavorable salinity conditions, to prevent internal soft organs from direct exposure to the surrounding seawater. During this time they respire anaerobically. Clams can keep their shell valves closed for several days in such environmental conditions (Baker *et al.*, 2007).

In *K. opima*, range of salinity to trigger valve closure and its extent of period were changes from season to season. During the summer season, clams from almost all salinity ranges (control to 10%) showed closed shell valves up to 3<sup>rd</sup> day of exposure, out of which clams exposed below 50% salinity showed higher number of individuals with closed shell valves (80 to 100%) (Table no. 02). During the post-monsoon season, clam of *K. opima* displayed closed shell valves around 60% individuals from 80% to 10% salinity range up to 8<sup>th</sup> day of exposure (192 hours) (Table no. 04). During winter season, clams of *K. opima* species from 80 to 10% salinity range displayed individuals having closed shell valves with 60% to 80% up to 5<sup>th</sup> day (120 hours) of exposure, which fluctuates with about 60% individuals up to 8<sup>th</sup> day of exposure (Table no. 06).

The blood cockle *Anadara granosa* is an osmoconformer species which closes its shell valve triggered by low salinity ranges below 19‰. Closure of the shell valves provides protection for relatively short periods of 3 days, therefore cockles are vulnerable to low environmental salinities which endure for longer time (Davenport and Wong, 1986). Asian clam *Corbicula fluminea* closed their valves naturally with extended periods up to 10 - 12 hours. The ability of clams to close the valve against any environmental stress, predation, pollution as well as any contamination with reduction in metabolic rate, saves an enormous amount of energy which can be beneficial during the starvation period (Ortmann and Grieshaber, 2003).

Clam *K. opima* in 50% to 30% salinity ranges showed increase siphon and mantle activity during first two days of exposure, which later reduced after the 3<sup>rd</sup> to 8<sup>th</sup> day of exposure during summer season (Table no. 02). During post-monsoon season, clam *K. opima* showed 60% siphon and mantle activity in clams from 80 to 50% salinity range till the 3<sup>rd</sup> day of exposure, further it was declined to 40% of individuals (Table no. 04). Comparatively, during winter season, clams exposed to 80 to 40% salinity showed increased siphon and mantle activity 5<sup>th</sup> day of exposure (Table no. 06). Stress conditions induced by lowering salinity changes from season to season. During the summer season due to salinity stress mantle and siphon activity reduced from 20% to 10% salinity, during post-monsoon season it starts from 40% salinity up to 10% salinity and during the winter season it was observed from 30% salinity to 10% salinity.

The blue mussel response to a rapid drop in ambient salinity by closing its exhalent siphon to stop the ventilation of the mantle cavity, and then closes its shell, if the salinity change is large enough. Such change in salinity may be resulted from the ebb tide in estuaries with a large input of fresh water (Davenport, 1982). It can thus effectively isolate its tissue with half change in ambient osmotic concentration (Shumway, 1977). But according to Gilles (1972), animals cannot maintain shell closure position longer than about 96 hours, because during the shell closure period it must depend on stored nutrient reserves and anaerobic metabolism to sustain energy demands. Therefore, if those adverse salinity

conditions remain for a longer period, then the animal opens its shell and adjust osmotically to the ambient conditions (Widdows, 1985 a,b).

Acute reduction in salinity may have a precise impact on clam survival. Reduction in salinity may also have sub-lethal effects on metabolic or feeding rates, resulting in reduced growth rate. For example, oyster spat subjected to low salinities for longer than 2 weeks did not immediately attain normal feeding levels to return to full salinities, and mortality continued to be high (Rodstrom and Jonsson, 2000).

During summer season, clams *K. opima* experienced 10% salinity reduction under natural estuarine condition, hence it is expected that they successfully acclimatized with such salinity fluctuation in natural conditions. But in laboratory experiment it was found that *K. opima* showed tolerance to lower salinity i.e. 40% salinity (19‰) with 87% survival rate (Table no. 03). As compared to the summer season, during post-monsoon season, due to the higher water influx from the river and adjacent lowland areas, estuarine water get diluted so estuarine animal experiences comparatively low salinity during post-monsoon season. During this season clam experience near about 40% low salinity than normal salinity of estuary during high tide (29‰) and low tide (17‰). So it is considered that in this period clams tolerance increased towards lower salinity as they continuously experienced nearly 40% lower salinity in natural environmental conditions. It was cleared during laboratory experiments, which showed 87% survival rate in clams exposed to 40% lower salinity range i.e. 60% lower salinity (11‰) in laboratory conditions compared to natural condition (Table no. 05). This indicates increase in clam's tolerance during post-monsoon season than expected range of tolerance in natural conditions. During winter season, clams experienced 20% salinity decrease from high tide to low tide water mark, which indicated that, clams can tolerate salinity from 100‰ to 80‰ during winter season (Table no. 07). Clams exposed to lower salinity ranges in laboratory condition showed their tolerance up to 40% salinity range (16‰). Clam *K. opima* from Bhatye estuary exposed directly to low salinity ranges from 30‰ to 10‰ salinity showed 77 to 100% mortality during summer, post-monsoon and winter season. But both, degree of salinity change and time taken by clams for 100% mortality was observed to be varied from season to season.

Sturmer, (2005) found that, Juvenile hard clams, *Mercenaria mercenaria*, having strength and rigidity towards sudden change in salinity reduction from 10 - 15‰ by experiencing less than 5% mortality. On the other hand, salinity declines with the extent of 20 - 24‰, resulted in significant mortality by 17%, when clams exposed step by step to these lower salinity; while 100% mortality observed in the clams which directly exposed to test salinity following 6 days of exposure. Kripa *et al.*, (2006) observed 100% mortality within 8 days in seed clams of *P. malabarica* (size 6 - 10 mm) exposed to 0, 5, and 10‰, whereas they found salinity greater than 25‰ is useful for clam farming as they observed 33 and 16% mortality in 10 days at 20 and 25‰ salinity. If low saline condition prevails, the seed must be removed within 10 days. They also observed that, the seed clams can tolerate exposure of low saline conditions up to 48 hrs at different percent survival. Such exposure will result in 12.5% mortality in 10‰ and 2.5% mortality in 15‰. In 20 and 25‰ salinity, survival of the clams will not affect up to 48 hrs of exposures.

During present study clam *K. opima* from Bhatye estuary showed overall tolerance towards lower salinity is up to 40‰ salinity range i.e. 19‰, 11‰, and 16‰ salinity for 8 days of exposure during summer, post-monsoon and winter season respectively. In brackish water areas of New South Wales, Australia, the clams *Katelysia rhytiphora* and *Tapes dorsatus*, were found to require salinities of 20 – 45‰ for survival, where these species can withstand longer than seven days at salinity ranges below 20‰. Therefore, they can only grow in the higher salinity range regions of the estuary (Nell, 1997). Similar observations were found with slight deviation in tolerance to salinity in the wedge clam, *Donax cuneatus*. It endures salinity dilution up to 22.05‰. Further dilution in salinity like 18.9‰ resulted in to erratic behavior with 100% mortality at 9.45‰ (Talikhedkar, 1981).

**Table 2: Behaviour observations of Clam *K. opima* under exposure of various salinity ranges during summer season**

Hours	Ranges Behaviour patterns	Contr ol	90%	80%	70%	60%	50%	40%	30%	20%	10%
0 Hours	1. SVC	A	A	A	A	A	A	A	A	A	A
	2. SVO	-	-	-	-	-	-	-	-	-	-
	3. M and S activity	-	-	-	-	-	-	-	-	-	-
24 Hours	1. SVC	D	B	B	B	B	C	C	A	A	A
	2. SVO	-	-	-	-	-	-	-	-	-	-
	3. M and S activity	A	C	C	C	C	B	B	D	-	-
48 Hours	1. SVC	B	B	C	B	B	C	D	B	B	A
	2. SVO	-	-	-	-	-	-	-	-	-	-
	3. M and S activity	C	C	B	B	C	B	A	C	D	-
72 Hours	1. SVC	B	B	C	B	B	C	C	D	D	C
	2. SVO	-	-	-	-	-	-	-	-	-	-
	3. M and S activity	C	C	B	C	D	B	B	B	D	-
96 Hours	1. SVC	C	C	D	A	D	D	B	D	-	Nil
	2. SVO	-	-	D	-	-	-	-	-	-	-
	3. M and S activity	B	B	A	D	A	B	D	C	D	-
120 Hours	1. SVC	C	D	D	B	C	A	B	-	Nil	Nil
	2. SVO	-	D	-	-	-	-	D	-	-	-
	3. M and S activity	B	B	B	D	C	D	D	D	-	-
144 Hours	1. SVC	D	C	C	C	D	C	B	-	Nil	Nil
	2. SVO	-	D	-	-	-	-	-	-	-	-
	3. M and S activity	B	C	D	B	B	C	D	D	-	-
168 Hours	1. SVC	D	C	C	C	D	C	B	Nil	Nil	Nil
	2. SVO	-	D	-	-	-	-	-	-	-	-
	3. M and S activity	B	C	D	B	B	C	D	-	-	-
192 Hours	1. SVC	D	C	C	C	D	C	B	Nil	Nil	Nil
	2. SVO	-	D	-	-	-	-	-	-	-	-
	3. M and S activity	B	C	D	B	B	C	D	-	-	-

SVC = Shell Valve Closed, SVO = Shell Valve Open, M and S activity = Mantle and Siphon activity, A= (more than 75%), B= (more than 50%), C = (more than 25%), D= (up to 25%), - = absent

**Table 3: Mortality of clam *Katelysia opima* under exposure to various salinity ranges during summer season**

Time in Hours	Control	90%	80%	70%	60%	50%	40%	30%	20%	10%
0 Hours	-	-	-	-	-	-	-	-	-	-
24 Hours	-	-	-	-	-	-	-	-	-	-
48 Hours	-	-	-	-	-	-	-	-	5	6
72 Hours	-	-	-	-	-	-	-	12	17	14
96 Hours	-	-	-	-	-	-	-	6	3	10
120Hours	-	-	3	-	-	-	-	7	5	-
144Hours	2	1	4	-	-	-	3	2	-	-
168Hours	-	-	5	-	-	-	1	3	-	-
192Hours	-	1	-	-	-	-	-	-	-	-
%Mortality	7	7	40	0	0	0	13	100	100	100

**Table 4: Behaviour observations of Clam *K. opima* under exposure of various salinity ranges during Post-monsoon season.**

Hours	Ranges	Control	90%	80%	70%	60%	50%	40%	30%	20%	10%
	Behaviour patterns										
0 Hours	1. SVC	A	A	A	A	A	A	A	A	A	A
	2. SVO	-	-	-	-	-	-	-	-	-	-
	3. M and S activity	-	-	-	-	-	-	-	-	-	-
24 Hours	1. SVC	A	B	A	A	A	B	C	A	B	B
	2. SVO	-	-	-	-	-	-	-	-	D	D
	3. M and S activity	D	C	D	D	D	C	C	D	D	D
48 Hours	1. SVC	B	B	B	B	B	C	C	A	B	D
	2. SVO	-	-	-	-	-	-	-	D	D	D
	3. M and S activity	C	C	C	C	C	B	B	D	D	D
72 Hours	1. SVC	B	C	C	B	B	C	C	C	D	Nil
	2. SVO	-	-	-	-	-	-	-	-	D	-
	3. M and S activity	C	B	B	C	C	B	C	C	D	D

	activity										
<b>96 Hours</b>	1. SVC	<b>B</b>	<b>C</b>	<b>B</b>	<b>C</b>	<b>C</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>Nil</b>	<b>Nil</b>
	2. SVO	-	-	-	-	-	-	-	-	-	-
	3. M and S activity	<b>D</b>	<b>C</b>	<b>D</b>	<b>C</b>	<b>C</b>	<b>D</b>	<b>C</b>	<b>A</b>	-	-
<b>120 Hours</b>	1. SVC	<b>B</b>	<b>B</b>	<b>B</b>	<b>B</b>	<b>C</b>	<b>C</b>	<b>C</b>	<b>D</b>	<b>Nil</b>	<b>Nil</b>
	2. SVO	-	-	-	-	-	-	-	<b>D</b>	-	-
	3. M and S activity	<b>D</b>	<b>D</b>	<b>D</b>	<b>C</b>	<b>C</b>	<b>C</b>	<b>C</b>	<b>C</b>	-	-
<b>144 Hours</b>	1. SVC	<b>B</b>	<b>B</b>	<b>B</b>	<b>B</b>	<b>B</b>	<b>B</b>	<b>B</b>	<b>D</b>	<b>Nil</b>	<b>Nil</b>
	2. SVO	-	-	-	-	-	-	<b>D</b>	<b>D</b>	-	-
	3. M and S activity	<b>C</b>	<b>D</b>	<b>D</b>	-	<b>D</b>	<b>D</b>	<b>D</b>	<b>D</b>	-	-
<b>168 Hours</b>	1. SVC	<b>C</b>	<b>B</b>	<b>B</b>	<b>B</b>	<b>B</b>	<b>B</b>	<b>B</b>	<b>D</b>	<b>Nil</b>	<b>Nil</b>
	2. SVO	-	-	-	-	-	-	-	<b>D</b>	-	-
	3. M and S activity	<b>C</b>	<b>D</b>	<b>D</b>	<b>C</b>	<b>D</b>	<b>D</b>	<b>D</b>	<b>C</b>	-	-
<b>192 Hours</b>	1. SVC	<b>C</b>	<b>B</b>	<b>B</b>	<b>B</b>	<b>B</b>	<b>B</b>	<b>B</b>	<b>D</b>	<b>Nil</b>	<b>Nil</b>
	2. SVO	-	-	-	-	-	-	-	-	-	-
	3. M and S activity	<b>C</b>	<b>D</b>	<b>D</b>	<b>C</b>	<b>D</b>	<b>D</b>	<b>D</b>	<b>D</b>	-	-

SVC = Shell Valve Closed, SVO = Shell Valve Open, M and S activity = Mantle and Siphon activity, A= (more than 75%), B= (more than 50%), C = (more than 25%), D= (up to 25%), - = absent

**Table 5: Mortality of clam *Katelysia opima* under exposure to various salinity ranges during Post-monsoon season**

<b>Time in Hours</b>	<b>Control</b>	<b>90%</b>	<b>80%</b>	<b>70%</b>	<b>60%</b>	<b>50%</b>	<b>40%</b>	<b>30%</b>	<b>20%</b>	<b>10%</b>
<b>0 Hours</b>	-	-	-	-	-	-	-	-	-	-
<b>24 Hours</b>	-	-	-	-	-	-	-	-	5	5
<b>48 Hours</b>	-	-	-	-	-	-	-	2	6	11
<b>72 Hours</b>	-	-	-	-	1	-	-	3	12	9
<b>96 Hours</b>	-	-	-	-	1	-	1	2	7	5



<b>120Hours</b>	-	-	-	-	<b>1</b>	-	<b>2</b>	<b>8</b>	-	-
<b>144Hours</b>	-	-	-	-	-	-	-	<b>4</b>	-	-
<b>168Hours</b>	-	-	-	-	-	-	<b>1</b>	-	-	-
<b>192Hours</b>	-	-	-	-	-	-	-	<b>4</b>	-	-
<b>%Mortality</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>10</b>	<b>0</b>	<b>13</b>	<b>77</b>	<b>100</b>	<b>100</b>

**Table 6: Behaviour observations of Clam *K. opima* under exposure of various salinity ranges during winter season**

<b>Hours</b>	<b>Ranges</b>	<b>Control</b>	<b>90%</b>	<b>80%</b>	<b>70%</b>	<b>60%</b>	<b>50%</b>	<b>40%</b>	<b>30%</b>	<b>20%</b>	<b>10%</b>
	<b>Behaviour patterns</b>										
<b>0 Hours</b>	1. SVC	A	A	A	A	A	A	A	A	A	A
	2. SVO	-	-	-	-	-	-	-	-	-	-
	3. M and S activity	-	-	-	-	-	-	-	-	-	-
<b>24 Hours</b>	1. SVC	A	B	B	A	B	C	D	A	A	B
	2. SVO	-	-	-	-	-	-	-	-	-	-
	3. M and S activity	D	C	C	D	C	B	A	D	D	D
<b>48 Hours</b>	1. SVC	A	B	B	A	A	B	C	C	B	B
	2. SVO	-	-	-	-	-	-	-	-	-	D
	3. M and S activity	D	C	C	D	D	C	B	B	D	-
<b>72 Hours</b>	1. SVC	A	B	B	B	B	A	C	D	C	D
	2. SVO	-	-	-	-	-	-	-	-	-	-
	3. M and S activity	D	C	C	C	C	D	B	B	D	-
<b>96 Hours</b>	1. SVC	B	B	B	B	B	B	B	D	D	Nil
	2. SVO	-	-	-	-	-	-	-	-	-	-
	3. M and S activity	D	D	C	D	D	D	D	D	D	-
<b>120 Hours</b>	1. SVC	B	B	B	A	B	B	B	D	D	Nil
	2. SVO	-	-	-	-	-	-	-	-	-	-
	3. M and S activity	D	D	D	D	D	D	D	D	-	-

<b>144 Hours</b>	1. SVC	<b>B</b>	<b>C</b>	<b>B</b>	<b>B</b>	<b>B</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>Nil</b>	<b>Nil</b>
	2. SVO	-	-	-	-	-	-	-	-	-	-
	3. M and S activity	<b>C</b>	<b>C</b>	<b>C</b>	<b>D</b>	<b>C</b>	<b>C</b>	<b>B</b>	<b>D</b>	-	-
<b>168 Hours</b>	1. SVC	<b>B</b>	<b>B</b>	<b>B</b>	<b>B</b>	<b>C</b>	<b>C</b>	<b>C</b>	-	<b>Nil</b>	<b>Nil</b>
	2. SVO	-	-	-	-	-	-	<b>D</b>	-	-	-
	3. M and S activity	<b>D</b>	<b>C</b>	<b>C</b>	<b>D</b>	<b>C</b>	<b>C</b>	<b>C</b>	<b>D</b>	-	-
<b>192 Hours</b>	1. SVC	<b>B</b>	<b>B</b>	<b>B</b>	<b>B</b>	<b>C</b>	<b>C</b>	<b>C</b>	<b>D</b>	<b>Nil</b>	<b>Nil</b>
	2. SVO	-	-	-	-	-	-	<b>D</b>	-	-	-
	3. M and S activity	<b>C</b>	<b>C</b>	<b>C</b>	<b>D</b>	<b>C</b>	<b>C</b>	<b>C</b>	<b>D</b>	-	-

SVC = Shell Valve Closed, SVO = Shell Valve Open, M and S activity = Mantle and Siphon activity, A= (more than 75%), B= (more than 50%), C = (more than 25%), D= (up to 25%), - = absent

**Table 7: Mortality of clam *Katelsia opima* under exposure to various salinity ranges during winter season.**

<b>Time in Hours</b>	<b>Control</b>	<b>90%</b>	<b>80%</b>	<b>70%</b>	<b>60%</b>	<b>50%</b>	<b>40%</b>	<b>30%</b>	<b>20%</b>	<b>10%</b>
<b>0 Hours</b>	-	-	-	-	-	-	-	-	-	-
<b>24 Hours</b>	-	-	-	-	-	-	-	-	-	<b>8</b>
<b>48 Hours</b>	-	-	-	-	-	-	<b>2</b>	-	<b>7</b>	<b>5</b>
<b>72 Hours</b>	-	-	-	-	-	-	<b>2</b>	<b>11</b>	<b>8</b>	<b>10</b>
<b>96 Hours</b>	-	-	<b>1</b>	-	-	-	<b>1</b>	<b>7</b>	<b>5</b>	<b>7</b>
<b>120Hours</b>	-	-	-	-	-	-	-	<b>5</b>	<b>6</b>	-
<b>144Hours</b>	-	-	-	-	-	-	-	<b>2</b>	<b>4</b>	-
<b>168Hours</b>	-	-	-	-	-	-	<b>1</b>	<b>1</b>	-	-
<b>192Hours</b>	-	-	-	-	-	-	-	-	-	-
<b>%Mortality</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>20</b>	<b>87</b>	<b>100</b>	<b>100</b>

## **CONCLUSION**

In the present investigation, the effect of environmental stress conditions like low salinity on estuarine clam *K. opima* under controlled laboratory conditions showed variation in physiological responses and tolerance with respect to the seasons. From the results of shell valve closing behaviour of clams of *K. opima*, it was clear that initial period of lower salinity exposure during post-monsoon season is more stressful, as compared to winter and summer season. Mantle and siphon activity of clam *K. opima* showed

positive correlation with salinity, but degree of change in response varies from season to season. The range of lower salinity from which, prominent reduction in mantle and siphon activity observed during post-monsoon season (40%) was closer to control salinity range as compare to summer season (20%) and winter season (30%). Seasonal changes in salinity variation in natural environmental conditions can alter the tolerance capacity of clam.

During present study, clam *K. opima* from Bhatye estuary showed overall tolerance towards lower salinity up to 40% salinity range i.e. 19‰, 11‰, and 16‰ salinity for 8 days of exposure during summer, post-monsoon and winter season respectively. On the basis of behavioural response in clam *K. opima* exposed to various lower salinity ranges, it is clear that, overall lower salinity tolerance limit is up to 70% salinity i.e. 30% reduction in salinity of normal estuarine water in that season. But below their adaptive limit of the salinity range like at 50% and 40% salinity, critical physiological changes were marked in this clam species.

### ACKNOWLEDGEMENT

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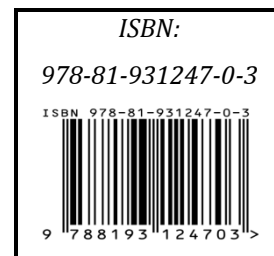
# CHAPTER 2

## AMYLASE ACTIVITY IN DIGESTIVE ORGANS OF FRESHWATER SNAIL *BELLAMYA BENGALENSIS* AGAINST TOXICITY OF COPPER SULPHATE AND *ACACIA SINUATA*

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### ABSTRACT

Enzymes are highly effective and extremely specific catalysts. These are the biological polymers that catalyse the chemical reactions. The presence and maintenance of a complete and balanced set of enzymes is essential for the breakdown of nutrients to supply energy and chemical building. In this study amylase activity was noted at pre-determined LC<sub>50</sub> concentration of metal copper sulphate (0.56 ppm) and plant extract of *Acacia sinuata* (232 ppm) under different exposure periods. i. e. 24 hrs., 48 hrs., 72hrs. and 96hrs. After exposure period, the amylase activity was recorded in digestive organs like salivary gland, oesophagus, intestine, stomach and hepatopancreas of freshwater snail *Bellamyabengalensis*. The experimental results revealed that amylase activity was decreased considerably ( $P < 0.001$ ) in all digestive organs up to 96 hrs. against metal and molluscicide. Reduced amylase activity imbalance the digestion mechanism and it may ultimately effects on nutrients and chemical building in freshwater snail *B. bengalensis*.

**KEY WORDS:** Amylase activity, Digestive organs, *Bellamyabengalensis*, Copper sulphate and *Acacia sinuata*.

### INTRODUCTION

Industrial effluents, domestic sewage and land run-off all enter into the environmental compartments and exert their impact on living organisms. Most of the aquatic ecosystem receives excessive heavy metals from industrial effluents. In biological cycle metals are neither degraded nor metabolized, so remain highly persistent in nature. They also possess property of accumulation over a long period throughout the food chain (Subramanian, 2010). Living organisms require stress amounts of heavy metals. Iron, cobalt, copper, manganese, molybdenum and zinc are required to human life. Excessive levels can damage the cell. Their accumulation in the bodies can cause serious illness. Some of the elements that are beneficial to the organisms under certain conditions become toxic (Clayton, 1981).

Aquatic mollusks, particularly gastropods have controlled by the mechanical, chemical, biological and other methods. Despite, an integrated approach to the control of snails and has proved to be a particularly intractable problem. It has high biotic potentials and ability to disperse. Molluscs showed considerable resistance to molluscicides, which documented simple method used for control the snails (Sudiono *et al.*, 2000). Pesticides are helpful, when they used in proper way, but due to indiscriminate use of these pesticides, it gets accumulated in air, water and soil to pollute the environment. In agricultural practices, in order to take more yield, large amount of chemical fertilizers, pesticides, herbicides and molluscicides were used to control the pests. Toxic content by runoff find its way to water bodies (Awati, 2004).

Analysis of intracellular enzymatic activity provides invaluable prognostic and diagnostic information related to health of animal. Measurement of enzyme activity is a central in research investigation. Amylase presents in saliva, which catalyses the breakdown of starch into sugar. Pancreatic amylase also hydrolyses the dietary starch into disaccharides and trisaccharides which are converted in to glucose by action of other enzymes in normal process. Digestive tract is the principle site for secretion of digestive enzymes, for digestion of food and absorption of nutrients (Pauchet *et al.*; 2007). Enzyme activities in body or cells (amylase, protease, and lipases) provide information about the digestive capacity and efficiency of species related to feeding components (Buddington *et al.*, 1997). But any harmful chemical enter in animal body, it effects the enzyme regulation process and its digestion mechanism.

By considering the important role of enzyme constituent of digestive organ in the normal physiological activity, work has been carried out to study comparative metal and molluscicide induced toxicity to the alimentary tract and associated digestive glands of freshwater molluscan species *Bellamyabengalensis* (Lamarck).

## MATERIALS AND METHODS

Freshwater snail *Bellamyabengalensis*(L) was collected from Rajaram tank, near Shivaji University, Kolhapur, Maharashtra (India). Water from tank used for irrigation, bathing, washing and also for idol immersion. For the present investigation, freshwater Prosobranch snail *Bellamyabengalensis* (Lamarck) selected. It is easily available and having population in the selected freshwater body.

### 1) Selected Toxicants:-

Two toxicants were used for the present study,

- i) Copper sulphate
- ii) Pods extract of *A. Sinuata*

### 2) Experimental setup:-

Experimental animals were exposed to pre-determined mean LC<sub>50</sub> concentration of heavy metal copper sulphate (CuSO<sub>4</sub>.5H<sub>2</sub>O) at 0.56 ppm and pod extract of *Acacia sinuata* toxicity at 232 ppm to different exposure periods at 24 hrs, 48hrs, 72 hrs and 96 hrs respectively. Treated animals were used for the enzyme activity. Control group for both was run simultaneously and for enzyme activity digestive tissue such as

salivary gland, oesophagus, intestine, stomach and hepatopancreas were selected and processed for estimation of amylase by (Ishaaya and Swirski, 1970) method..

All results of the enzyme analysis are given as the mean of three readings with  $\pm$  standard deviation (SD). In the statistical analysis, the one-way analysis of variance (ANOVA) was used to test.

## RESULTS

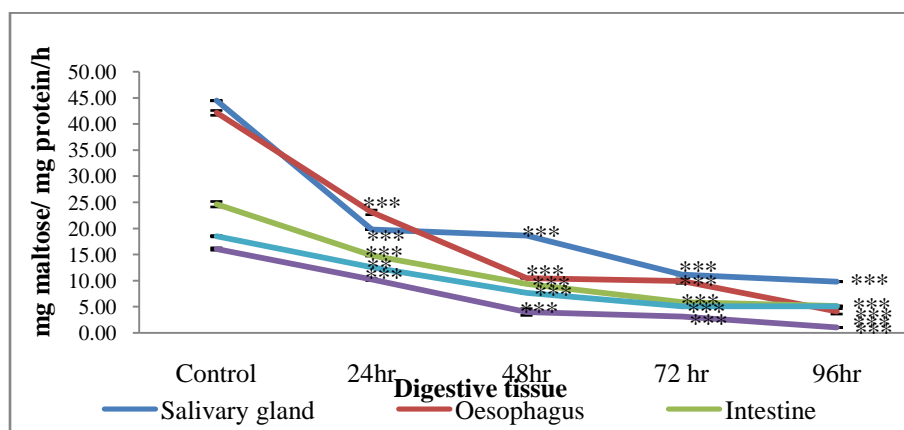
### A) Amylase activity in different digestive organs of control group:-

Amylase activity of control group in snail *B.bengalensis* of different digestive organs, where salivary gland showed 44.47 mg maltose/mg protein/hrs, oesophagus contained 42.13 mg maltose/mg protein/hrs, intestine showed 24.65 mg maltose/mg protein/hrs, stomach has 16.07 mg maltose/mg protein/hrs and hepatopancreas was with 18.53 mg maltose/mg protein/hrs. Results showed that, salivary gland and oesophagus has maximum amylase activity as compared to other tissues. Above results of enzymatic activity was compared to the metal and molluscicide induced experimental group.

### a) Effect of Copper sulphate on activity of amylase:

Intoxication of coppersulphate has changed amylase activity after 24 hrs, it was 19.81 mg maltose/mg protein/hrs, up to 96 hrs reduced significantly in 9.83 mg maltose/mg protein/hrs. The amylase activity in oesophagus after 24 hrs was 23.09 mg maltose/mg protein/hrs, after 48 hrs 10.53, at 72 hrs 9.93 and 4.41 after 96 hrs exposure. Intestine has 14.82 after 24 hrs and after 96 hrs 5.15 was found. The stomach showed 10.23 amylase activity after 24 hrs, 4.02 and after 96 hrs 1.06 was noted. The hepatopancreas has amylase activity as 12.6 after 24 hrs, 5.11 at 96 hrs. The enzymatic data was represented in graph No. 1.

**Graph 1: Changes in the Amylase activity after exposure to copper sulphate**

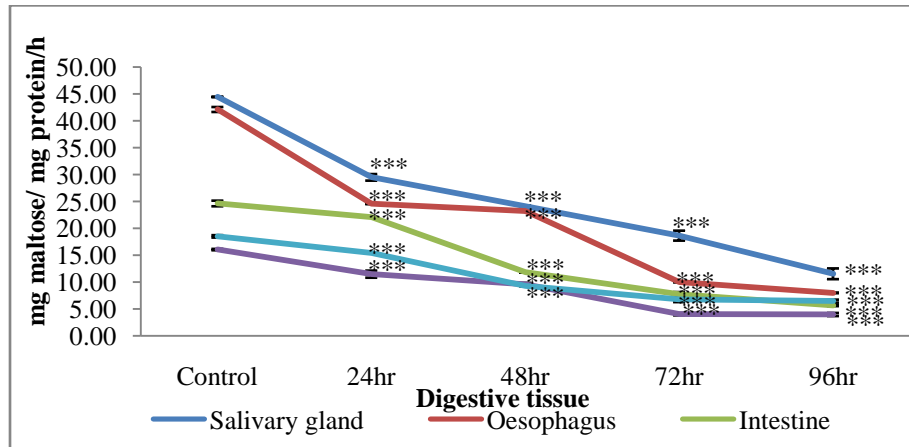


### b) Effect of *A. sinuata* on activity of amylase:

Intoxication of *A. sinuata* to the experimental snail, the amylase activity was decreased as compared to control group. Salivary gland found 29.51 mg maltose/mg protein/hrs at 24 hrs, 24.10 mg maltose/mg protein/hrs after 48 hrs, 18.67 mg maltose/mg protein/hrs at 72 hrs and 11.57 mg maltose/mg protein/hrs decreased amylase activity at 96 hrs. In oesophagus, at 24 hrs 24.57 and 96 hrs found 8.01 mg maltose/mg

protein/hrs. Intestine showed 22.08 after 24 hrs, and 5.67 at 96 hrs. Stomach recorded 11.50 amylase activity at 24 hrs, and 3.99 mg maltose/mg protein/hrs at 96 hrs respectively. In hepatopancreas amylase activity was 15.42 at 24 hrs, and at 96 hrs 6.48 amylase activity was reduced. The enzymatic data was represented in graph No. 2.

**Graph 2: Changes in the Amylase activity after exposure to *Acacia sinuata***



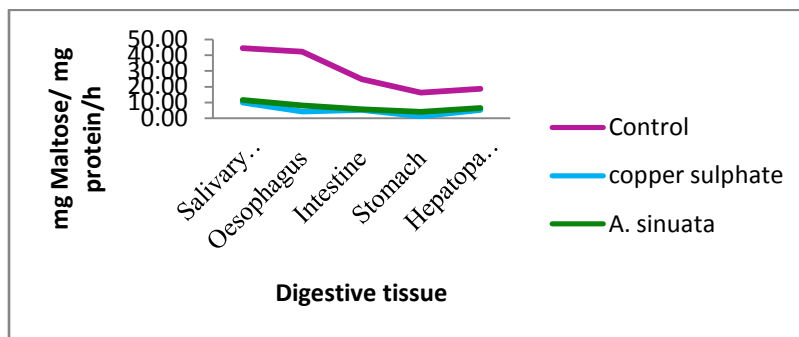
## DISCUSSION

In the present study, effect of metal copper sulphate and pod extract of *Acacia sinuata* was assessed for enzymological alterations in the amylase activity. Recently, Al Daihan (2008) noted that, activity of  $\alpha$ -amylase and lipase were significantly reduced in *S. nigrem* in treated snails, inhibition of these two enzymes activity has affected the development of *Schistosoma parasite*. Alteration in enzyme activity can be correlated with molluscicide induced changes and altered structure of the cell (Triebskorn, 1991). Exposing *Cnaphalocrocismedinalis* (Guenee) invertebrate to sub-lethal doses of *Bacillus thuringiensis* (Kurstaki) in the laboratory reduced digestive enzyme activities (Senthil Nathan *et al*; 2005 and 2006). Some workers, found the biomechanisms of digestive enzymes constitute a physiological parameter affecting the digestive capacity (Ibarrola *et al*, 2000), the control of such a parameter may be important elevate assimilation rate and consequently the level of energy gain (Grizwi and Herral, 1991).

In the present investigation, we found that copper induced amylase activity was decreased up to 78% in salivary gland, oesophagus has 90%, intestine with 79%, stomach 93% and 72% reduction was found in hepatopancreas. Intoxication of *A. sinuata* showed reduction of amylase activities approximate 74% in salivary gland, 81% in oesophagus, 76% in intestine, 75% in stomach and 65% in hepatopancreas respectively (Graph No. 3).



**Graph 3: Comparative account of Amylase activity in digestive organs after intoxication of CuSO<sub>4</sub> and *A. sinuata***



In molluscan species the structure of  $\alpha$ -amylase cDNA was determined in *Pectin maximus* (LE Moineet *al.*, 1997); in the oyster, from a digestive gland cDNA library, only one cDNA was recovered and other isoforms were determined by electrophoretic separations (Moalet *al.*; 2000). Gene B preferentially expressed in labial palps (to be compared to mammalian salivary  $\alpha$ -amylase) and at a lower level, in the other tissues. In the tropical shrimp *Litopenaeusvanname*; the three genes were found to be expressed only in the digestive gland (LE moullacet *al.*; 1996). Amylase activity promoted carbohydrate digestion in animals (Areekijsereeet *al.*, 2006; Supannaponget *al.*, 2008) and used indicator for carnivorous feeding habit (Hofer and Schiemer, 1981). Results were comparatively interpreted in which maximum amylase reduction was found in stomach and oesophagus by both intoxicants of freshwater snail *B. bengalensis*.

## CONCLUSION

Present investigation concludes that, any toxic content was responsible for reduction of physiological and enzymatic activity. So, the copper sulphate and pod extract of *Acacia sinuata* has significantly decrease the amylase activity in the freshwater snail *B. bengalensis*.

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# CHAPTER 3

## AVIFAUNAL DIVERSITY OF SIR PIRAJI RAO LAKE, MURAGUD, KOLHAPUR DISTRICT, MAHARASHTRA

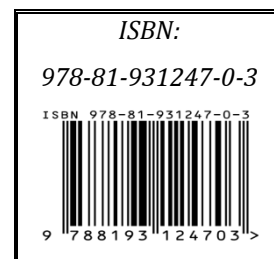
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### ABSTRACT

Birds are one of the sensitive bioindicators of the environmental health as well as its sustainability; being high in food chain and the best known and most popular component of wildlife. Sir Pirajirao Lake, Murgud, Kolhapur is one of the major water reservoir in the present area which is surrounded by planned agricultural field and residential houses having vegetation variations from grassland to trees. To plan accordingly at the state and regional level, as well as to assess valuable guidelines and prioritization of reserves, the biodiversity of birds plays an important role. The present study includes study period of five months in which total 44 birds species were recorded, out of which 15 were resident migratory and 29 were resident. This paper provides an overview of status of birds and their occurrence in the study area.

**KEYWORDS:** Avifaunal Diversity; Lake; Murgud

### INTRODUCTION

Birds are sensitive indicators of the health of the environment and sustainability, reflecting trends in other biodiversity, being responsive to change, high in food chains, inexpensive to survey and the best known and most popular component of wildlife. Freshwater ecosystems may well be the most endangered ecosystems in the world. Declines in biodiversity are far greater in freshwaters than in the most affected terrestrial ecosystems.

In addressing the environmental problems of an area, birds can be used as very appropriate bio-indicators suggesting the status of biodiversity in general. Biodiversity assessment provides valuable guidelines for the prioritisation of reserves and protected areas for the resource conservation and planning accordingly at state and regional level (Badola & Aitken, 2010). In biodiversity conservation efforts, the assessment and evaluation of bird communities have been considered as important tools (Shafiq et al., 1997).

In understanding biodiversity, altitudinal gradients for the bird distribution provide highly useful clues. Comprising about 13% of the world avian diversity, India has approximately 1300 species of birds (Grimmett et al., 1998). Relatively, there is insufficient knowledge available regarding the bird communities and their dynamics in India. In mountain context, altitudinal gradients display a number of diversity patterns of birds. Moreover, the Hima-layan avian diversity for a wider range remains relatively least investigated. However, some important studies on Himalayan context of bird diversity and community structure have been made (Laiolo, 2003).

Wetlands constitute a treasury of biodiversity. The social demand and dependence on the wetlands provide an unaccountable economic value to such habitats. They are complex water and land interactive systems and are supposed to be the most fertile and productive sites in the world. Lakes are highly complex water, land interactive systems, supposed to be the most fertile - productive ecosystems in the world (R G Wetzel, 2001) and constitute a treasury of biodiversity. Due to inadequate attention and ignorance of common man, these lakes are referred as wastelands in the past, leading to their disappearance in the process of urbanization and development.

## **MATERIAL AND METHODS**

The study site of Sir Pirajirao water reservoir, Murgud is situated in Kagal Taluka of Kolhapur district. The area covered by the Lake is about 4.5km. The varied vegetation covers the most of the study area. The study area surrounding contains planned agricultural field sites and residential houses. The Sir Pirajirao water reservoir has varied vegetation from grassland to trees.

The study was carried out during September 2012 to January, 2013. The observations regarding the bird diversity were made two times daily i.e. during early morning and late evening.

A binocular was used as a field instrument and camera was used for catching some photos. For identification of birds "The Book of Indian Birds" by Salim Ali (2002) was referred.

### **STUDY AREA:**

The lake is owned by Maharashtra state Minor Irrigation department. According to the history, the lake is constructed by Sir Pirajirao ghadage in 1923. Lake is surrounded by three villages (one on the east, one on the west and the other one on north side). It is wholly rain fed and canal is connected to it for traditional supply of water and Irrigation. The northern embankment runs about a kilometer and is still strong.

## **RESULTS**

During the study period of the five months (Spt.2012- Jan.2013) a total of 44 bird species belonging to 27 families and to 9 order were observed in the said of water bodies. Their local status was also analyzed through the study data. Among these 44 birds were observed in sir Pirajirao Lake out of which 15 were Resident Migratory (RM) and 29 were Resident (R).

**Table 1: Checklist of Birds of Sir Pirajirao Lake during the study period:**

Order	Family	Scientific Name	Common Name	Migratory Status	Status
Anseriformes	Anatidae	<i>Anas Poecilorhyncha</i>	Spot billed duck	RM	1
Bucerotiformes	Bucerotidae	<i>Ocyrceros birostris</i>	Indian Grey Hornbill	R	2
Upupiformes	Upupidae	<i>Upupa epops</i>	Common hoopoe	RM	2
Coraciformes	Alcedinidae	<i>Alcedo atthis</i>	Small blue Kingfisher	RM	3
	Dacelonidae	<i>Halcyon smyrnensis</i>	White breasted Kingfisher	R	1
	Cerylidae	<i>Ceryle rudis</i>	Lesser pied Kingfisher	R	1
	Meropidae	<i>Merops orientail</i>	Small bea eater	R	1
Cuculiformes	Centropodidae	<i>Centropus sinensis</i>	Greater Cauca	R	2
Columbiformes	Columbidae	<i>Columba livia</i>	Blue rock pigeon	R	1
Gruiformes	Rallidae	<i>Gallinula Chloropus</i>	Common moorhen	RM	2
		<i>Fulica atra</i>	Common coot	RM	2
Ciconiformes	Scolopacidae	<i>Actitis hypoleucos</i>	Common sandpiper	RM	1
	Charaatriidae	<i>Charadrius dubius</i>	Little ringed plover	RM	2
		<i>Vanellus indicus</i>	Red wattled lapwing	R	1
	Laridae	<i>Sterna aurantia</i>	River tern	R	1
	Accipitridae	<i>Milvus migrans</i>	Black kite	R	2
		<i>Haliastur indus</i>	Brahminy kite	R	2
	Phalacrocoracidae	<i>Phalacrocorax niger</i>	Little Cormorant	RM	1
	Ardeidae	<i>Casmerodius albus</i>	Large Egret	RM	1
		<i>Ardea purpurea</i>	Purple Heron	RM	1
		<i>Ardea Cinerea</i>	Grey Heron	RM	1
		<i>Bubulucus ibis</i>	Cattle Egret	RM	1
		<i>Egretta garzetta</i>	Little Egret	R	1
		Threskiornithidae	<i>Threskiornis melanocephalus</i>	Oriental white ibis	R
	<i>Pseudibis papilloso</i>		Black ibis	R	2
	<i>Platalea Leucorodia</i>		Eurasian Spoonbill	RM	2
Passeriformes	Lanidae	<i>Lanius schach</i>	Rufous Backed shrike	R	2
	Corvidae	<i>Corvus Splendens</i>	House Crow	R	1
		<i>Corvus macrorhynchos</i>	Jungle crow	R	2

		<i>Dicrurus macrocercus</i>	Black drongo	R	2
	Muscicapidae	<i>Saxicola torquata</i>	Common stonechat	RM	2
		<i>Saxicola leucura</i>	White tailed stonechat	R	2
	Sturnidae	<i>Sturnus pagodarum</i>	Brahminy starling	R	2
		<i>Acridotheres tristis</i>	Common Myna	R	2
		<i>Acridotheres fuscus</i>	Jungal Myna	R	1
	Hirundinidae	<i>Hirundo smithii</i>	Wire tailed swallow	R	2
	Pycnonotidae	<i>Pycnonotus cafer</i>	Red vented bulbul	R	1
		<i>Pycnonotus jocosus</i>	Red whiskered bulbul	R	2
	Alaudidae	<i>Gealerida cristata</i>	Common Crested lark	R	1
		<i>Gealerida deva</i>	Sykes's Crested	R	1
	Passeridae	<i>Motacilla flava</i>	Yellow wagtail	RM	2
		<i>Motacilla alba</i>	White Wagtail	RM	1
		<i>Motacilla maderaspatensis</i>	Large pied wagtail	R	1
	Fringillidae	<i>Crested bunting</i>	Melophus lathami	R	2

(Abbreviations: Migratory status: R – residential, M – migratory, RM – residential migratory. Status: 1- abundant or very common, 2- common, 3- fairly common)

## DISCUSSION

In the present study, total 44 species of birds were observed on the Sir Pirajirao Lake, Murgud. The lake provides the optimum requirements for birds. It is a good site for bird study.

The selected water body has the potential for shelter to various bird species. The availability of food in the area and low anthropogenic activities attract various birds to come over the site.

The status and variation in the diversity of birds during the study period is presented in Table 1. It was observed that the avifaunal diversity was more in December and January as there was optimum water storage, availability of abundant food, increased vegetation and the arrival of migratory birds. The same observation was recorded by Bhat et al. (2009) of Anekere wetland, Karkala, Udipi Karnataka. Similar observations were made by Saxena (1975) on avifauna of Keoladeo National Park, Bharatpur.

## CONCLUSION

The water body is attracting variety of birds since many years and considered as stopover site for migratory birds. To conclude, December month was found to be most favourable to Avifauna of Sir Pirajirao Lake.

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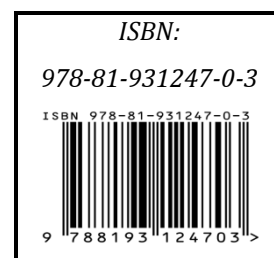
# CHAPTER 4

## SOME STUDIES ON HAND GRIP STRENGTH (HGS) OF THE WORKERS IN DAIRY INDUSTRY

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### ABSTRACT

The present study deals with the Hand Grip Strength of workers from different sections involved in Gokul Dairy. The working continuously in cold environment has directly reflected on the physical, mechanical, organizational environment and working conditions of the workers. The workers have been asked with left and right hand separately to squeeze the Dynamometer for maximum duration of 5 minutes. No any other part of the body was allowed to move while squeezing. For the each worker two trials for each hand have been recorded after 15 seconds recovery. The highest and lowest average left grip strengths 44.2 Kg and 34.6 have been observed for workers of Mechanical section and Cold Storage sections, respectively. Further these workers are found to be suffering from body ache, lack of grip strength, increased heart beats, palpitation, joint pains etc. Further for all workers the grip strength for non dominant hand is found 10% lower than the dominant one. Some preventive steps have been suggested for the well-being, health, competence of workers and the product, profit and the economic growth rate of the Dairy occupation is concerned.

**KEYWORDS:** Dynamometer, Grip Strength, Health, Competence

### INTRODUCTION

The present industrial workers working in highly complicated environment is getting complicated with the environmental and health problems due to modern development. Even though the modern technical machineries have considerably decreased the physical burden of the work but there are still some unfavorable side effects of the modern development which have created problems like noise, vibration, excessive temperature etc.

The present study consists of the dairy industry and different sections involved in processing milk and other dairy products. This is directly reflected on the physical, mechanical, organizational environment and working conditions. Working conditions includes cleanliness, light, heat, ventilation, physical energy, required length of the work day, irregularity of the work hours such as night shifts or the rotation of shifts, physical hazards exposure to possible industrial disease and similar conditions that



directly or indirectly influence the workers happiness, satisfaction or dissatisfaction while working. These conditions have a very wholesome influence on the efficiency and morale of the industrial workers. Concept of Industrial health implies the mere absence of an ascertainable disease or infirmity. Industrial health is the outcome of the interaction between the individual and the working environment. The workers are often exposed to the occupational hazards at their work place in addition to common community health hazards. Industrial health aims at protecting the workers against any health hazards, which includes the physical and mental attitude of workers suited for the jobs and skill. Industrial health comprises measures to establish and maintain the highest possible degree of physical and mental well being of the workers.

Ergonomics is the science of fitting work place conditions and job demands to the capabilities of the working population. It is an approach or solution to deal with a number of problems like work-related musculoskeletal disorder. Since last 25 years the Bureau of Labour Statistics (BLS) is conducting annual survey of occupational injuries and illness and as per the reports the Musculoskeletal disorders seems to be the most prevalent medical problems. It had been reported in 1995 that 308,000 or 62% of all illness cases were due to disorders associated with repeated trauma. There were 367,424 injuries due to over-exertion in lifting 65% affected the back 93,325 injuries due to overexertion in pushing and pulling objects.

Dairy industry plays a very important role in improving the economy of the Indian country since substantial contribution has been added to the national economic growth. It is more dependable and perennial source of income as compared to the agriculture sector. Kolhapur Zilla Sahakari Dudh Utpadak Sangh Ltd. a co-operative organization which is radically known for its most prominent brand name 'Gokul' has carved a special place in the growth of dairy industry in Maharashtra. The workers in the various sections of the Gokul Dairy plant have been exposed to various occupational hazards and stresses. The problems related to loading and unloading of cans, lifting of cans, and continuous bending in awkward position which directly or indirectly affect on the physical and mental health of the dairy workers seems to be of specific interests as far as happiness, health and humanity is concerned.

The present study has been carried out to evaluate the physiological responses of the workers engaged in dairy industry, in particular, the workers devoting their duties at Gokul Dudh Sangh, Gokul Shirgaon, located in the Kolhapur district of Maharashtra state.

## **MATERIALS AND METHODS**

Dynamometer is required to measure the grip or forearm muscle strength. Hand Grip Strength (HGS) is important for catching, lifting and throwing. The Dynamometer was used to test the hand grip strength of the dairy workers. The workers were asked to hold and squeeze the Dynamometer (Danish electronics 0 to 100 Kg) with the maximum isometric effort for 5 seconds. The handle of the Dynamometer was adjusted according to the requirement. Jamar Dynamometer is referred to as the

best tool in the measurement of grip strength, but due to cost effectiveness we preferred the Danish one. Without hand movement no other part of body was allowed to move. The two trials for each hand of the workers under study were recorded after 15 seconds recovery between each effort.

**Table 1: Values about expected scores of the workers**

Sr. No.	Rating	Males (Kg)	Females (Kg)
	Excellent	>64	>28
02	Very Good	56-64	34 - 38
03	Above average	52-56	30 - 32
04	Average	48-52	26-30
05	Poor	40-44	20-22
06	Very poor	<40	<20

This is a simple and commonly used test of general strength level. It is also useful to record whether the worker is left or right handed. Non dominant hand normally scores 10% lower than the dominant one.

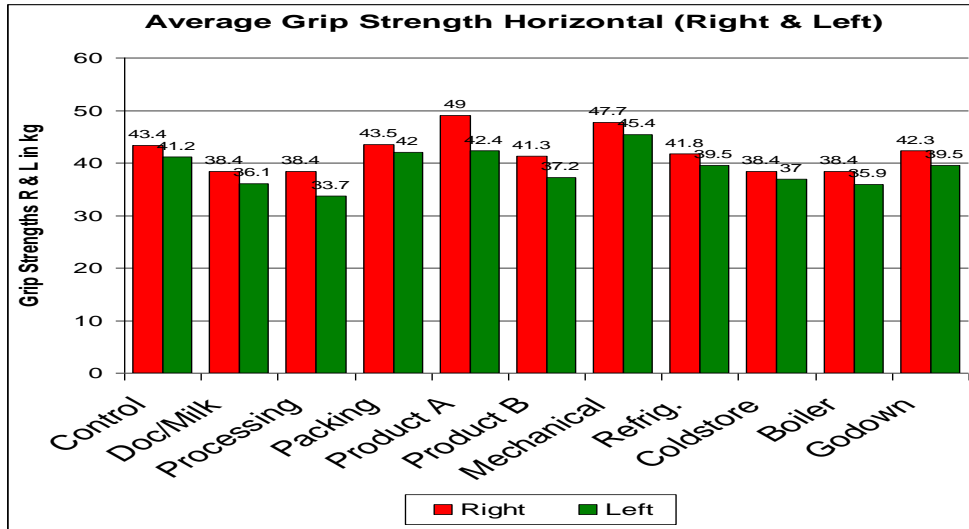
## RESULTS

The multiple bar diagram given in Fig. 1 represents the left and right average horizontal and grip strengths in Kg for the workers from different dairy sections. Figures shown are the average Horizontal right and left grip strength in kg of the workers. The workers in product A section have the highest average right grip strength which is 49 kg and the workers in Doc, Processing, Cold store and Boiler sections have the lowest average right grip strength 38.4 kg. . The workers in Mechanical section have the highest average left grip strength which is 45 kg and the workers in processing section have the lowest average left grip strength 33.7 kg.

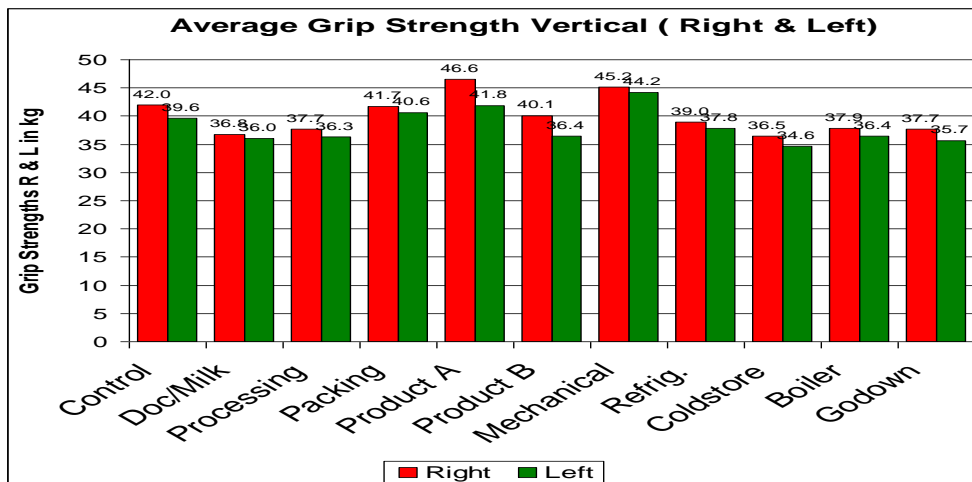
There are two product sections viz. A and B. The Product A section consists of the products like Butter, Ghee and Powder sections while in the Product B section different products like Shrikhand, Paneer, Lassi and Curd have been produced.

Fig. 2 represents the multiple bar diagram of average vertical right and left grip strength in Kg of the workers working in different sections of the dairy. The workers in product A section have the highest average right grip strength which is 46.6 kg and the workers in cold store section have the lowest average right grip strength 36.5 kg. The workers in Mechanical section have the highest average left grip strength which is 44.2 kg and the workers in cold store section have the lowest average left grip strength 34.6 kg.

**Fig. 1: Average grip strength (horizontal) of dairy workers**



**Fig. 2: Average grip strength (vertical) of dairy workers**



## DISCUSSION AND RECOMMENDATIONS

Dairy industry is one of the oldest occupations of the world. From the workers health matter, it is interesting to study the work place environment, work place hazards and stresses in dairy plant as they have to face the various occupational hazards, which diverges from section to section. The workers suffer from physiological stress factors like heat, cold, humidity, dust and chemical factors like gases particularly the effect of ammonia gas. The awkward position while carrying out the work has potential to cause musculoskeletal disorders.

Ergonomic survey of the various sections has revealed the physical, chemical, biological and musculoskeletal related problems owing to potential hazards and stress factors. When the worker comes in

contact with vibrating surface, machinery or equipment for prolonged periods occupational hazards of vibration stem out. Adverse health effects have been observed to take place from vibration at frequencies 2 to 1,000 Hz. Hand-arm vibration causes damage to blood vessels and nerves in the fingers, which is known as hand-arm vibration syndrome. This causes a loss of grip force and reduced touch. The use of smaller hand-held vibrating tools can cause carpal tunnel syndrome. The whole body vibration causes disorders of the bowel and the circulatory, musculoskeletal and neurological systems. The research study has shown that exposure to vibration can cause complaints about the joint pain, stiffness in the hand, arm, shoulder and particularly in the wrist.

In Gokul Dairy the workers working in Milk processing section and Refrigeration sections have to remain constantly in contact with the machines. The compressors in Refrigeration section causes noise level of 130 dB in addition to the vibrations. The workers in this section suffer from body ache, lack of grip strength, increased heart beats, palpitation, joint pains etc.

According to Tochiara (1997) there are two types of cold workplaces viz. outside work place in winter, an artificially cold environment. When the work in the artificial cold environment is done throughout the year, it is stressful to the workers. There are six cold storage rooms having the temperature varying from 0°C to -4°C and -18 °C to -20°C at Gokul Dairy. The workers in these sections have to work most of the time of their duties for unloading the trolleys of final Milk Products. The frequency of a worker depends upon the products to be stacked. Nearly half to 1 hour the worker remains inside the Cold storage room. These workers are found to be suffering from frostbite, shivering, numbness of extremities, poor coordination, fungal infection, cold and cough, less grip strength.

Handgrip strength indicates forearm muscle strength. It is important and most required for carrying out a number of tasks like lifting, catching, throwing the objects. The hand grip strength test carried out at various section of the dairy plant has revealed that dairy workers from Product A section have the highest average of grip strength 46.6 kg right and 41.8 kg for left. The workers of the cold store have the lowest average right grip strength 36.5 kg and lowest average of the left grip strength 34.6 kg. Hand grip strength between 40-44 kg is rated as poor and below 40 kg is rated as very poor. The workers working in Office, Packing, Product A and B, Mechanical sections have the right hand grip strength in between 40-46.6 and those working in Milk Reception, Doc, Milk Processing, Packing, Refrigeration, Cold store, Boiler and Godown sections have average range between 36.5 kg to 39.0 kg. As far as the left highest average of left hand grip strength the workers of the Mechanical have highest of 44.2 kg and the workers in Cold store section have the lowest average of 34.6 kg. It is found that that for all workers the non dominant hand normally scores 10% lower than the dominant one as far as both hands grip strength is concerned. The dairy workers working in the various sections of the dairy plant have shown the poor to very poor performance in the hand grip strength indicating poor physical fitness. The occupational hazard like cold, heat and personal health status are the reasons for this poor rating.

Kagan and Levi (1974) observed that to be able to identify the risk factors in the working environment and their negative health effects, a continuous monitoring is necessary including integrated occupational

environment and health statistics. Data gathering should be premised on a holistic view of the employee and their working life and include physical, chemical, environmental, psychological and socio-economic factors.

Protection of the workers is very important and necessary. Preventive measures are very important for workers well-being, health and competence. The following recommendation seems to be helpful to increase the productivity, efficiency and well-being of the dairy workers.

- Machines causing vibration must be identified.
- The type of vibration whether whole body vibration or part body vibration has to be recognized using expertise of specialists.
- Vibrating machines should be replaced with less vibrating machines.
- Vibrations absorbing material should be used at floor joints.
- Durations of the work should be minimized.
- Regular rest breaks should be given to the workers working on vibrating machines.
- Workers should be transferred after some period from one section to other sections, to minimize monotonous work.
- Anti-vibration gloves should be provided.
- The job should be redesigned to minimize the use of hand-held vibrating surface.
- To reduce the hazards of cold faced by the workers working in the cold storage and cold rooms, they should be trained to recognize the signs of frostbite.
- Workers should be trained to recognize the signs of hypothermia and the precautions taken while working in the cold with necessity of proper use of protective clothing and equipment.
- Rest allowance should be allowed to workers for purpose of recuperation from fatigue resulting from effects of manual task and adverse working conditions.

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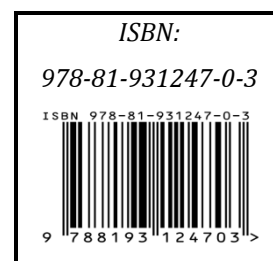
# CHAPTER 5

## DIVERSITY OF ZOOPLANKTONS IN MORANA RIVER, SHIRALA, DIST- SANGLI, MAHARASHTRA (INDIA)

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### ABSTRACT

Zooplanktons are an important component of aquatic ecosystem. The present study deals with Diversity of Zooplanktons in Morana River, Shirala, Dist- Sangli and Maharashtra. The zooplanktons play an important role as they indirectly convert food energy because of their role as prey of economically important fishes. Zooplankton encompasses an array of macro and microscopic animals and comprises representatives of almost all major taxa particularly the invertebrates. The Zooplanktons are reported by the groups of Rotifera, Ostracoda, Copepoda and Cladocera .Total 26 species of zooplanktons are recorded as 10 species of Rotifer,8 species of Cladocera,6 species of Copepoda and 2 species of Ostracoda. This study includes species diversity, density of zooplanktons presented in this paper.

**KEYWORDS:** Zooplankton, Species diversity, Density

### INTRODUCTION

Zooplankton diversity is one of the most important ecological parameters in water quality assessment. Zooplanktons are microscopic floating animal components of an aquatic ecosystem. They play important role in fresh water ecosystem as they indirectly convert the food energy due to their role as preys of economically important fishes. They are usually acts as primary consumers in aquatic food chains. Zooplanktons can exists under a wide range of environmental conditions such as dissolved oxygen, temperature, salinity etc.They play important role in indicating the pressure of absence of certain fish species or in determining the population densities of the zooplankton. The zooplankton diversity is reported by all groups viz, Rotifers, Cladocera, Copepods, and Ostracoda.

The zooplankton community composition and structure is affected by eutrophication, these communities can also be used as indicator of changing trophic status of an aquatic ecosystem (Blancher, 1984) zooplankton has long be used as indicators of eutroficatins (Vandysh, 2004,Webber ,et.al.,2005). The present work was undertaken with the aim of study the diversity of zooplankton communities of Marana River Shirala Tq, Shirala, dist. Sangali.

## MATERIALS AND METHODS

For present investigation three sampling station were selected. The monthly sample collection for zooplankton analysis was done in every month from the reservoir for the period of one year June 2011-May 2012 at selected sampling station by using plankton net made of bolting silk (Mesh 25  $\mu$ m) by sieving a known volume of water sample.

For identification of zooplankton sample were examined in data under the microscope with high magnification. Standard literature was used for identification of species Edmondson, (1959), Michael (1973), Adoni (1985), Dhanapathi (2000) and Batish (1992), For numerical estimation of the zooplankton were used the Sedgwick Rafter cell method as per procedure given in standard methods APHA (1991) and Trivedi & Goal (1986).

## RESULT AND DISCUSSION

In the present investigation the Zooplankton diversity morana river water total 26 species were found belonging to four different group's viz., Rotifera, Cladocera, Copepoda, and Ostracoda. Out of the species 10 of Rotifera, 8 species of Cladocera, 6 species of Copepoda & 2 species of Ostracoda. Among the zooplankton members of Rotifera was dominant on a year study.

**Table 1: Seasonal variation of Zooplankton count organisms per liter (2011-2012)**

Spot	Component	Monsoon	Winter	Summer
A	Rotifera	120	150	180
	Cladocera	110	90	55
	Copepoda	65	70	40
	Ostracoda	60	44	33
B	Rotifera	100	160	212
	Cladocera	110	68	75
	Copepoda	70	75	55
	Ostracoda	78	60	41
C	Rotifera	110	120	165
	Cladocera	100	80	90
	Copepoda	80	60	45
	Ostracoda	60	50	45

The total number of zooplankton population varied from 55to 80/lit at Spot.. The season wise analysis of Zooplankton diversity shown in table 1. The results are in accordance with the results of Sharma (2001), Sunkud and Patil (2004) and Jose et al (2008). The distribution of the Zooplankton viz. Rotifera, Cladocera, Copepoda and Ostracoda in the Dhanegaon reservoir. The rotifer was found minimum in monsoon and maximum in summer season but cladocera, copepod and ostracoda was found maximum in monsoon

season and minimum in summer season during the study period June -May. This maximum and minimum count per liter of the Zooplankton in Marana river is due to the clarity of water, fluctuation of temperature, favorable range of physic-chemical parameter and it totally depends upon the seasonal changes in the aquatic environment by adding the rain water it suitable for the growth of Zooplankton in Marana river.

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# CHAPTER 6

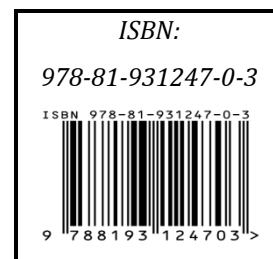
## EVALUATION OF WATER QUALITY IN VASHISHTI RIVER USING PHYSICOCHEMICAL PARAMETERS

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### ABSTRACT

Present paper assesses the study of physico-chemical parameters of Vashishti river water in Chiplun, District: Ratanagiri, Maharashtra. Monthly changes in physical and chemical parameters such as temperature (°C), pH, free carbon dioxide, dissolved oxygen, phosphate and nitrates were analyzed for period of one year from 1st December 2008 to 31st November 2009. All Parameters were within the permissible limits. The result indicates that the river water is non-polluted and can be used for domestic, irrigation and pisciculture purpose.

**KEYWORDS:** Physico-chemical parameters, monthly variations, VashishtiRiver.

### INTRODUCTION

Water is an absolutely essential component for the maintenance of life on the earth. It is one of the most unusual natural compounds found on the earth. Vital natural resource which forms the basis of all kinds of life is water. It is also key resource in all economic activities right from agriculture to industries. For both, natural ecosystem and human development, water resources have critical importance. It is a vital factor of life and is considered as a precious compound on the earth. The water is used for domestic purpose, washing, agriculture and for industries. The water is polluted when it changes its quality or composition, directly or indirectly by human activities, it becomes less suitable for drinking, domestic use, agriculture purpose, fisheries and for other purposes for which it would otherwise be suitable in its natural state (Odum, 1971). One of the important natural resources is water, it has many conflicting demands. The skillful management of water bodies is required if it is to be used for diverse purpose as domestic and industrial supply, fisheries, transport, irrigation, recreation, sport, commercial power generation and for waste disposal. Water pollution is generally associated with the discharge of effluents from drains, sewage treatment plants, and factories to the different water bodies such as of lakes, rivers, and seas. The quality of water deteriorates mainly because

of human activities. Such activities possibly lead to water pollution. This pollution is such as urbanization, industries, mining, agriculture, power stations and transport (Van Vuren, et. al., 1999). Now days it is assumed that to survive mankind as today's way of life, it is necessary to increase our knowledge about the environment and acquire concomitant behaviour patterns to safeguard the proper functioning of the ecosystem. First of all the analysis of aquatic network is the measure of the healthiness of the surrounding area. Water pollution becomes most evident when it involves poisoning of drinking water or causes the death of a large number of fish or other aquatic organisms, which could be caused by sewage and industrial effluent. Disposal of sewage wastes and industrial effluents into a large volume of water could reduce the biological oxygen demand to such a great level that the entire oxygen may be removed. This would cause the death of all fish species (Water facts, 1997).

## **MATERIALS AND METHODS**

The River Vashishti has a course of about 50 Km and becomes tidal near Chiplun below the island Govalkot. The river widens and meets the Arabian Sea after course of 40 Km at Dabhol. The water sample from study station was collected in the morning hours between 9.00 to 11.00 am, in polythene bottle regularly for every month to assess the water quality during the period from December, 2007 to November, 2008. The water samples were immediately brought to the laboratory for estimation of various physico-chemical parameters. Parameters like water temperature and pH were recorded at the time of sample collection, by using thermometer and pocket digital pH meter. While other parameters such as DO, Free CO<sub>2</sub>, phosphate and nitrate were estimated in the laboratory, by using standard methods prescribed by APHA, (1985), Kodarkar (1992), Trivedy and Goel, (1986).

## **RESULTS AND DISCUSSION**

The water samples from study station showed variations in temperature from 26 °C to 28.5 °C with average of 26.7 °C. The pH values indicated acidic nature of water samples with and range between 6.40 to 7.33 and average of was 6.99. The maximum concentration of free carbon dioxide 16.10 mg / l was recorded at study station in the month of December 2008. While the minimum concentration of 3.00 mg / l was recorded in the month of March 2009 and average was 9.37 mg / l. The dissolved oxygen content varied between 6.70 to 10.72 mg / l. The dissolved oxygen was recorded at minimum level 6.70 mg / l in the month of February 2009. Inorganic phosphate and nitrate content of water samples were 2.25 to 5.00 mg / l and 1.24 to 17.50 mg / l respectively.

In the present study temperature of water samples showed variations in the range of 26 °C to 28.5 °C. The measurement of temperature in water is important basically for its effect on the chemistry and biochemical reactions in the organisms. The atmospheric temperature generally varies between 10 °C to 35 °C in a year.

The pH of water drastically changes with time because of exposure to air, temperature changes and biological activities. Significant change in pH occurs due to disposal of industrial wastes and acids in drainages (Trivedy and Goal, 1986). The pH of natural water varies around seven (i.e. alkaline). High pH is unfavorable to aquatic organisms. Beyond 8.5 pH, water will affect the mucous membrane and / or water supply system (Das, 1978). In the present investigation pH ranged from 6.40 to 7.33.

**Table 1: Physico - chemical parameters of Vashishti river water**

<b>Month</b>	<b>Temp. ( °C )</b>	<b>pH</b>	<b>Free Carbon dioxide (mg/lit)</b>	<b>Dissolved Oxygen (mg/lit)</b>	<b>Phosphate content (mg/lit)</b>	<b>Nitrate content (mg/lit)</b>
<b>Dec-08</b>	26.5	6.80	16.10	9.50	2.25	BDL
<b>Jan-09</b>	26.0	7.17	10.20	10.20	3.50	BDL
<b>Feb-09</b>	27.0	7.13	4.40	6.70	4.50	2.00
<b>Mar-09</b>	27.0	6.50	3.00	8.00	5.00	1.50
<b>Apr-09</b>	28.0	7.10	3.50	8.33	2.50	BDL
<b>May-09</b>	28.5	6.60	4.50	8.17	2.50	BDL
<b>Jun-09</b>	26.5	7.20	6.70	10.39	3.00	2.00
<b>July-09</b>	26.5	7.13	7.50	9.95	3.50	15.00
<b>Aug-09</b>	26.0	6.40	14.71	10.72	2.75	17.50
<b>Sep-09</b>	27.0	7.20	12.19	6.83	4.50	12.50
<b>Oct-09</b>	26.0	7.33	14.18	10.12	2.25	15.80
<b>Nov-09</b>	26.5	7.27	15.40	7.90	3.50	14.15
<b>Average</b>	26.7	6.99	9.37	8.90	3.31	6.70

Carbon dioxide is commonly found in water from photosynthesis and decomposition of organic matter. Excessively high levels of Carbon dioxide (Greater than 20 ppm) may interfere with the oxygen utilization by the fish. (Sawane, et. al., 2006) reported the inverse relationship between pH and Carbon dioxide.

In the present study, minimum concentration of free carbon dioxide (3.00 mg / l) was recorded at study station in the month of March, 2009. Carbon-dioxide accumulates in water due to microbial activity and respiration of organisms. In summer, with increase in atmospheric temperature, there was corresponding rise in water temperature and consequent increase in biological oxidation of organic matter that might have caused an elevation in level of carbon dioxide (Singh and Srivastava, 1988).

Dissolved oxygen (D.O.) is very important parameter to assess the quality and is an index of physical and biological processes going on in the water. The sources of oxygen in water are mainly by two ways, either from atmospheric diffusion or from photosynthetic activities. Dissolved oxygen is a key parameter reflecting

the quantity of water and hence used in classifying the water quality, which receives the wastes. Its presence is essential to maintain biological life in water.

Dissolved oxygen is one of the important factors in water quality assessment. Its presence is essential in aquatic ecosystem in bringing out various biochemical changes and its effects on metabolic activities of organisms. The oxygen balance of the system largely determines the effects of waste discharged in water body. Non - polluted surface waters, remain saturated with dissolved oxygen. Dissolved oxygen levels in natural and waste waters are dependent on physical, chemical and biological activities primarily by three factors Viz. Free diffusion of atmospheric oxygen, Oxygen production through photosynthesis, and Dissolved oxygen consumption by plants, animals and decomposers.

In the present study, minimum 6.70 mg / l, and maximum 10.72 mg / l, D.O.contents was recorded in the months of February and August 2009, respectively at study station. The dissolved oxygen was as recorded at minimum levels in the month of, February 2009.

In aquatic ecosystem phosphate-phosphorus plays an important role as a nutrient. Nitrates, domestic sewage, industrial effluents, detergents are the main sources of phosphates in water. The phosphate contents of the effluents may lead to significant undesirable growth of the planktons and other weed species leading to organic pollution of water body. Inorganic phosphorus is one of the most important nutrients limiting growth of autotroph and thus biological productivity of system. Industrial effluents, domestic sewage, detergents are main sources of phosphates in water.

In present study, the phosphate content was maximum of 5.00 mg / l in the month of March, 2009 while minimum of 2.25mg / l in the month of December, 2008 and October, 2009 at study station.

Nitrates are the highest oxidized form of nitrogen. It is contributed to surface water to a large extent, by sewage and industrial effluents and also due to biological fixation and oxidation of organic matter. The run-off water coming from intensive agricultural activity (involving the use of fertilizers) also significantly contribute to the higher nitrate content in water is an indication of pollution.

Concentration of nitrate beyond 45 mg / l causes methaemoglobinemia (Horne and Goldman, 1983). In the present study, the values of nitrates ranged between BDL to 17.50 mg / l. The values of nitrate concentration at study station were within the limit of ISI desirable standard (25 mg / l).

## **CONCLUSION**

The present study indicates that the various physico-chemical parameters of the river water were within the limits of ISI standard. The water is non-polluted and can be used for domestic, irrigation and pisciculture purpose.

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# CHAPTER 7

## PHYSICOCHEMICAL CHARACTERIZATION OF GRAIN BASED DISTILLERY SPENTWASH AND ITS USE IN CATTLE FEED

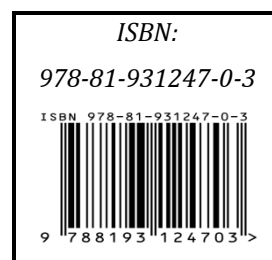
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### ABSTRACT

As far as world's ethanol production is to be concern India has fourth rank and India is the second largest in ethanol production in Asia. Now days in India most of distilleries which are coming soon as grain based . Effluent originating from distilleries known as spentwash leads to extensive water pollution. Spentwash contains high concentration of decomposable organic matter , dissolved salts and high load of pollutants and has a persistant yellowish colour. A study was conducted for to check the quality of spentwash generated from grain based distillery for the purpose of proper treatment before it discharge in water or on land. Also their use for agriculture purpose and cattle feed. Physicochemical characteristics of distillery spentwash are analysed. It was observed that spentwash have high load of organic and chemical pollutants. Thus, the spentwash donot allow its discharge into waterbody. So, there is seperation of spentwash in solid and liquid state by high speed centrifugal decanter. In that solid material called as DWGS (Distillers Wet Grain and Solubles), it is used as cattle feed. Whereas liquid material termed as Thin Slop. It is processed and further used to prepare organic manure.

**KEYWORDS:** Physicochemical Characteristics, Spentwash, Distillers Wet Grain and Solubles, Thin Slop.

### INTRODUCTION

Agro industry particularly the food industry generates large amount of liquid solid and gaseous wastes which is produced not only from processing methods but also from their treatment and disposal. The composition and quantity of agro industrial wastes depends on the source of raw materials, the nature of the products, operations and processing steps. In general food processing wastes consists of large amount of organic material. Due to their nutrient rich content agro industrial wastes have a high potential to cause

severe pollution problems if not properly treated. In Ethyl Alcohol producing industries cane molasses is used as a major constituent. World's total alcohol produced from cane molasses is more than 13 million m<sup>3</sup> / annum. The aqueous distillery effluent stream known as a Spent wash & is approximately 12 to 15 times by volume of the product alcohol. (Nagraj et al.)

Distillery effluent has a high load of pollutants. The effluent has a reddish brown colour, alcoholic odour, having a high value of solids, electrical conductivity, hardness, Calcium, Magnesium Chlorides, BOD, COD contents & highly acidic pH while dissolved oxygen was found nil & contains a high organic load of nutrients like Nitrogen, Potassium & Phosphorus. (Farid Ansari et al) Due to high concentration of organic matter has a great nutrient and energy potential that can be utilized for fertilizing or power generating purposes. (Naturgerechte, 2000)

Most of the times many industries discharge their waste during rainy season in the rivers and other waterbodies that results in contamination. (Khairnar et al. 2013). Untreated wastewater containing a large amount of organic matter, if discharged in to river will consume the oxygen for biological oxygen demand and due to this there is depletion of dissolved oxygen of the stream which causes the killing of aquatic animals and other wastewater effects. (Niraj S. et al; 2011)

Distillery wastes do not directly apply to agricultural soils because it contains an acidic pH, high organic charge & notable polyphenol, Sodium & in general micronutrient & heavy metal contents. Some of these properties are not suitable for agriculture. Therefore conditioning treatments prior to use of waste water are necessary. (Bustamante et al. 2005) ).

Raw spentwash can be used for sugarcane cultivation without fertilizer & this helps in the economy of farmers because distillery spentwash contains a high level of plant nutrients & are made available to the plants & its resulting in better growth & development of yield. (P. Rath et al. 2010)

For the evaluation and reporting of any treatment process sufficient details about the characteristics and concentration of species present in the distillery waste are required for the judgement of application of treatment process to waste water. (X.L. Melamane et al. 2007)

## **MATERIAL AND METHODS**

The sampling and analysis of various physicochemical properties has been done to understand the composition of distillery effluent. The effluent samples were collected from VIRAJ ALCOHOLS & ALLIED INDUSTRIES LTD. SHIRALA, DIST-SANGLI, MAHARASHTRA.

- The spentwash was collected in container, properly sealed and stored at 4<sup>o</sup> C for further analysis. The physicochemical characteristics were analyzed by standard methods.
- Physicochemical and biological characterization of sample. With respect to
- pH - pH Meter
- Color - Spectrophotometer.
- Odour - Organoleptically Unpleasant due to high organic load and presence of skatole, indole, etc.

- Electrical conductivity – Electrical conductivity meter
- Carbon content (C) - ( $K_2Cr_2O_7$  Digestion method),
- Nitrogen content (N) - Kjeldhals method)
- Biological oxygen demand (BOD) - (Magnous sulphate method)
- Chemical oxygen demand (COD) - (APHA -5220-B method)
- Total Solids, Total Volatile Solids, Dissolved Solids,
- Chlorides content
- Total Potassium content
- Sodium content

## RESULT AND DISCUSSION

The physicochemical properties of spentwash was studied. Chemical composition such as colour, odour, pH, Electrical Conductivity, BOD (Biological Oxygen Demand), COD (Chemical Oxygen Demand), Total Solids, Total Volatile Solids, Dissolved Solids, Chlorides, Sulphates, Total Nitrogen, Potassium, Phosphorus, Sodium, Calcium analysed.

**Table 1: Physicochemical Characteristics of spentwash**

Parameters	Values
Colour	Whitish Yellow
Odour	Unpleasant
PH	3.27
Electrical conductivity	4.16
Total solids ( mg/lit)	4.20
Total dissolved solids (mg/lit)	3.10
Total suspended solids (mg/lit)	1.10
Nitrogen (%)	0.98
Total carbon (%)	1.3
Chloride(mg/lit)	18994
Total sodium (mg/lit)	160
Total pottasium (mg/lit)	110
BOD value(mg/lit)	27000
COD value(mg/lit)	56000



- Colour: The colour of spentwash was found Whitish Yellow.
- Odour: Odour of the distillery effluent was Unpleasant due to to high organic load and presence of skatole, indole , etc.
- pH: The pH of the spentwash was acidic in nature . i. e. 3.27 (the pH of the distillery effluent was ranges from 3.2 – 3.5)
- Electrical conductivity: The electrical conductivity of the spentwash was 4.16
- Total solids: Total solids of the spentwash were 4.2 mg/lit . It contains both dissolved solid as well as suspended solids.
- Total dissolved solids: Total dissolved solids were 3.1 mg/lit
- Total suspended solids: Total suspended solids were 1.1 mg/lit
- Total Nitrogen content: Total Nitrogen content were 0.98 %
- Total Carbon content: Total Carbon content were 1.3 %
- Chlorides content: Chlorides content of the spentwah were 18994 mg/l
- Total sodium content: Total sodium content were 160mg/lit
- Total potassium content: Total potassium content of the spentwah were 110mg/lit
- Biological Oxygen Demand: Biological Oxygen Demand value of the spentwah were 27000 mg/lit .
- Chemical Oxygen Demand: Chemical Oxygen Demand value of the spentwah were 56000 mg/lit.

## **CONCLUSION**

The study reveals that the physicochemical characteristics of spentwash have high load of organic matter. The effluent was yellowish white in colour , Odour of sample was alcoholic in nature . It is one of the most complex troublesome waste having very value of BOD, COD, Total solids , Electrical conductivity, total Nitrogen ,carbon, calcium ,magnesium , and highly acidic pH.

Thus the characteristics of spentwash , do not allow its discharge in to waterbody hence it requires treatment before it discharge . After evaporation and condensation of spentwash thick slope was remained it is highly protein rich material so it can be used as cattle feed.

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# CHAPTER 8

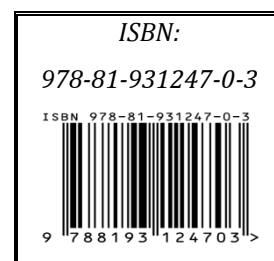
## BIRD DIVERSITY IN AND AROUND GARGOTI TOWN

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### ABSTRACT

The present study was carried out to check the bird diversity in and around Gargoti town of Kolhapur district. The vegetation and geographical landscape of the study region shows varied conditions. It includes some freshwater small ponds, riverside, agricultural lands, educational campus, human residence area and varied type of tree vegetation. The study area attracts various type of birds. A total of 40 species of birds belonging to 9 orders and 23 families were recorded during the study.

**KEYWORDS:** Bird Diversity; Gargoti Town.

### INTRODUCTION

Birds are among the best monitors of environmental changes and have been used to evaluate the environment throughout the history as biomonitors and; the changes in their population, behavior patterns and reproductive ability have most often been used to examine the long term effects of habitat fragmentation. Hence they are the good indicators of ecological status of any given ecosystem (Bilgrami, 1995). Forests attract a large number of avifauna because of the habitat suitability for most of them. This especially include the birds that are associated with the vegetation, and for most, the existence of trees is vital to their life cycle. Birds show different levels of interest to various stands depending on the age of the stands. The bird species composition is highly related to the forests vegetation structure.

Avifauna are important for the ecosystem as they play various roles as scavengers, pollinators, predators of insect pest, bio- indicators of different kind of environment like urbanization and industrialization, human disturbance illumination. They are very sensitive indicators of pollution problems and function as early warning system (Talukdar, 1997; Becker, 2003). Birds play prominent and diverse roles in folklore, religion, and popular culture. Birds have been always fascinated for their ability to fly in air and for their exquisite coloration. They have their functional role in the ecosystem as potential pollinators and

scavengers and are rightly called as bio-indicators. Birds are most useful to human as destroyers of harmful insects and as consumers of weed seeds (Harney et al, 2011).

The diversity of birds, and in particular the native species, is positively correlated with increasing structural complexity of the vegetation. Also a seasonal change in species diversity of birds occurs in forests due to their foraging behavior (Robertson and Hackwell, 1995).

## MATERIAL AND METHODS

The study site of Gargoti campus is situated in Bhudargad Taluka of Kolhapur district. The area covered by the campus is about 6.2 k.m acres. The varied vegetation covers the most of the study area. The study area contains planned garden, Amarai, agricultural field sites and residential houses. The Gargoti campus has varied vegetation from grassland to trees.

The study was carried out during October to December, 2012. The observations regarding the bird diversity were made two times daily i.e. during early morning and late evening. A binocular and camera was used as a field instrument. For identification of birds "The Book of Indian Birds" by Salim Ali (2002) was referred.

## RESULTS

**Table 1: Checklist of birds in and around Gargoti town during study period**

Sr. No.	Order	Family	Scientific Name	Common Name	Migratory Status	Abundance Status
1	Galiformes	Phasianidae	<i>Gallus sonneratil.</i>	Jungle fowl	R	3
			<i>pavo cristatus.</i>	Indian pea fowl	R	1
2	Bucerotiformes	Bucerotidae	<i>Ocyrceros birostris</i>	Indian horn bill	WM	1
			<i>Anthra coceras coronates</i>	Indian pied hornbill	WM	3
3	Coraciiformes	Coraciidae	<i>Caracius benghalesis</i>	Indian roller	R	1
		Dacetonidae	<i>Halcyon samyrinsis</i>	White breasted kingfisher	R	1
		Mesopidae.	<i>Merops Orientails.</i>	Small bee eater	R	1
4	Culculiformes	Cucilidae	<i>Discrurus macrocerw.</i>	Drongo cuckoo	R	1
			<i>Eudynamys scolapacesa</i>	Asian Koel	R	1

		Centropodidae	<i>Centropus sinensis.</i>	Greater coucal	WM	1
5	Psittaciformes	Psittacidae	<i>Psittacula cyanocephala</i>	Plum headed parakeet	R	3
			<i>Psittacula himalaya</i>	Salaty headed parakeet	R	3
			<i>Psittacula krameri</i>	Rose ringged parakeet	WM	1
6	Strigiformes	Strigide	<i>Athene brawa</i>	Spotted owlet	R.	1
7	Columbiformes	Columbidae	<i>Columba livia.</i>	Blue rock pigeon	R	1
8	Ciconiformes	Charadriidae	<i>Vanellus indicus</i>	Red watled lapwing	R	1
		Accipitridae	<i>Milvus migrans</i>	Black kite	R	2
			<i>Haliastar indus</i>	Brahmany kite	R	2
			<i>Spilornis cheel</i>	Crested serpent eagle	RM	3
			<i>Falco tinnunculus.</i>	Comman kestrel	WM	2
		Ardeidae	<i>Bubulcus ibis</i>	Cattle egret	R	3
			<i>Ardeola grayii</i>	pond heron	R	2
Ciconidae	<i>Ciconia episcopus</i>	White necked stork	WM	2		
9	Passeriformes	Irenidea	<i>Chloropsis aurifrane</i>	Gold fronted chlorosis	WM	1
		Lanidae	<i>Lanius Schach</i>	Rufous Backed shrike	WM	2
		Corvidea	<i>Corvus splendens</i>	House crow	R	1
			<i>Dicrurus Macroescens</i>	Black drongo	R	1
			<i>Dicrurus Carulescens</i>	White belleid drongo	R	1

Passeriformes	Muscicapidea	<i>Orthotomus sutorius</i>	Common tailor bird	R	1
		<i>copychus saularis</i>	Oriental magpie robbin	R	2
		<i>Saxicoloides fullicata</i>	Indian robin	R	1
	Sturnidae	<i>Acridotheres tristis</i>	Common myna	R	1
		<i>Acridotheres fuscuc</i>	Jungle myna	R	1
	Paridae	<i>Parus xanthogenys</i>	Black lored yellow tit	R	1
	Pycnonotidae	<i>Pycnonotus cafer</i>	Red vented bulbul	R	1
		<i>Pycnonotus jocosus</i>	Red whiskered bulbul	R	1
	Nectarinibae	<i>Nectarinaia asitica</i>	Purple sunbird	R	1
	Passeridae	<i>Passer domesticus</i>	Sparrow	R	2
		<i>Motacillia flava</i>	Yellow wagtail	R	2
		<i>Motacilla moderaspatis</i>	Large pied wagtail	R	2

(Migratory status: R – residential, M – migratory, RM – residential migratory.  
Abundance Status: 1- abundant or very common, 2- common, 3- fairly common)

## DISCUSSION

A total of 40 species of birds belonging to 9 orders and 23 families were recorded during the study (Table 1). The family Passeridae and Accipitridae (4 species each) is dominant in the present study followed by family Muscicapidea, Corvidea, Accipitridae and Psittacidae (3 species each). Same results were recorded by Mahabal and Mukherjee (1991) in Mandi district of Himachal Pradesh.

The seasonal higher diversity of birds was recorded in this study. During winter the diversity of birds was higher. It should be due to a number of reasons, including bird migration, breeding, food availability and vegetation changes (Anand et al., 2007). Along with these reasons another reason for higher

diversity during late winter is the end of the winter in which these species migrate back towards north (Jayson and Mathew, 2000).

As the study area lies within the parts of the Western Ghat, it receives heavy rain which varied from 1200 to 2600 mm and most of which falls during July to September through the southwest monsoon. This is a major decisive factor. It results into a hostile environment for the birds to stay. The same observations of greater diversity of birds was recorded in Lakkavalli Rangs forest of Bhadra Wildlife Sanctuary of Karnataka (Harisha and Hossetti, 2009).

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# CHAPTER 9

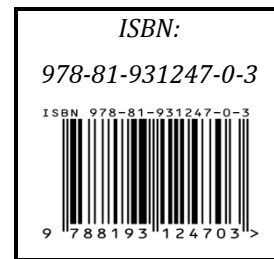
## DIVERSITY OF ICHNEUMONID FLIES (HYMENOPTERA: ICHNEUMONIDAE) FROM AGROECOSYSTEMS OF WESTERN MAHARASHTRA

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### ABSTRACT

Ichneumonid flies (Hymenoptera: Ichneumonidae) are very potential biocontrol agents of insect pests damaging agricultural and horticultural crops. Studies on biodiversity and taxonomy helps in planning and designing the pest management strategies against different pests in field conditions. Therefore, biodiversity of Ichneumonid flies have been studied from Western Maharashtra. In all, 45 species belonging to genera, *Charops*, *Xanthopimpla*, *Diadegma*, *Isotima*, *Campeletis*, *Eriborus*, *Goryphus*, *Echtmomorpha*, *Enicospilus* and *Netelia* were found parasitizing the economically important agricultural crops.

**KEY WORDS:** Biodiversity, Biocontrol agents, Ichneumonids, Western Maharashtra.

### INTRODUCTION

Ichneumonid flies (Hymenoptera: Ichneumonidae) are very potential biocontrol agents of several insect pests causing great damage to economically important crop plants. Saving crop losses by implementing pest management programme in agricultural ecosystem is difficult task. Crop protection by using pesticides have several adverse effects on man and other organisms and need special devices for application of pesticides on crop plants. Use of parasitoids proved helpful in biological insect pest control programme at global scenario including India. About 60,000 species of Ichneumonids have been described from all over the world (Gupta, 1987). Several species belongs to family Ichneumonidae are mass reared and successfully utilized in biological pest suppression (Coppel and Mertins, 1971, Sathe, 2003). Any advance knowledge on their biodiversity, abundance, host record etc. has therefore practical relevance in pest management strategies. Keeping in view all above facts the present work was under taken. In past, Morley (1913a, b), Cameron (1909), Cushman (1933), Momois (1961), Townes et.al. (1961), Bultazar (1966, 1967), Gupta (1967), Gupta and Tikar (1967), Townes (1969), Rao (1970), Nikam (1980), Sathe et.al. (2003), Sathe et.al.



(2003), Sathe and Chougale (2008) etc. contributes on taxonomy and biodiversity of Ichneumonids from India.

## MATERIALS AND METHODS

Ichneumonid flies have been collected from different field of Kolhapur, Sangli, Satara and Pune districts of Maharashtra at evening and morning at 15 days interval from 2012-2014 by one man one hour search method with the help of insect net. The collection was made early in the morning and evening throughout the year. After taking observations, the parasitoids have been released in the field from where they were collected. Immature stages of pest insects have also been collected and reared on their natural host plants for parasitoid emergence. The parasitoids emerged were identified by consulting appropriate literature (Townes et.al., 1961; Gupta, 1987; Sathe et.al. 2003; etc.). Observations were continued throughout the course of study and parasitoid pest (host) index and seasonal abundance have been studied.

## RESULTS

Results tabulated in Table No. 1 indicate that 34 species were common in the region whereas 11 species were rare. Out of which 6 species were quite potential in suppression of pest population. Results further indicate that *Campoletis chlorideae* has tremendous biocontrol potential against *H. armigera* and *Spodoptera* sp. Similarly *D. argenteopilosa* caused considerable parasitism in *Spodoptera litura* in field condition. *Xanthopimpla* spp. has also potential against stem borers of paddy, jowar, maize and sugarcane crops in region. *Charops* spp. parasitizes several species of insect pests including Anar caterpillar, Ber hairy caterpillar and several semi-loopers on forest trees and worth utilizing in pest management strategies. *Enicospilus* spp. and *Netelia* spp. were also found effective in parasitizing host larvae of different genera.

**Table 1: Biodiversity of Ichneumonid flies from Western Maharashtra**

Sr. No	Parasitoid species	Host species	Crop	Abundance
1.	<i>Charops charukeshi</i> S. & D.	<i>Thiocidas postica</i> (Walk)	Ber	Common
2.	<i>Charops patmangiri</i> S. & D.	<i>Spilosoma obliqua</i> (Walk)	Mulbery	Common
3.	<i>Charops obtusa obtusa</i> Morley	Unknown	-----	
4.	<i>Charops</i> sp.	<i>Thiocidas postica</i> (Walk)	Ber	Common
5.	<i>Charops</i> sp.	<i>Vilrachola iscolartes</i> (Fabr)	Pomogranate	Common
6.	<i>Campoletis chloride</i> Uchida	<i>Helicoverpa armigera</i> (Hubn.) <i>Spodoptera litura</i> (Fabr)	Gram	Common
7.	<i>Campoletis</i> sp.	Unknown	-----	Common
8.	<i>Diadegma argenteopilosa</i> (Cameron)	<i>S. litura</i> <i>S. exigua</i> (Hubn.)	Groundnut Groundnut	Common

9.	<i>D. fenestralis</i> (Cameron)	<i>H. armigera</i>	Jowar	Common
10.	<i>D. trichoptilus</i> (Cameron)	<i>Exelastis atomosa</i> (Wal.)	Pigeon pea	Common
11.	<i>D. recini</i> R. and K.	<i>Dichocrocis puntiferalis</i> (Guenee)	Caster	Common
	<i>D. vulgari</i> Morley	<i>S. exigua</i>	-----	Common
12.	<i>Ecthromorpha</i> sp.	<i>Mythimna separata</i> Walk.	Jowar	Rare
13.	<i>Eriborus trochanteratus</i> (Morley)	<i>H. armigera</i>	Pigeon Pea	Common
14.	<i>E. sinicus</i> Holm.	<i>Tryporira insertulus</i> Wlk	Paddy	Rare
15.	<i>Enicospilus diurnus</i> Nikam	<i>H. armigera</i>	Gram	Common
16.	<i>Enicospilus paraclinatus</i> Nikam	<i>Hemileuca</i> sp.	Canna	Common
17.	<i>Enicospilus</i> sp.	<i>H. armigera</i> <i>S. litura</i>	Gram Groundnut	Rare Rare
18.	<i>Goryphus chaitshri</i> S. & D.	<i>Erias vitella</i> Fab.	Cotton	Rare
19.	<i>G. nursei</i> (Cam.)	<i>E. vitella</i>	Cotton	Common
20.	<i>Goryphus</i> sp.	<i>E. vitella</i>	Cotton	Common
21.	<i>Isotima javensis</i> Rohwer	<i>Acigona steniella</i>	Sugarcane	Common
22.	<i>I. dorsalis</i> K. & N.	Unknown	-----	Common
23.	<i>I. Aurangabadensis</i> K. & N.	Unknown	-----	Common
24.	<i>Netelia</i> sp.	<i>Achea janata</i> Linn.	Caster	Rare
25.	<i>Netelia</i> sp.	<i>M. separata</i>	Jowar	Rare
26.	<i>Netelia rugosa</i> Nikam & Rao	<i>Automeris</i> sp.	-----	Common
27.	<i>Netelia carinata</i> N. & R.	Unknown	-----	Rare
28.	<i>Netelia areoleta</i> N. & R.	<i>Automeris</i> sp.	-----	Common
29.	<i>Netelia (Netelia) punctata</i> Nikam	<i>Automeris</i> sp.	-----	Common
30.	<i>Perilissus cingulator</i> (Morley)	<i>Athalia proxima</i> (Klug)	Mastard	Common
31.	<i>P. testaceous</i> (Morley)	<i>Leucinodous orbonalis</i> Guenee	Bringle	Rare
32.	<i>Pimpla turionelle</i> (Linn.)	<i>Ostrinia kashmirica</i> (Moore)	-----	Common
33.	<i>Pristomerus valuator</i> Pan.	<i>Phthorimaea operculella</i> Zeller	Potato	Common
34.	<i>Xanthopimpla cera</i> Cam.	<i>Scirpophaga novella</i> Fab.	Sugarcane	Rare
35.	<i>X. nursei</i> Cameron	<i>Sylepta derogata</i> Fab.	Cotton	Common

36	<i>X. punctata</i> F.	<i>Chilo partellus</i> (Swin.)	Jowar	Common
37	<i>X. stemator</i> Cameron	<i>C. partellus</i>	Jowar	Common
38	<i>X. transversalis</i> Voll.	Jamun borer	Jamun	Common
39	<i>X. Kolhapurensis</i> S. & C.	Host unknown	Unknown	Common
40	<i>X. paddae</i> S. & C.	<i>Chlo</i> sp.	Paddy	Common
41	<i>X. partellae</i> S. & C.	<i>Chilo partellus</i> (Swin.)	Jowar	Common
42	<i>X. connexa poonensis</i> (Rao)	<i>Actias</i> sp.	-----	Common
43	<i>Xanthopimpla</i> sp.	Unknown	-----	Rare
44	<i>Xanthopimpla</i> sp.	<i>Antheraea</i> sp.	Almond	Rare
45	<i>Xanthopimpla</i> sp.	Paddy borers	Paddy	Common

## DISCUSSION

Ichneumonid parasitoids have been widely attempted from Marathwada region (Sathe et.al, 2003). However, very little attention on Ichneumonid species having biocontrol potential is paid from Western Maharashtra. The climate of Kolhapur, Sangli, Satara, and Pune districts is different (rainy and humid) than Marathwada (dry) hence the diversity of Ichneumonid species also shows variation with climate change. Western districts harbor several new species of Ichneumonids to expose and exploit in biological control programs for agricultural and horticultural pests. In the survey studies many species found were with potential for pest control of different economically important agricultural and horticultural crops.

## CONCLUSION

In all, 45 species of Ichneumonid flies belongs to 12 genera were reported from Western Maharashtra. Out of 45 species, 34 species were common in the region whereas 11 species were rare. The pests such as stem borers, hairy caterpillars, semi-loopers, fruit borers, leaf rollers were parasitized by Ichneumonid flies in the region. Many species having biocontrol potential will be utilized in minimizing pest population affecting different crop plants.

## ACKNOWLEDGEMENT

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# CHAPTER 10

## ON THE COLEOPTERA OF PANDHARPUR TAHSIL, DISTRICT SOLAPUR (M.S.) INDIA

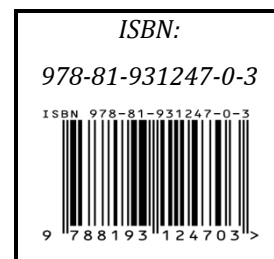
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### ABSTRACT

This study provides the detailed information on the coleopteran assemblage from the of Pandharpur tahsil, district Solapur (M. S.) India. The study reports beetles from the 20 different families of order Coleoptera viz. Carabidae, Haliplidae, Dytiscidae, Gyrinidae, Hydrophilidae, Histeridae, Staphylinidae, Leucanidae, Scarabaeidae, Buprestidae, Elateridae, Lampyridae, Bostrichidae, Nitidulidae, Coccinellidae, Meloidae, Tenebrionidae, Cerambycidae, Chrysomelidae and Curculionidae.

**KEY WORDS:** Coleoptera, Arid Zone, Diversity, Solapur

### INTRODUCTION

The insects from the Order Coleoptera are known occur in almost all kinds of habitats except polar regions. The order Coleoptera exhibit great diversity and species richness with remarkable plasticity in the development and constituting about 25 % of the all known types of animals. It is very difficult to estimate accurate species number from any taxonomic group of animals. As far as concerned to the described number of coleopteran species counts to 3, 60,000 throughout the world (Bouchard et al., 2009). These species are distributed within 211 families, 541 subfamilies, 1663 tribes and 740 subtribes of order Coleoptera (Bouchard, 2011). The number of earlier described species of Coleoptera from the Indian subcontinent was 15088 (Kazmi & Ramamurthy, 2004).

The order Coleoptera represents both beneficial and harmful species. Several studies have been carried out on the diversity of coleoptera, their assemblage in different ecosystems, utilization of food resource, their role in maintenance of different ecosystem (Stebbing , 1914; Beeson, 1941, Lefroy, 1971; Erwin & Scott, 1980; Meshram et al., 1990; Nair, 2000, 2001, 2007; Pardo-Locarno et al., 2005; Anitha et al., 2006; Kulkarni et al., 2009).

Taking into consideration the huge diversity of order Coleoptera and its twofold importance, the present work has been undertaken to find out the coleopteran assemblage from the agro-ecological zone of Pandharpur tahsil, district Solapur (M.S.) India.

## MATERIALS AND METHODS

### Collection of Beetles

Faunistic surveys of the Pandharpur Tahsil especially in the agro-ecological zone were conducted between Jan. 2014 to December 2014 and beetles were collected from agro-ecological zone of 10 different villages, viz., Gadegaon, Takali, Mendhapur, Sarkoli, Gursale, Ozewadi Ranjani, Ambe, Chale and Mundhewadi. The beetles were collected during the morning hours during 7.00 am to 9.00 am. The collection of beetles was also made with the help of light trap from 7.00 pm to 8.00 pm. The collection method of beetles was followed according to (Alfred and Ramakrishna, 2004 and Leather et al., 2005).

### Study Area

Pandharpur tahsil of Solapur district geographically lies between 17°30'00"N to 18°05'00"N latitude & 75°05'00"E to 75°35'00"E Longitude, which cover 1303.6 Sq Km area. There are 103 villages in Pandharpur tahsil. For the present study, the agro-ecological zone 10 different villages was selected for the present study. These villages are Gadegaon, Takali, Mendhapur, Gursale, Sarkoli, Ozewadi, Ranjani, Chale, Ambe and Mundhewadi.

The land use pattern of Pandharpur tahsil shows 52% of the land is used for agriculture, 18 % represents fallow land, 17% barren land, 11% grassland and 2% land is occupied by water body (Palkar & Gavade, 2013).

## RESULTS

The present investigation reports the coleopteran species associated with the agro-ecological zone of Pandharpur Tahsil. The agricultural area of the selected villages includes vegetable crops, fruit crops and cash crops. The villages selected for the present study are mentioned in the study area. A total of 70 species were recorded during the study period under 53 genera distributed in 20 families of order Coleoptera viz. from the agro-ecological zone of Pandharpur Tahsil, district Solapur Maharashtra, India. Table 1 presents the checklist of the beetles collected during the study period.

**Table 1: Checklist of Coleoptera from the agro-ecological zone of Pandharpur Tahsil, District Solapur (M.S.) India**

Sr. No.	Species	Family
1.	<i>Brachinus sp.</i>	Carabidae
2.	<i>Eudema sp.</i>	
3.	<i>Chlaenius sp.</i>	
4.	<i>Haliphus sp.</i>	Haliplidae

5.	<i>Sandracottus dejeani</i> Aube ?	Dytiscidae
6.	<i>Cybister</i> sp.	
7.	<i>Dinutes (Protodinutes) indicus</i> Aube	Gyrinidae
8.	<i>Orectochilus</i> sp.	
9.	<i>Sphaeridium</i> sp.	Hydrophilidae
10.	<i>Hister</i> sp.	Histeridae
11.	<i>Hister</i> sp.	
12.	<i>Platydorus</i> sp.	Staphylinidae
13.	Unidentified sp.	Leucanidae
14.	<i>Aphodius moestus</i> Fab.	Scarabaeidae
15.	<i>Aphodius</i> sp.	
16.	<i>Aphodius</i> sp.	
17.	<i>Scarabaeus sacer</i> ?	
18.	<i>Heliocopris bucephalus</i> Fab.	
19.	<i>Catharcus pithecius</i> Fab.	
20.	<i>Catharcus</i> sp.	
21.	<i>Onthophagus catta</i> Fab.	
22.	<i>Oniticellus cinctus</i> Fab.	
23.	<i>Onthophagus</i> sp.	
24.	<i>Onthophagus</i> sp.	
25.	<i>Onthophagus</i> sp.	
26.	<i>Onthophagus</i> sp.	
27.	<i>Holotrichia fissa</i> Brenske	
28.	<i>Maladera castanea</i>	
29.	<i>Maladera holosericea</i> 23	
30.	<i>Maladera</i> sp	
31.	<i>Apogonia</i> sp.	
32.	<i>Anomala bengalensis</i> Blanch.	
33.	<i>Anomala</i> sp.	
34.	<i>Anomala</i> sp.	
35.	<i>Anatona stillata</i> New.	
36.	<i>Adoretus versutus</i> Harold	
37.	<i>Adoretus</i> sp.	
38.	<i>Chiloloba acuta</i> Wied.	
39.	<i>Oryctes rhinoceros</i> Linn.	

40.	<i>Phyllognathus dionysius</i> Fab.	
41.	<i>Psiloptera orientalis</i> Laporte & Gory	Buprestidae
42.	<i>Sternocera laevigata</i> Olivier	
43.	<i>Sternocera orientalis</i> Castelnau & Gory	
44.	<i>Agrilus</i> sp.	
45.	<i>Argypnus</i> sp.	Elateridae
46.	<i>Melanotus</i> sp.	
47.	<i>Melanotus</i> sp.	
48.	<i>Lamprophorus</i> sp.	Lampyridae
49.	<i>Sinoxylon</i> sp.	Bostrichidae
50.	<i>Sinoxylon</i> sp.	
51.	<i>Carpophilus</i> sp.	Nitidulidae
52.	<i>Menochilus</i> sp.	Coccinelidae
53.	<i>Illies</i> sp.	
54.	<i>Mylabris pustulata</i> Thunberg	Meloidae
55.	<i>Mylabris</i> sp.	
56.	<i>Gonocephalum</i> sp.	Tenebrionidae
57.	<i>Gonocephalum</i> sp.	
58.	<i>Tribolium</i> sp.	
59.	<i>Batocera rufomaculata</i> De Geer	Cerambycidae
60.	<i>Xystocera globosa</i> Olivier	
61.	<i>Olenocamptus bilobus</i> Dillon & Dillon	
62.	<i>Stromatium barbatum</i> Fab.	
63.	<i>Pterolophia</i> sp.	
64.	<i>Stibara nigricornis</i> Fab.	
65.	<i>Coptops aedificator</i> Fab.	
66.	<i>Macrotoma</i> sp.	
67.	<i>Celosterna scabrator</i> 52 Fab.	
68.	<i>Aspidomorpha</i> sp.	Chrysomelidae
69.	<i>Myllocerus</i> sp.	Curculionidae
70.	<i>Euplatypus</i> sp.	

## DISCUSSION

The present inventory in the coleopteran assemblage from the agro-ecological zone of Pandharpur Tahsil reports 70 species belonging to 53 genera distributed within 20 different families. These species exhibits different feeding guilds viz. phytophagous, saprophagus, coprophagous and carnivorous. The beetles



from the Carabidae, Histeridae, and Coccinellidae are predatory in nature. Among these family Histeridae and Coccinellidae represents the genera *Hister*, *Menochilus* and *Illies*, which are widely used in the biological control programme of pests. Summerlin et al., (1984) studied the life cycle and habits of *Hister abbreviatus* and its potential in reduction of fly population. Netam et al., (2013) reported the seasonal incidence of insect pests from the Soyabean field with variation in the bio-control agents like coccinellid beetles, spiders and pentatomid bugs. Among these three groups, family Coccinellidae represented two species that are *Menochilus sexmaculatus* and *Coccinella septempunctatus*.

The aquatic beetles recorded from the present study region belong to the families Haliplidae, Gyrinidae, Dytiscidae and Hydrophilidae. These families represent only five species from the present study area. This number is very low as the aquatic ecosystems i.e. seasonal streams and lakes present near agro-ecological zone represent great variety of aquatic beetles. More concentrated efforts are needed in future to explore this particular fauna from the Pandharpur Tahsil. Among the ground dwelling beetle families, Tenebrionidae represented only 3 species of which *Tribolium* is a serious pest of stored grains.

The phytophagous group represents the families Scarabaeidae, Elateridae, Cerambycidae, Buprestidae, Meloidae Bostrichidae, Nitidulidae, Chrysomelidae and Curculionidae. The beetles from these groups feed on the different plant parts that are foliage, stem, bark, root, seeds, fruits. These seven families many pestiferous species of agricultural fields, plantation crops and fruit crops. The major pestiferous general are *Holotrichia*, *Apogonia*, *Maladera*, *Adoretus*, *Anomala*, *Oryctes*, *Phyllognathus*, *Oryctes*, *PSiloptera*, *Sternocera*, *Agrilus*, *Argyppus*, *Sinoxylon*, *Myloceros* and *Euplatypus*. The species from these genera are reported as serious pests of agricultural crops, plantations crops, forest plants from the different parts of the country (Beeson, 1941; Meshram et al., 1990; Nair, 2000, 2001, 2007; Anitha et al., 2006; Kulkarni et al., 2009).

The coprophagous beetles play a significant role in the decomposition of organic matter and nutrient recycling. During the present study, 12 species of beetles were recorded which use animal excrements as food resource. These beetles represent genera *Aphodius*, *Scarabaeus*, *Heliocopris*, *Catharcus*, *Oniticellus* and *Onthophagus*. These genera were recorded from the excrements of buffalo, cow, dog and humans. Likewise several studies have been carried out on the insects associated with animal excrements and their ecological role (Bornemissza, 1960, 1968, 1969; 1970; Koskela and Hanski, 1977; Hanski, 1987; Pinero and Milo, 2004. Venugopal et al., 2012).

The present study will be helpful in the management of pestiferous species of agricultural field, in determination of potential and use of predatory beetles as bio control agents. The coprophagous beetles recorded during the present study can be used in the decomposition organic waste material after the determination of their potential.

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# CHAPTER 11

## STUDIES ON NEW SPECIES OF CESTODE PARASITE *PHOREIOBOTHRIUM MUMBAIENSIS* OF *TRYGONZUGEI* FROM MUMBAI COAST

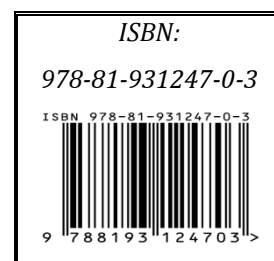
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### ABSTRACT

The scolex is medium in size, quadrangular in shape, divided into two regions – anterior and posterior. The scolex bears four bothridia, which are medium in size, roughly oval in shape, broad posteriorly and narrow anteriorly. The hooks are bifurcated, each hook bearing two prongs the inner prong is small, short. The handle is short. A single, round, small accessory sucker is present, at the anterior extremity, on each bothridium. Testes are medium in size, rounded in shape, 38 in numbers, pre-ovarian, almost evenly distributed. The vas deferens is medium, straight, posteriorly directed. The ovary is large in size, bilobed, extend anteriorly, up to the testes. The vagina is narrow tube, posterior to the cirrus pouch, start from the common genital pores, runs in the middle of the segment reaches and open into the ootype. The genital pores are medium in size, oval in shape, placed just anterior to the middle of the segments.

**KEYWORDS:** Cestode Parasites, *Phoreiobothrium mumbaiensis*, *Trygonzukei*, Mumbai Coast.

### INTRODUCTION

The genus *Phoreiobothrium* was erected by Linton, 1889, to accommodate a cestode, recovered from dusky Shark *Carcharias obscurus* at Woods hole, with its type species, *P. lasium*. Later on Linton reported three species, i.e. *P. exceptum* Linton, 1924, *P. pectinatum* Linton, 1924, *P. trilocolatum* Linton, 1901 at Woods hole. Cheung, Nigrelli and Ruggieri, 1981 reported *P. tiburensis* from *Sahyrnatiburo* at Florida Key's, U.S.A., Shrivastava and Capoor, 1982 reported *P. puriensis* from *Zygaenablochii* at Puri, Orissa, India. Later on Jadhav and Shinde reported *P. arabiansis* in 1984. Shinde and Jadhav, 1987 reported

*P. ratnagiriensis* from *Carchariasacutus* at Ratnagiri, M.S., India. Jadhav, Shinde and Jadhav D.H., reported *P. carchariasae* from *Carchariasaeacutus* at Bombay, M.S., (west coast of India), India. Afterwards Shinde, Jadhav, D.H. Jadhav, 1990, reported *P. shindei* and *P. carchariasae* from *Carchariasacutus* at Bombay, M.S. India. Pawar, 2005 reported new species *P. bhagwantiensis* from *C. acutus* at Ratnagiri, M.S. (West Coast of India).

## MATERIALS AND METHODS

The scolex is medium in size, almost quadrangular in shape, having four sessile bothridia, somewhat narrow anteriorly and posteriorly and measures 0.495 (0.485-0.504) in length and 0.514 (0.509-0.519) in breadth. The scolex bears four bothridia, which are medium in size, roughly oval in shape, broad posteriorly and narrow anteriorly and measures 1.666 (1.593-1.739) in length and 1.679 (1.640-1.718) in breadth. The hooks are bifurcated, each hook bearing two prong, the inner prong is small, short and measures 0.0026 (0.0021-0.0032) in length and 0.0015 (0.0010-0.0021) in breadth. The outer prong is big and measures 0.541 (0.538-0.543) in length and 0.104 (0.101-0.106) in breadth. The handle is short, narrow and measures 0.0028 (0.0019-0.0038) in length and breadth respectively. A single, round, small accessory sucker is present, at the anterior extremity, on each bothridium, at the junction of the hooks and measures 0.0097 in diameter. The scolex is followed by thin, short neck and measures 0.354 (0.349-0.359) in length and 0.176 (0.174-0.179) in breadth.

The mature segments are large in size, longer than broad, with straight, lateral margins without spines. This segment varies in length and projection at the anterior and posterior corners of the segments and measures 0.873 (0.864-0.883) in length and 0.611 (0.606-0.616) in breadth.

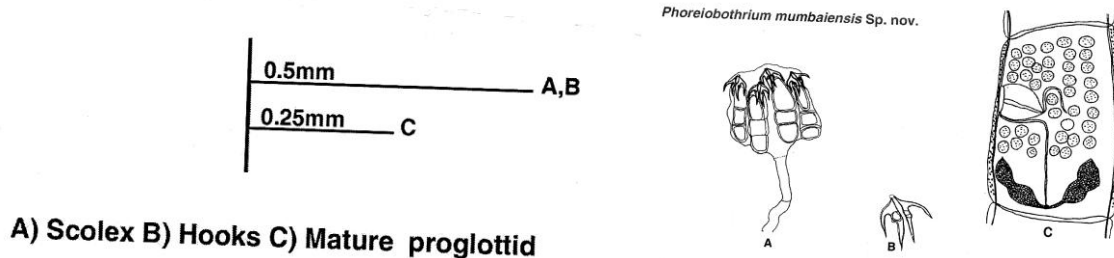
Testes are medium in size, rounded in shape, 38 in numbers, pre-ovarian, almost evenly distributed, central medulla, from ovary to anterior margin of the segment and measures 0.286 in diameter. The cirrus pouch is medium in size, oval in shape and measures 0.189 (0.184-0.194) in length and 0.162 (0.160-0.165) in breadth. The cirrus is thin, straight, contained within the cirrus pouch and measures 0.191 (0.189-0.194) in length and 0.00028 (0.00019-0.00020) in breadth. The vas deferens is medium, straight, posteriorly directed and measures 0.269 (0.266-0.271) in length and breadth respectively.

The ovary is large in size, bilobed, extend anteriorly, up to the testes and measures 0.604 (0.601-0.604) in length and 0.0898 (0.0873-0.0922) in breadth. The vagina is narrow tube, posterior to the cirrus pouch, starts from the common genital pores, runs in the middle of the segment reaches and open into the ootype and measures 1.835 (1.796-1.875) in length and 0.086 (0.078-0.095) in breadth. The ootype is small in size, rounded in shape, situated in the concavity of the ovarian lobes and measures 0.0019 in diameter.

The genital pores are medium in size, oval in shape, placed just anterior to the middle of the segments, marginal and measures 0.0036 (0.0024-0.0048) in length and breadth respectively.

The vitellaria are granular on each lateral side and from the anterior to the posterior margin of the segments. Longitudinal excretory canals are thin and measure 0.012 in width.

## RESULT AND DISCUSSION



The genus *Phoreiobothrium* was erected by Linton, 1889, as a typespecies, *P. lasium* from *Carcharias obscures* at Wood Hole. Later on the following species are added to this genus;

- |  |  |
|--|--|
| 1) <i>P. trilocolatum</i> Linton, 1901.          | 2) <i>P. exceptum</i> Linton, 1924.                  |
| 3) <i>P. pectinatum</i> Linton, 1924.            | 4) <i>P. puriensis</i> Shrivastava & Capoor, 1982.   |
| 5) <i>P. arabiansis</i> Jadhav and Shinde, 1984. | 6) <i>P. ratnagiriensis</i> Shinde and Jadhav, 1987. |
| 7) <i>P. shindei</i> Shinde et al. 1990.         | 8) <i>P. carchariasae</i> Jadhav et al. 1990.        |
| 9) <i>P. marirei</i> Cairns et al. 1996          | 10) <i>P. bhagwantiensis</i> Pawar et al. 2005.      |

The worm, under discussion, the genus *Phoreiobothrium mumbaiensis* sp. nov. in having scolex quadrangular, with bothridia sessile, medium, neck is present, mature segments are broader than long, testes 38 in number, evenly distributed, ovary bilobed in appearance, genital pores sub marginal, irregularly alternate, vitellaria granular.

1) The present cestode parasite, differs from *P. lasium* (1889) which is having bothridium tubular, posterior end, divided into number of loculi by transverse septa, hooks paired, trifurcated, inner Prong small and asymmetrical, the neck present, ovary bilobed and vagina anterior to cirrus pouch.

2) The present form, differs from *P. trilocolatum* (1901) which is having the bothridium, whose posterior margin with three loculi, hooks paired, trifurcated, symmetrical, tubercle on middle prong, testes 150-160 in number, ovary granular and other characters not mentioned.

3) The present cestode, differs from *P. exceptum* (1924) which is having the bothridium elongated towards the posterior end, six loculi present at the posterior end, paired hooks, bifurcated and other characters not mentioned.

4) The present tapeworm, differs from *P. pectinatum* (1924) which is having the bothridia with 7 loculi at the posterior end, the septa in front of locule bordered with seven papillae, hooks trifurcated, symmetrical hook in middle prong and other characters not mentioned.

5) The present worm, differs from *P. puriensis* (1982) which is having scolex pyramidal in shape, bothridium with posterior end divided into 12 or more loculi neck present with spines, testes 125-140 in number, vagina anterior to the cirrus pouch, vitellaria follicular, in one or two rows, on each side.

6) The present cestode, differs from *P. arabiansis* (1984) which is having four sessile, quadrangular bothridia with paired hooks trifurcated, testes 60-75 in number, ovary bilobed, vagina anterior to cirrus pouch.

7) The present parasite, differs from *P. ratnagiriensis* (1984) which is having the scolex quadrangular with spines, bothrium with a single large loculus at posterior end, hooks paired, trifurcated, neck present, with spines, testes 180 (175-185) in number, mature segment with spines, vagina anterior to the cirrus pouch, vitellaria follicular, in a single row.

8) The present cestode, differs from *P. shindei* (1990) which is having the scolex quadrangular with spines, bothridium with a single large loculus at posterior end, neck present with spines, testes 92-98 in number, cirrus pouch oval, just posterior to middle of the segment, vagina posterior to cirrus pouch.

9) The present tapeworm, differs from *P. carchariasae* (1990) which is having the scolex rectangular without spines, bothridium sessile with a single large loculus at its posterior end, neck present, without spines, testes 180-190 in number, ovary 'U' shaped, with 38-41 acini and vagina posteroventral to cirrus pouch.

10) The present parasite differs from *P. marirei* (1996) which is having scolex elongated, hooks trifurcated, neck present, testes 92-98 in number, ovary oval.

11) The present cestode differs from *P. bhagwantiensis* (2005) which is having bothridium rectangular, hooks paired and trifurcated, testes 116-126 in number, ovary 'U' shaped, mature segments longer than broad, vagina posteroventral to cirrus pouch, vitellaria granular.

## CONCLUSION

By observing the above noted characters, it is desirable to erect a new species, to accommodate these worms and hence the name *P. mumbaiensis* sp. nov. is proposed after the city, Mumbai.

Type species: *Phoreiobothrium mumbaiensis* sp. nov.

Host: *Trygonzuei* (Muller & Henle, 1841). Habitat: Spirial valve. Locality: Mumbai coast.

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# CHAPTER 12

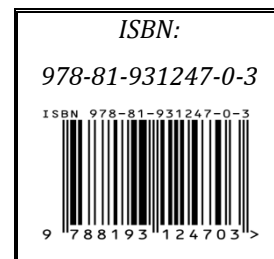
## ON THE DEVELOPMENT AND DIET BREADTH OF *PARASA LEPIDA* CRAMER (LEPIDOPTERA: LIMACODIDAE) FROM RADHANAGARI WILDLIFE SANCTUARY, KOLHAPUR (M.S.) INDIA

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### ABSTRACT

The present study provides detailed information on the development of *Parasa lepida* Cramer (Limacodidae: Lepidoptera). The study also reports existing larval diet breadth of *Parasa lepida* Cramer from the Radhanagari wild life Sanctuary, Kolhapur. The data obtained from the developmental studies under laboratory conditions revealed that incubation period of eggs ranged from 7 to 8 days. The first instar was completed in 2 to 3 days. The second instar lasted for 4 to 6 days. The fourth instar required 4 to 6 days to enter in the fifth instar. The fifth and sixth instar required 7 to 8 days and 6 to 8 days respectively. After completion of the larval period, the sixth instar larva pupates within hard oval shaped pupal case. The pupal period ranged from 12 to 14 days. The adult longevity was ranged from 2 to 4 days.

**KEYWORDS:** Blue nettle grub, Radhanagari Wild life Sanctuary, Diet Breadth, Polyphagous

### INTRODUCTION

On the basis of species number, the order Lepidoptera is the second largest order in the class Insecta and they are treated as one most important part of biodiversity (New and Collins, 1991). The total number of described species from Order Lepidoptera counts to 1, 50,000 (Grimaldi and Engel, 2005). In economic view point also, it is second in rank that is after Coleoptera. Several lepidopteran species have been treated as serious pests of agricultural crops, plantation crops and forest plants. Usually adults are short lived, feed on nectar and other fluids while the immature stages feed on the foliage and also bore shoots, fruits, trunks of the trees and few species are carnivorous in nature (Nair, 2007).

The blue- striped nettle grub *Parasa lepida* Cramer belongs to the family Limacodidae of order Lepidoptera. It is an invasive pest primarily distributed in the tropics and subtropics that is China, South east



Asia, India and Central South Africa (Hirashima, 1989; Zhang, 1994). *Parasa lepida* is highly polyphagous pest for instance Robinson et al., (2001) recorded 81 larval food plants belonging to 35 different plant families. It is reported as serious pest of several fruit trees such as coconut, coffee, mango and Cacao in Indonesia (Kalshoven, 1981). In India, it is reported major pest of mango (Kapoor et al., 1985, Jeyabalan and Murugan 1985). Shemila and Semwal (2015) reported as a pest of *Polypilus deltooides* and described the life cycle.

During the survey on the insect herbivores in the Radhanagari Wildlife Sanctuary, a large scale defoliation of *Terminalia tomentosa* and *Careya arborea* was observed. This was due to feeding of caterpillars of *Parasa lepida* Cramer. Taking in to consideration the polyphagous nature of *Parasa lepida* Cramer and its pest status, the present study has been carried to find out the larval diet breadth in the Radhanagari Wild life Sanctuary and its development under laboratory condition.

## **MATERIALS AND METHODS**

### **Collection of material for life cycle study**

The life cycle of *Parasa lepida* Cramer was studied during Jan.2011 to Sept. 2013 in laboratory by collecting the last instars regularly from Radhanagari wild life Sanctuary, Kolhapur, Maharashtra. Larvae were hand collected by using forceps from the trunks of trees and placed in plastic containers (2 kg capacity) and brought to the laboratory. Branches were also examined in the field for any pupa or eggs found were collected with same piece of bark.

### **Rearing under laboratory conditions**

The collected larvae were reared in glass jars (20X 20 X17 ½ cm) by providing fresh leaves of larval food plants twice in a day. The male and female moths obtained were released in cages for mating. Mated females were kept in cages separately for egg laying. After egg laying, eggs were transferred to petri dishes contacting fresh tender leaves at room temperature. A moistened filter paper (Whatmann No. 3) was kept in each petri dishes to prevent drying of tender leaves.

The caterpillars were maintained in petri dishes up to second instar. Later on they were transferred and reared in separate glass jars (20X 20 X17 ½ cm) and allowed them to complete first generation. Observations were recorded daily on the duration of different developmental stages. The detailed morphometric data of sixth instar, pupal case, pupa and adult was recorded by using millimeter scale (Rono et al, 2008).

### **Observation on the larval diet breadth in the field**

In order to find out the existing larval diet breadth of *Parasa lepida*, 5 different sites viz. Ugawai, Dajipur, Dhanagarwada, Shelap and Surangi were visited at fortnight interval in the Radhanagari Wildlife Sanctuary for the period of two years. This includes observation on the deciduous and evergreen trees from the sanctuary.

## RESULTS AND DISCUSSION

The life cycle *Parasa lepida* Cramer was studied under laboratory conditions during 2011 to 2013. The field observations were also made on the larval diet breadth of *Parasa lepida* Cramer and the data obtained from the field observations presented in table 3. The duration of different stages and morphometric data of sixth instar, pupa and adult of *Parasa lepida* Cramer presented in table no 1 and 2.

### **Egg**

The incubation period of eggs ranged from 7 to 8 days with a mean of 7.5 days.

### **Larval Development**

The data obtained from the laboratory studies shows that the caterpillar pass through six instars and pupate in hard shell on the external surface of tree trunk or on the branches.

#### **1<sup>st</sup> Instar**

The neonate larvae gregarious, feeds actively on the tender leaves. The duration of first instar ranged from 2 to 3 days with a mean of 2.6 days.

#### **2<sup>nd</sup> Instar**

The second instar lasted for 6 to 4 days with an average of 5 days.

#### **3<sup>rd</sup> Instar**

The third instar lasted for 4 to 6 days with a mean of 5.4 days.

#### **4<sup>th</sup> Instar**

The fourth instar ranbged from 5 to 6 days with a mean of 5.7 days.

#### **5<sup>th</sup> Instar**

The fifth instar lasted for 7 to 8 days with a mean of 7.5 days

#### **6<sup>th</sup> Instar**

The duration of sixth instar ranged from 6 to 8 days with an average of 6.6 days. The length of the sixth instar ranged from 19 mm to 21 mm with a mean of 20.4 mm while the width was recorded 4 mm.

The head of the caterpillar was brown and retractile. First segment retractile with double black spot. Ground colour green, a blue dorsal strip edged with whitish and similar lateral strip. A sublateral series of ten scoli tufted with urticating bristles which are short and mossy, the posterior two pairs with black basal spot. Among the ten scoli, 9<sup>th</sup> scoli large and red tufted. The ventral surface of the grub whitish outlined in yellow. The fifth instar is much similar to sixth instar except the area between the dorsal and lateral stripes. No black basal spot on the scoli. The lateral scoli themselves much longer and not so much mossy in appearance. The first three and last two of the subdorsal series very much longer and tufted with black bristles, 4<sup>th</sup> to 8<sup>th</sup> practically invisible (Sevastopulo, 1939).

### **Larval food plants**

The larvae of *Parasa lepida* are commonly known as Blue nettle grubs. It is polyphytophagus species found abundantly in the forests and plantation crops. Earlier several workers have reported the biology and larval food plants of *Parasa lepida* from the different parts of the Indian subcontinent. Lefroy (1909) reported

that the immature of this species feeds actively on the foliage of *Terminalia catappa* and *Terminalia tomentosa*. Beeson (1941) reported 25 different larval food plants from the Indian subcontinent and added a note on the biology. In the recent past, the caterpillars of *Parasa lepida* were recorded on the foliage of *Mangifera indica* and *Syzygium cumini* (Butani 1979; Regupathy et al., 1995). Hiroichi et al., (2008) provided the comparative account on the coccon density and blue stripped nettle grub moth *Parasa lepida* Cramer between deciduous and evergreen trees viz. *Triadica sebifera* and *Quercus myrsinaefolia*. During the present study, the larvae of *Parasa lepida* Cramer were recorded to feed on the foliage of 6 different plant species viz. *Mangifera indica*, *Terminalia tomentosa*, *Syzygium cumini*, *Sapium insigne*, *Careya arborea* and *Terminalia bellirica*.

**Pupa:** Prior to pupation, the full grown grubs prepare a hard shell and pupate within. Pupal case hard and blackish brown in colour, oval in shape, possesses some larval bristles which appeared black in colour woven into each end. Several cocoons or shells are spun together and they extremely difficult to detect on the trunk of tree as the colour of the bark and shell matches with each other. The adult escape from the shell by cutting a circular lid. The length of pupal case ranged from 11 mm to 13 mm with a mean of 11.9 mm while the width ranged from 5 to 6 mm with an average of 5.5 mm. The length of the pupa ranged from 10 mm to 12 mm with a mean of 10.4 mm while the breadth ranged from 4 to 5 mm with an average of 4.2 mm.

**Adult :** The adult morphology was described by Hampson (1892). *Parasa lepida* is one of the largest species of nettle grubs. Forewings with reddish brown basal area and a broad green area crossing the middle of the wing. Thorax green in colour, abdomen brown. Frenulum present, hindwing with vein 8 anastomosing with cell, separate from 7 vein 1c present. The body length of the moth ranged from 15 to 18 mm with a mean of 15.7 mm while the width ranged from 4 to 5 mm with a mean of 4.5 mm. The wing expanse of the moth ranged from 31 mm to 34 mm with a mean of 32.5 mm.

**Table 1: Duration of different stages of *Parasa lepida* Cramer (in days)**

Stages	Min	Max	Mean	SD	SEM
Egg Incubation Period	7	8	7.5	0.527	0.175
1 <sup>st</sup> Instar	2	3	2.6	0.516	0.163
2 <sup>nd</sup> Instar	4	6	5	1.054	0.333
3 <sup>rd</sup> Instar	4	6	5.4	0.966	0.305
4 <sup>th</sup> Instar	5	6	5.4	0.483	0.152
5 <sup>th</sup> Instar	7	8	7.5	0.527	0.305
6 <sup>th</sup> Instar	6	8	6.6	0.966	0.305
Pupa	12	14	12.8	1.033	0.326
Adult	2	4	2.8	0.788	0.249

Figures are mean of 10 samples, SD- Standard deviation, SEM, Standard Error of mean

**Table 2: Morphometric data of *Parasa lepida* Cramer (in mm)**

Stages		Min	Max	Mean	SD	SEM
6 <sup>th</sup> Instar	Length	19	21	20.4	0.966	0.305
	Width	4	4	4	0.00	0.00
Pupal Case	Length	11	13	11.9	0.994	0.315
	Width	5	6	5.5	0.527	0.166
Pupa	Length	10	12	10.4	0.699	0.221
	Width	4	5	4.2	0.421	0.133
Adult	Length	15	18	15.7	1.167	0.366
	Width	4.	5	4.5	0.527	0.166
Wing Expanse		31	34	32.5	1.581	0.500

Figures are mean of 10 samples, SD- Standard deviation, SEM, Srandard Error of mean

**Table 3: Larval food plants of *Parasa lepida* Cramer recorded from Radhanagari Wildlife Sanctuary**

Sr. No.	Scientific Name	Common Name
1	<i>Mangifera indica</i>	Mango
2	<i>Terminalia tomentosa</i>	Ain
3	<i>Syzygium cumini</i>	Jamun
4	<i>Sapium insigne</i>	Hurra
5	<i>Careya arborea</i>	Kumbha
6	<i>Terminalia bellirica</i>	Behada

### ACKNOWLEDGEMENT

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# CHAPTER 13

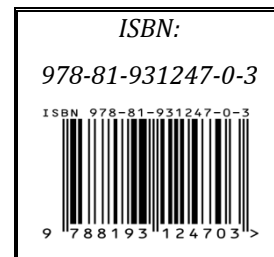
## IMPACT OF PHYSICO-CHEMICAL CHARACTERISTIC OF BIRNAL RESERVIOR (JAT, DIST-SANGLI) ON PHYTOPLANKTON COMMUNITIES

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### ABSTRACT

Present study deals with the impact of physico-chemical parameters on one of the important constituents of life support. The physical & chemical parameters are very important in each water body; as a birnal area location is in jath tehsil, rainfall is very less in the area, the rainfall is 20.06". Variable analysed from surface water of the reservoir. The physical parameters included temperature; transparency; pH; electrical conductivity; dissolved oxygen; hardness; alkalinity; chlorides; nitrates & phosphate. A total 43 species of phytoplankton were observed during the study period. There were 19 species observed from the class chlorophyceae; 10 species of the class cynophyceae; 12 species of the Bacillariophyceae; 2 species of the class Euglenophyceae were the indicator of water quality. The favourable physico-chemical parameters such as nitrates; phosphate; temperature & alkalinity show growth of phytoplankton. The class chlorophyceae species were observed in maximum number during the study period.

**KEY WORDS:** Phytoplankton, Physico-chemical; Birnal reservoir.

### INTRODUCTION

Water is one of the most natural resources of all the living organisms, weather unicellular or multicellular ; since it required for various domestic purposes like washing; bathing ; drinking ; agricultural; irrigation; shipping ; now a days for aquaculture and power generation; industries (Patil & Ghorade 2012) water of good quality is required by living organisms to meet their everyday demands . the domestic uses ; pestisiced; fertilizers; industrial drainage is leading pollution of water which is causing serious disturbance in the aquatic ecosystem which is reflected in the biotic community structure (Cairns ; 1979 )

The physio – chemical study of the water body help us to understand structural and functional relation of its habitants water reservoir have more fragile ecosystem because they do not have or very little

self-purification capacity & it gets polluted very quickly. Lakes also act as re – charger for aquifer .Aquatic as well as terrestrial fauna & flora are supported by the lakes. (Purushottam J.P., 2010 )

Phytoplankton is the major primary producers in many aquatic systems & is important food sources for other organisms. The plankton diversity responds rapidly to changes in the aquatic environment particularly in relation to nutrients. Extensive studies have been conducted pertaining to qualitative & quantitative ecology of phytoplankton. Recently increased importance is given to the plankton productivity in relation to physical & chemical parameters of aquatic system.

Therefore; an extensive study of the physico- chemical parameters & their effects on plankton were made for the period of one year in the selected area of Birnal reservoir.

## MATERIALS AND METHODS

### STUDY AREA

Jat taluka is well developed agricultural area. The landscape of taluka is dotted with Many minor and major irrigation reservoirs. These reservoirs are constructed for irrigation Purpose, the perennial reservoir of Birnal is situated in jath taluka 6 km west; its latitude is  $17^{\circ} 31' N$ . & Longitude  $75^{\circ} 10' E$ . The catchment area 29.772 qm km. The gross capacity of Reservoir is 85.94 mt Birnal reservoir Height of reservoir is 18.60 mt & length is 290 mt. jath city utilizes 62.84 % water from Birnal reservoir.



The samples of surface water were collected fortnightly from four sampling sites Of the tank monthly. The tests particularly for dissolved oxygen and alkalinity were performed at the site. The water temperature was measured by using mercury thermometer. The transparency of water was measured by using secchi disc. The pH was determined by using pH meter. The water samples were transferred to the laboratory for further chemical Analysis. Standard methods as described and Trivedi et al. (1998) were followed for Various

physico-chemical parameters. Statistical analysis was done to find out the Interrelationship among physico-chemical factors.

### FIELD SAMPLING AND ANALYSIS FOR PLANKTON

Samples from four sites are collected, fifty litres of tank water from each Site was filtered through plankton net made up of bolting silk No. 125. The concentrated Samples were preserved by adding 4% formalin and 1ml lugols iodine the identification of Phytoplankton was made following Fritsch (1944); Bongale and Bharati (1978) and Cox (1966). the quantitative analysis of Phytoplankton was done by using Lackey's (1938) drop count method and results were expressed as no/ lit at monthly intervals. The counting and identification of zooplankton species were done of Koste (1978) ; Michael and Sharma ; (1988) Korovchinsky (1992). And preserved in 4% formalin Solution. The qualitative and quantitative analysis of phytoplankton was done with the help of Sedgwick-Rafter Cell method by using following formula

$$\text{Phytoplankton units/ L} = N \times C / V$$

Where N = Number of plankton in 1 ml.

C = Volume of concentrate

V = Volume of sample in Litre (Litre presented to total volume filtered)

The identification of phytoplankton done by referring standard text Adoni *et.al* (1985) and Desikachary (1959). The results were expressed as organisms per liter. The phtoplanktonic study is very useful tool for the assessment of water.

### RESULT

The fluctuation of phytoplankton diversity & physico – chemical characteristics of water of birnal reservoir; in Table 1 & Table 2

**Table 1: Average values (ranges in parentheses) of physical and chemical parameters recorded at birnal reservoir (Jan 2013 to Dec. 2013)**

PARAMETERS	TEM 0c	pH	DO mg/l	TA mg/l	TH mg/l	TRANS. c.m	TN mg/l	TP mg/l
AVERAGES VALUES	22.10 to 300c	7.8 to 8.6	6 to 7.4	128 to 285	180 to 300	20 to 40	0.7 to 0.9	0.034 to 0.1075

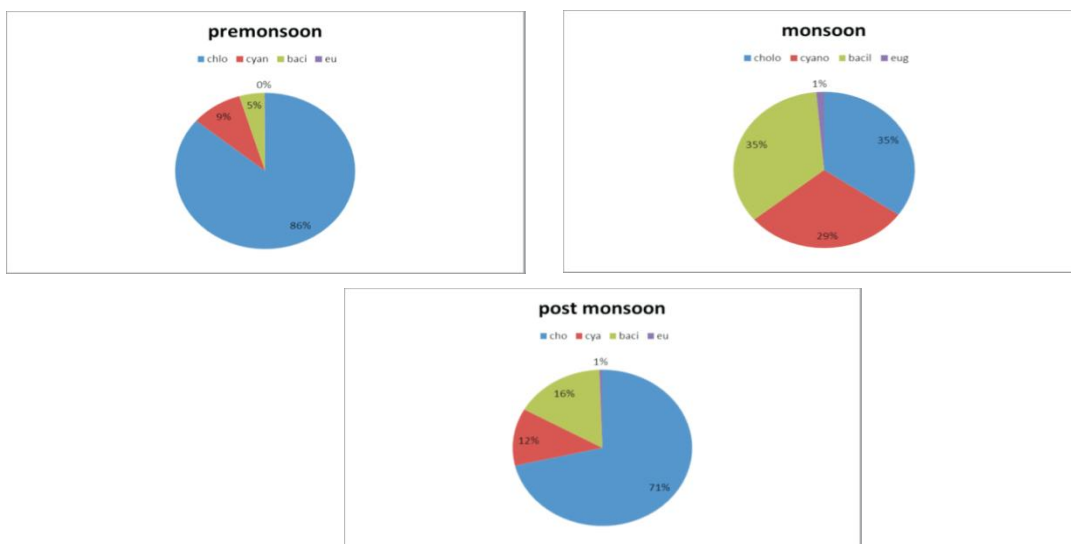
**Table 2: Phytoplankton species of Birnal reservoir**

Sr.No.	Cholorophyceae	Cyanophceae	Bacillariophyceae	Euglenophyceae
1	<i>Ankistrodesmus falcatus</i>	<i>Anabaena spherica</i>	<i>Amphora ovalis</i>	<i>Euglena pisciformis</i>
2	<i>Ankistrodesmus convolutes</i>	<i>Chroococcus varians</i>	<i>Amphora venta</i>	<i>Euglena proxima</i>



3	<i>Pediastrum tetras</i>	<i>Chroococcus minor</i>	<i>Gomphonema sp.</i>	-----
4	<i>Pediastrum duplex</i>	<i>Microcystis aeruginosa</i>	<i>Gomphonema gracile</i>	-----
5	<i>Scenedesmus quadricauda</i>	<i>Oscillatoria amhibia</i>	<i>Melosira granulate</i>	-----
6	<i>Scenedesmus perforates</i>	<i>Oscillatoria obscura</i>	<i>Navicula mutica</i>	-----
7	<i>Scenedesmus dimorphus</i>	<i>Phormodium sp</i>	<i>Navicula cryptocephala</i>	-----
8	<i>Chlorella vulgaris</i>	<i>Rivularia sp.</i>	<i>Fragilaria construens</i>	-----
9	<i>Spirogyra sp</i>	<i>Spirulina laxa</i>	<i>Diatoma vulgaris</i>	-----
10	<i>Staurastrum sp</i>	<i>Lyngbya sp.</i>	<i>Synedra sp</i>	-----
11	<i>Cosmarium sp</i>	-----	<i>Pinnularia sp.</i>	-----
12	<i>Cosmarium distichum</i>	-----	<i>Synedra acus</i>	-----
13	<i>Tribonema bombycium</i>	-----	-----	-----
14	<i>Krichneviella lunaris</i>	-----	-----	-----
15	<i>Gonatozygon</i>	-----	-----	-----
16	<i>Treubaria</i>	-----	-----	-----
17	<i>Volvax spp</i>	-----	-----	-----
18	<i>Suriella sp</i>	-----	-----	-----
19	<i>Ulothrix sp</i>	-----	-----	-----

**Graphs: Percent composition of phytoplankton in Birnal reservoir**



A total 43 species of phytoplankton recorded during the study period form that 19 spss. Chlorophyceae; 10cyanophyceae;12 spss. Bacillariophyceae, 2 Euglenaphyceae was observed

Undichalkulam contain high amount of physico – chemical parameters like water temp. (29°C); (pH 8);rainfall 52mm;alkalinity (128.7 mg/l); Salinity (64ml/l); dissolved oxygen (4.2 mg/l) Biological oxygen (5ppm) low phytoplankton diversity.

The Average temperature of birnalreservoir was ranging between 22.1°C to 30°C during study period .The pH of reservoir was found to be alkaline ranging from 7.8 to 8.6 during study period.

The low dissolved oxygen concentration i.e.< 3mg/lit in fresh water aquatic system indicates higher pollution causing negative effects on aquatic ecosystem. In Birnal reservoir dissolved oxygen during study period was 6 to 7.4. The total alkalinity of lakes was limits of BIS (200 mg/lit ) the birnal reservoir alkalinity was from 128 to 285 mg/l. the alkanitlity of water may be due to microbial decomposition or domestic discharge in reservoir .

The hardness in the values observed were in the range of 180 to 300 mg/l all value are within the limit of BIS (300 mg/l)The secchi disc transparency of reservoir ranged from 20 to 45 c.m during the study period .The transparency values represent distinct seasonal pattern i.e. lower transparency values were observed in winter & higher in summer & post monsoon

The concentration of Nitrates is indication of level of micronutrients in water bodies & support the plant growth .During study period the Nitrates of reservoir was 0.7 to 0.9 mg/l in October to February which indicates the favourable growth of phytoplankton.

The phosphate is essential nutrients for plant growth ; but increase in phosphate causes excessive growth of algae & weeds Hence it is good indicator of pollution for algal growth In the reservoir total 0.034 to 0.1075 mg/l phosphate concentration was observed during study period .Phosphate conc. Was minimum in post winter ; and maximum in monsoon & moderate in summer & post monsoon as shown in graphical representation.

The physico – chemical parameters such as nitrates ; phosphate ; temperature are favourable for the growth of phytoplankton.

## CONCLUSION

The physical parameters like temperature, transparency, pH are important .The seasonal pH study period was alkaline .The concentration of chemical parameters of the reservoir was prescribed limits of surface water. The low concentration of total nitrates and total phosphate affects the productivity of reservoir. The Birnal reservoir is suitable for irrigation, aquaculture and it shows rich phytoplankton diversity

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# CHAPTER 14

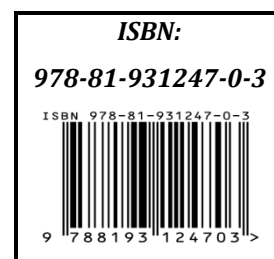
## DIURNAL VERTICAL MIGRATION (DVM) OF PLANKTONS FROM MAHALAXMI RESERVOIR OF PETH VADGAON, DIST- KOLHAPUR

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### ABSTRACT

The present investigation was aimed to study Diurnal Vertical Migration (DVM) of planktons from Mahalaxmi reservoir Peth Vadgaon. The 24 hrs study on DVM revealed that the phytoplanktonic communities were dominant during day time and minimum in night. Zooplanktonic groups showed fluctuations in their abundance. Rotifers were recorded maximum at midnight sampling and minimum at early morning. The functional response to the light and its vertical migration study showed that the changes and availability of planktons. As the planktons form the basic tropic levels in the aquatic ecosystem support the aquaculture practices hence we recommend that this reservoir is suitable for aquaculture practices.

**KEYWORDS:** DVM, Planktons, Mahalaxmi reservoir.

### INTRODUCTION

At night larger herbivores surface feeders are come on surface. In the dark they cannot be seen by their even much larger predators. The periodic vertical swimming behaviour therefore occurs twice a day, this behaviour pattern is called vertical diurnal migration and it one of the most pervasive pattern on earth. Planktons can be used as good bioindicator of water quality as well as pollution. Diurnal vertical migration of zooplanktons is observed in many lakes has received considerable attention in liminological research for many decades. Zooplankton migrates into deeper water layers at dawn and spends the whole day in this dark, cold habitat. DVM is a very effective strategy in habitats with high fish stocks DVM is also costly because of lower temperatures and usually poor food conditions in deeper layers (Stich & Lampert, 1981; Loose & Dawidowicz, 1994) whereby the costs mediated by the temperature-effect appeared to be much stronger than the food related costs (Loose & Dawidowicz, 1994; Rinke & Petzoldt, 2008).

## MATERIALS AND METHODS

**Study area:** Mahalakshmi tank a manmade reservoir is situated on south side of Vadgaon city. The tank was constructed in 1882 by Late Chattrapati Shahu Maharaj of Kolhapur Empire. The tank is mainly constructed to provide drinking water and irrigation facilities.

**Material and Method:** For the qualitative and quantitative study of planktons samples were collected in early morning to get maximum species. About 200 lit. of water was filtered and plankton were concentrated up to 300 ml. The planktons were studied qualitatively by employing Sedge Wick Rafter cell method (Adenoidal 1985). Sedge Wick Rafter cell is a simple and handy device contains slides with rectangular cavity of 50×20×1mm size having capacity of 1ml (1000mm<sup>3</sup>) water sample. About 1ml sample was taken in cell and by placing cover glass it was observed under microscope and no of planktons were counted. The total number of planktons was counted.

$$1. \text{ Conc. factor} = \frac{\text{Vol. of water filtered in ml}}{\text{Vol. of conc. Sample}}$$

**Diurnal Vertical Migration (DVM):** In the present investigation to study the Diurnal Vertical Migration (DVM) of zooplankton from Mahalakshmi Reservoir, Peth Vadgaon. Planktons were collected the samples at interval of 3 hours from 6.00 am to 12.00 am.

## RESULTS AND DISCUSSION

During present investigation we recorded various types of zooplankton and phytoplanktons from different groups i.e. Protozoan, Crustaceans, Copepods, Cladocera, Crustaceans larvae, Rotifers etc. and phytoplankton's from groups like Green, blue and green algae, Diatoms etc.

The observations showed that the number of zooplankton was more at the 6.00 am and this number was decreases up to 7.00 pm and it was again increases after 7.00 pm. The density of zooplanktons was observed at 12.00 am. It indicates that, these characteristics features of zooplanktons are observe due to two main reasons like for escaping from the predators such as planktivorous fishes and other animals which fed on them. Secondly, to complete their food requirement which are abundant at the surface water. During noon time we observed phytoplankton's at the surface level. From evening to the night the number of rotifers was increased and from midnight the number was decreased. According to tropic level the planktons present at the photic zone of the water body. Hence we observed maximum plankton species at the shallow water.

The zooplankton spends whole day time in deep and dark region for protecting themselves from predators. And they migrate toward surface at night for fulfillment of their food requirement. After observation we concluded that the following groups of zooplanktons are observed abundantly at different timescale.

The surface planktonic communities were fluctuating according to the environmental factors like light, temperature nutrient level in the water body etc. The functional response to the light and its vertical migration result from this study showed that the changes in the abundance of planktons.

**Table 1: DVM of zooplanktons from Mahalakshmi reservoir**

Note: Number shows plankton number per ml of concentrated sample

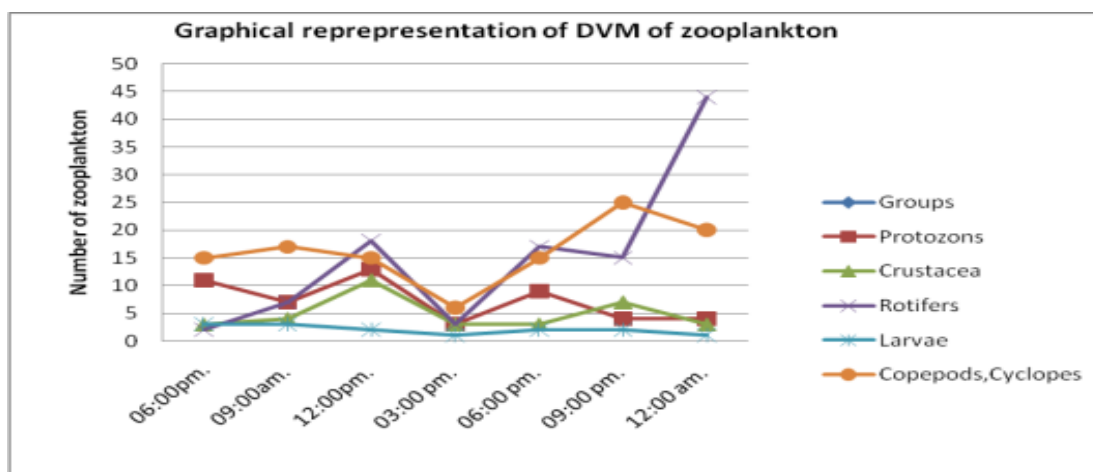
Time	06:00 am.	09:00 am.	12:00 pm.	03:00 pm.	06:00 pm.	09:00 pm.	12:00 am.
Protozoans	11	7	13	3	9	4	4
Crustacea	3	4	11	3	3	7	3
Rotifers	2	7	18	3	17	15	44
Larvae	3	3	2	1	2	2	1
Copepods, Cyclopes	15	17	15	6	15	25	20

**Table 2: DVM of phytoplankton's from Mahalakshmi reservoir.**

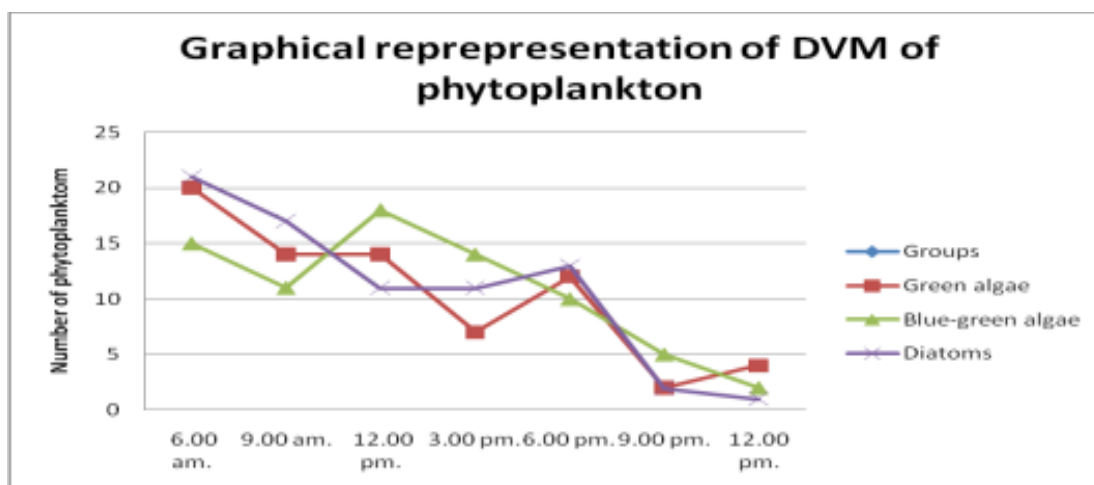
Time	6.00 am.	9.00 am.	12.00 pm.	3.00 pm.	6.00 pm.	9.00 pm.	12.00 pm.
Green algae	20	14	14	7	12	2	4
BGA	15	11	18	14	10	5	2
Diatoms	21	17	11	11	13	2	1

Note: Number shows plankton number per ml of concentrated sample

**Figure 1: Graphical representation of DVM of zooplankton**



**Figure 2: Graphical representation of DVM of Phytoplankton**



## CONCLUSION

From the present investigation it was observed that the various planktonic communities are abundantly available in the study area. As the planktons form the basic trophic levels in the aquatic ecosystems supports the aquaculture practices hence we can recommend that the Mahalakshmi reservoir is suitable for aquaculture practices.

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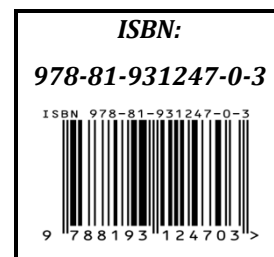
# CHAPTER 15

## EFFECT OF DIFFERENT PHOSPHATE SOURCES ON THE GROWTH OF *ALTERNARIA ALTERNATA* CAUSING LEAF SPOT OF ROSE

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### ABSTRACT

Microorganism requires proper nutrition source for their growth. In the present study investigation is made on the effect of different phosphate source on growth of *Alternaria alternata*. Phosphate sources such as ammonium dihydrogen orthophosphate, potassium dihydrogen orthophosphate and sodium dihydrogen orthophosphate were tested against the pathogen. In the result it was found that 0.1% concentration of ammonium dihydrogen orthophosphate and sodium dihydrogen orthophosphate reduced the growth while Potassium dihydrogen orthophosphate stimulated the growth of *Alternaria alternata*.

**KEY WORDS:** *Alternaria alternata* , Phosphate source, *Rosa floribunda*

### INTRODUCTION

Rose is one of the most commercially important ornamental plant belongs to the family Rosaceae. Now days it is severely affected by the various fungal, bacterial and viral diseases. From the fungal diseases leaf spot of rose caused by *Alternaria alternata* is very serious problem to this plant (Waghmare, 2010). For getting high yield of the flower disease management is necessary. Microorganism requires proper nutritional source for their growth. Previous workers studied the growth of various plant pathogens in different food sources. Therefore in the present study investigation is made on the effect of different phosphate sources on growth of *Alternaria alternata* because if we know nutrition requirement that will help to control the growth of pathogen.

### MATERIAL AND METHODS

Samples exhibiting the leaf spot of rose were collected from the different localities of Kolhapur district during the period of 2010-2011, Infected samples brought to the Botany laboratory of Shivaji University, Kolhapur and isolated the Pathogen on Czapek Dox Agar (CDA) medium , identified the

pathogen with help of standard mycological literature (Subramania, 1971) . Pure culture was maintained at  $23 \pm 2^{\circ}\text{C}$  in BOD incubator for further study. For the study three Phosphate sources Potassium dihydrogen orthophosphate, Sodium dihydrogen orthophosphate and Ammonium dihydrogen orthophosphate were used at 0.1% in Czapek Dox agar medium. 6 mm freshly growing 8 days old pure culture of *Alternaria alternata* grown on agar medium and incubated at  $28 \pm 2^{\circ}\text{C}$  . Plates without phosphate source treated as control. After 8 days of incubation linear growth was of mycelium was measured at different intervals.

## RESULT AND DISCUSSION

Three phosphate source such as Phosphate sources such as potassium dihydrogen orthophosphate, sodium dihydrogen orthophosphate, ammonium dihydrogen orthophosphate were used for this study. In the result it was found that 0.1% concentration of ammonium dihydrogen orthophosphate and sodium dihydrogen orthophosphate reduced the growth while Potassium dihydrogen orthophosphate stimulated the growth of *Alternaria alternata*. (Table -1).

Results are in agreement with Waghmare (2015). Similarly Bhale, 2002 Studied the effect of different phosphate source on growth of *Alternaria alternata* causing leaf blight of spinach. Similarly other workers studied the effect of different nutritional sources on growth of different plant pathogens ( Patil, 2009; Khilare and Rafi,2011; and Ramteke 2011; Naim, and Sharoubeem, 1963; Oritsejafor, 1986; Steinber, 1999; Wadikar,2002; Waghmare *et.al* 2010. Sharma and Mohinder Kaur, 2014 Effect of different nutrient sources on the production of plant growth regulators (PGRs) by fluorescent *Pseudomonas* species

**Table 1: Effect of different phosphate sources on the linear growth (mm) *Alternaria alternata* causing leaf spot of rose on CDA medium**

Phosphate sources 0.1%	Days and radial growth of pathogen in mm.			
	2	4	6	8
Potassium dihydrogen orthophosphate	23.33	43.33	66.66	80.00
Sodium dihydrogen orthophosphate	18.33	34.66	49.66	72.66.
Ammonium dihydrogen orthophosphate	19.66	31.66	47.66	63.33
Control	22.33	40.66	56.33	71.66

## CONCLUSIONS

Use 0.1% concentration of ammonium dihydrogen orthophosphate and sodium dihydrogen orthophosphate for the management of *Alternaria aletranata* causing leaf spot of rose .

## ACKNOWLEDGEMENT

Author is very much thankful to the UGC, WRO Pune for the financial assistance, he is also thankful to Prof. (Dr.) Kamble S.S, Shivaji University, Kolhapur for guidance and help in this work.

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# CHAPTER 16

## INFLUENCE OF SOME GROWTH FACTORS ON IN-VITRO GROWTH OF *FUSARIUM OXYSPORUM F. SP. CUBENSE* CAUSING PANAMA WILT OF BANANA

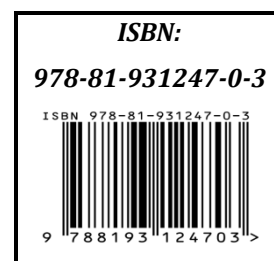
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### ABSTRACT

The present experiment was conducted to determine the influence of different temperature, pH levels and light spectra on *in-vitro* growth of *Fusarium oxysporum f.sp.cubense* causing panama wilt of banana. Physical factors such as, temperature, pH and various light colour indicated that resistant isolate had higher growth at pH 6.5 and at the temperature of 25+3°C than the sensitive one. Sensitive and resistant isolates showed their maximum growth under yellow light. It was seen that there was always higher growth of resistant isolate than the sensitive at all temperature. Both isolates failed to grow at 10°C.

**KEYWORDS:** Growth factors, *in-vitro* growth, *Fusarium oxysporum f.sp.cubense (Foc)*

### INTRODUCTION

Banana (*Musa spp.*) is the oldest and commonest fruit. Banana constitutes second largest industry in India. There are more than fifty diseases of banana reported from India. Out of which *Fusarium oxysporum f.sp. cubense* causing Panama wilt of banana (Rangaswami and Mahadevan, 2002) is most dreaded plant disease in the world. Panama wilt of banana is managed by various systemic and conventional fungicides by the farmers. The benomyl fungicide was used in this experiment, because it had been found to be effective in controlling *Fusarium oxysporum f.sp. cubense* (Nel *et al.*, 2007). Present work on abiotic factors associated with disease development will contribute to a better understanding of ecological survival of pathogen which will be helpful in management strategy and laboratory evaluation.

## MATERIALS AND METHODS

**Physiological studies:** Sensitivity test to benomyl was determined by food poisoning test (Dekker and Gielink, 1979). Benomyl sensitive (1µg/mL) and resistant (400µg/mL) isolates of *Fusarium oxysporum* f.sp. *cubense* were selected for this purpose, obtained by sensitivity test. Studies of the following physiological aspects of *Fusarium oxysporum* f.sp. *cubense* were conducted *in vitro*.

**Effect of temperature:** The sensitive and resistant isolates of *Fusarium oxysporum* f.sp. *cubense* were inoculated on CDA Czapek's Dox agar (Rangaswami and Mahadevan, 2002) medium and incubated under different temperatures viz. 0, 5, 10, 15, 20, 25, 30, 40, and 45 in BOD incubator.

**Effect of different pH levels:** CDA medium was separately prepared and their pH was adjusted to 4.5, 5.5, 6.5, 7.5, 8.5 and 9.5 using hydrochloric acid (0.1N) or sodium hydroxide (0.1N). The pH was measured using electrical pH meter and set before sterilization in autoclave.

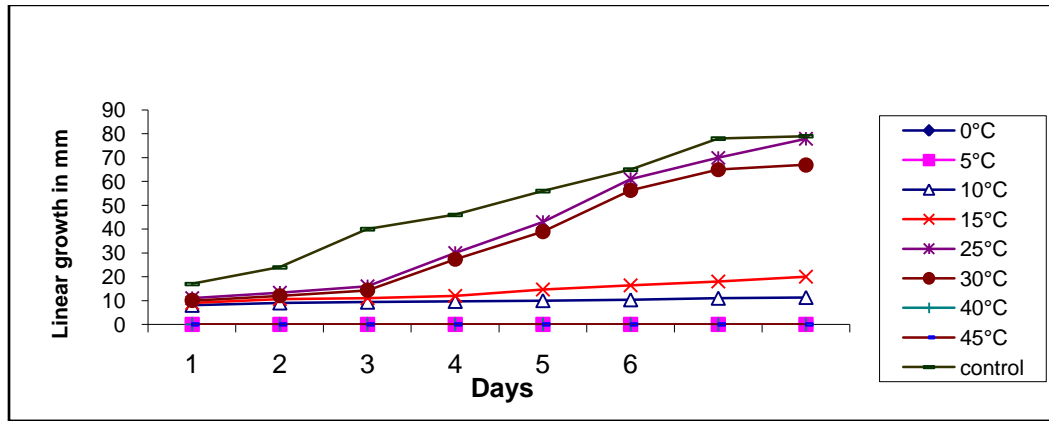
**Effect of different light:** Petri plates containing CDA were inoculated with both isolates and wrapped with gelatine sheets of different colours. Plates kept in normal condition served as control. All the experiments were conducted in triplicates. Petri plates were inoculated with 8 mm culture discs taken from the periphery of seven days old cultures of both isolates of *Fusarium oxysporum* f.sp. *cubense* and incubated at  $28 \pm 2^\circ\text{C}$  (except for the study of temperatures). Observations on radial mycelial growth (mm) were recorded after eight days in case of temperature, pH and light.

## RESULT

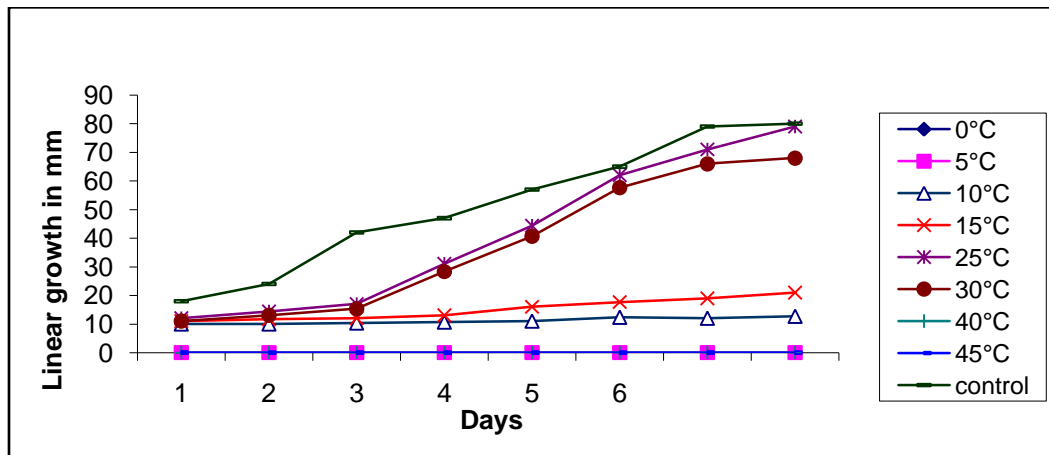
### Effect of Temperature:

In order to know the best temperature for the mycelial growth of sensitive and resistant isolates of *Fusarium oxysporum* f.sp. *cubense* eight temperatures varying from 0 °C to 45°C with an interval of 5°C were tested. Results (Fig. 1 and 2) showed that at all the temperature there was higher growth of resistant isolate. The optimum mycelial growth of both sensitive and resistant isolates was obtained at 25°C. Both sensitive and resistant isolates were failed to grow at low temperature (0°C, 5°C and 10°C) and high temperature (40°C).

**Figure 1. Effect of temperature on the growth of sensitive isolate of *Foc***



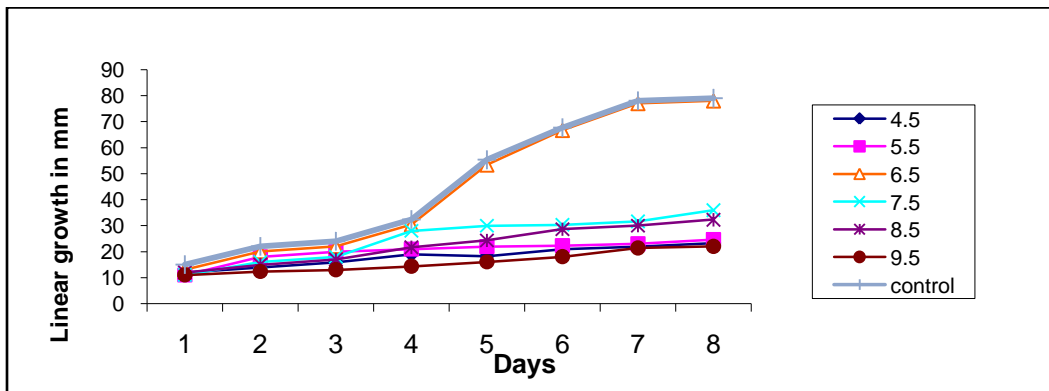
**Figure 2. Effect of temperature on the growth of resistant isolate of *Foc***



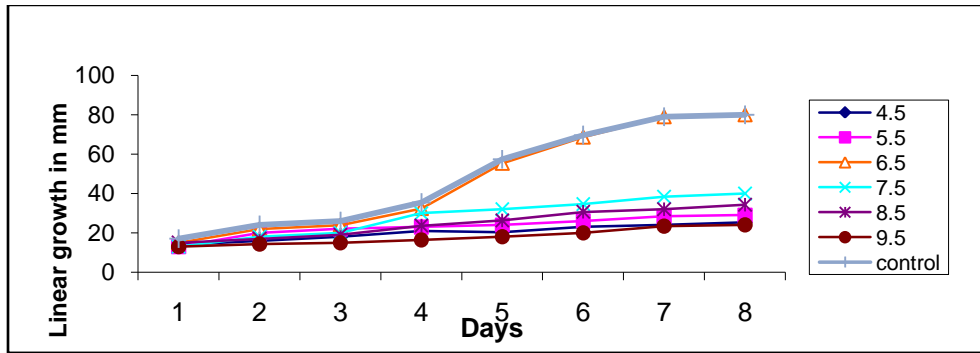
**Effect of pH:**

Sensitive and resistant isolates showed their maximum growth under yellow light. It was seen that there was always higher growth of resistant isolate than the sensitive at all temperature. Both isolates failed to grow at 10°C. (Figs. 3 and 4)

**Fig.3. Effect of pH on the growth of sensitive isolate of *Foc***



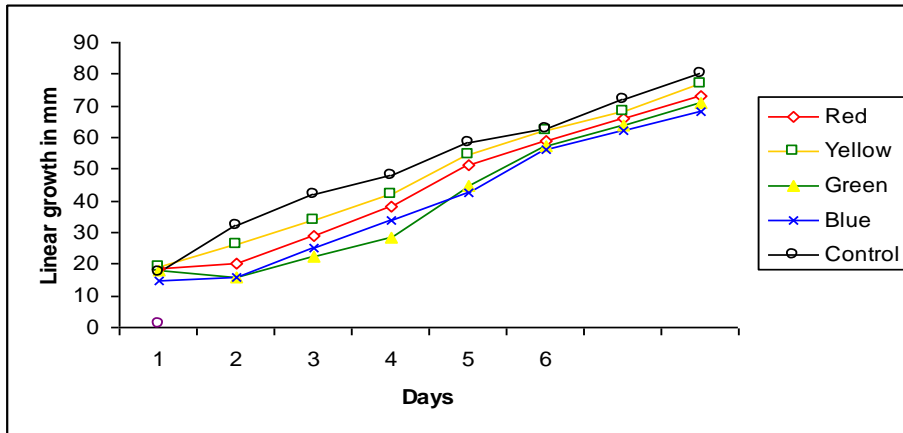
**Fig.4.Effect of pH on the growth of resistant isolate of *Foc***



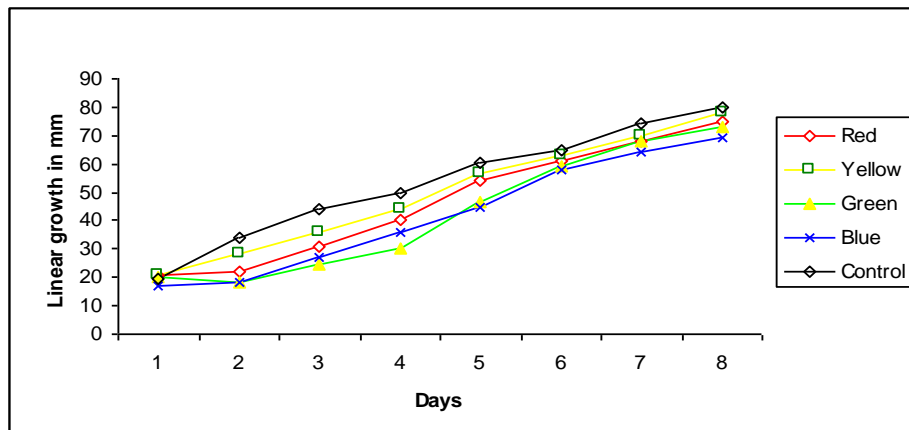
**Effect of light:**

Light had little influence on mycelial growth. Among different light spectra, results in the (Figs. 5 and 6) indicate that under normal light maximum growth was observed by *Fusarium oxysporum* f.sp. *cubeense* isolates. There was again higher growth of resistant isolate than sensitive isolate, under yellow light the resistant and sensitive isolates showed maximum growth.

**Fig. 5. Effect of light on the growth of sensitive isolate of *Foc***



**Fig. 6. Effect of light on the growth of resistant isolate of *Foc***



## DISCUSSION

Growth factors such as pH, temperature and various light spectra indicated that resistant isolate had higher growth at pH 6.5 and at the temperature of 25°C than the sensitive one. Same observation was made by Hiwale (2003). Sensitive and resistant isolates showed their maximum growth under yellow light. It was seen that there was always higher growth of resistant isolate than the sensitive at all temperature. Both isolates failed to grow at 10°C. Whether exposure of resistant isolate to colour spectra other than these is a matter of further investigation which may help in controlling resistance in the field. According to Kamble (1991) resistant isolate of *Macrophomina phaseolina* causing charcoal rot of potato also showed higher growth at pH 4.5 and the temperature of 35°C than the sensitive one. Sensitive isolate showed its higher growth under green light while resistant isolate showed its higher growth under yellow and orange light. pH 6.5 was more favourable for both the resistant and sensitive isolates of *Alternaria tenuissima* causing leaf spot of Spinach (Bhale, 2002). The maximum growth of both the isolates was at 25°C. Resistant and sensitive isolates showed more growth under blue light. Wadikar (2002) reported that pH 4.5 was more favourable to the resistant isolate of *Macrophomina phaseolina* while pH 6.5 was found to be more favourable to sensitive isolate of *Macrophomina phaseolina* causing charcoal rot of pigeon pea. Further he found that 40°C temperature was most favourable for both the isolates. Sensitive isolate showed maximum growth under yellow light while resistant isolate showed its higher growth under blue light.

## CONCLUSION

On the basis of present in vitro experiments it can be concluded that knowledge of influence of growth factors such as pH, temperature and various light colour will help for more successful protection against the disease.

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# CHAPTER 17

## BIOPESTICIDAL CONTROL OF FUNGI USING *DATURA STRAMONIUM* LEAVES EXTRACTS

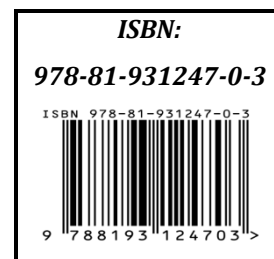
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### ABSTRACT

Medicinal plants are most important in tropical countries. In Ayurveda, all parts of the plants used in different procedures to cure various diseases. One of the major medicinal plants is *Adulsa (Adhatoda zeylanica* Medic) which leaves are used in different formulations to treat diseases like blood disorder, asthma, jaundice, leprosy, etc. Unfortunately the leaves suffers from attack of fungal pathogen i.e. *Alternaria alternata* which results in severe loss of biochemical constituents. Hence, the investigation is undertaken to overcome and management of plant disease. By keeping in mind the adverse effect of fungicide and pesticides the use of biopesticide agents i.e. *Datura stramonium* was selected. During the treatment of acetone, alcohol and aqueous leaves extracts percent inhibition recorded as 10.90-98.68 %, 10.90-99.06 % and 10.00-99.31 % respectively. Acetone leaves extract concentration at 2.5 % was found to be most inhibitory against *A. alternata* viz. followed by alcoholic and aqueous leaves extracts.

**KEYWORDS:** *Alternaria alternata, Datura stramonium, acetone, alcohol aqueous extract.*

### INTRODUCTION

The fungi are major disease causing agents on several medicinal plants responsible for decreasing their yield. Different fungicides can be used to control the plant disease. But the continuous use of such synthetic fungicides results in development of resistance of fungal pathogens (Gangawane, 1990). Fungicides also cause pollution in soil and environment. Their use can affect non target organisms also.

Hence, the use plant extract or biopharmaceutical components instead of chemical fungicides are world widely accepted (Izzat, 2001, Gupta *et al* 2008). Therefore, three different types of leaves extracts i.e. acetone, alcohol and aqueous were studied to control the mycelial growth of fungal pathogen i.e. *Alternaria alternata*.

## MATERIALS AND METHODS

To determine the effect of acetone, alcohol and aqueous extract fresh and healthy leaves of *Datura stramonium* were used .

**Preparation of leaves extract:** For the preparation of leaves extract healthy leaves of plant were collected and washed with distilled water for three times. 50 gm leaves were washed by using 50 ml of Acetone with the help of mortar and pestle. The extract was filtered by using muslin cloth. Filtrate was then centrifuged at 5000 r.p.m. for 10 min at 4 °C. Supernatant was collected and treated as 100 % i.e. stock solution. Further, different concentration of leaves extract were prepared i.e. 0.5, 1.0, 1.5, 2.0, 2.5, 3.0 , 3.5, 4.0 and 4.5 % by adding 99.5, 99, 98.5, 98, 97.5, 97.0, 96.5, 96 and 95.5 ml of sterilised distilled water respectively. In the same way different concentrations of alcohol and aqueous leaves extract were prepared.

For the determination of antifungal activity of *Datura* leaves extract, another plant leaves were selected i.e. *Adulsa*. The leaves were collected and washed with distilled water and then dipped in different concentrations of *Datura* leaves extract for 15 minutes. These leaves then kept on the filter paper in sterile petriplates. Sterilised distilled water was added to petriplates time to time to maintain the moisture content in leaves, as performed by Dhavle et. al.,(2008) , (2009) and (2011). 5 mm disc of pure fungal culture was added in 1 ml distilled water in a test tube and suspension was prepared. This suspension was applied over the leaves with the help of brush and incubated at room temperature for 8 days. Effect of acetone, alcohol and aqueous leaves extract was calculated by using following formula:

$$\% \text{ inhibition} = \frac{C - T}{C} \times 100$$

Where, C - Control reading.

T -Treated reading.

## RESULTS AND DISCUSSION

During acetone leaves extract study, different concentrations i.e. 0.5, 1.0, 1.5, 2.0 and 2.5 % shows percent inhibition from 10.00 to 70.46, 27.27 to 78.75, 45.45 to 85.00, 72.72 to 90.62 and 93.63 to 98.68 % within 8 days of incubation period. In case of alcoholic leaves extract study, in the treatment of 0.5, 1.0, 1.5, 2.0, 2.5 and 3.0 % concentrations records percent inhibition from 10.90 to 68.25, 27.72 to 73.75, 34.54 to 79.68, 59.09 to 84.00, 67.27 to 86.78 and from 92.72 to 99.06 % respectively, within 8 days. On the other hand, in aqueous leaves extract study different concentrations i.e. 0.5, 1.0, 1.5, 2.0, 2.5, 3.0 and 3.5 shows percent inhibition from 10.00 to 46.96, 28.18, to 57.28, 38.18 to 64.75, 48.18 to 82.53, 67.27 to 93.31, 77.27 to 99.31 and from 90.90 to 99.31 % respectively.(Plate A) Besides, 4.0 % concentration shows 100 % inhibition within 8 days of incubation period.

From above data it is clear that acetone leaves extract is most effective than alcoholic and aqueous leaves extracts. It also indicates that percent inhibition increases with the increase in period and leaves extract concentrations.

Similar results were obtained by Anjana and Virendrakumar (2009) while studying *In vitro* investigation of the acetone extracts of *Saraca indica* Linn. and *Datura stromonium* Linn. against multidrug resistant human pathogens. They observed that acetone extracts of both the plants i.e. *S. indica* and *D. stromonium* had more potency than ethanol and aqueous extracts.

**Plate (A): Effect of acetone leaves extract of *D.stromonium* on *A. alternata***



**Table 1: Effect of Acetone, Alcohol & Aqueous leaves extract of *Datura stramonium* on *Alternaria alternata***

I.P days	Concentration (%)														
	Percentage inhibition (%)														
	0.5			1.0			1.5			2.0			2.5		
	Ac	Al	Aq	Ac	Al	Aq	Ac	Al	Aq	Ac	Al	Aq	Ac	Al	Aq
<b>1day</b>	10.90	10.90	10.00	27.27	22.72	28.18	45.45	34.54	38.18	72.72	59.09	48.18	93.63	68.27	67.27
<b>2day</b>	39.39	36.36	12.72	45.45	46.66	32.12	54.54	52.12	52.72	75.75	69.69	63.03	94.54	73.33	75.75
<b>3day</b>	51.61	47.74	17.74	61.29	59.67	34.51	69.35	64.19	54.83	79.03	77.41	70.00	95.80	83.22	81.93
<b>4day</b>	52.38	52.38	29.76	61.90	65.71	42.85	71.42	66.42	56.66	81.42	79.76	74.04	95.95	84.04	83.80
<b>5day</b>	52.78	72.78	32.42	68.42	65.78	45.78	78.94	70.31	58.10	87.36	81.89	77.15	97.68	86.21	89.57
<b>6day</b>	58.99	58.99	33.99	68.74	70.89	49.93	82.14	76.19	58.59	88.09	82.80	79.16	98.01	86.37	90.27
<b>7day</b>	63.83	61.83	46.47	76.78	71.87	56.91	83.92	76.65	63.08	89.28	83.08	80.49	98.39	86.60	91.02
<b>8day</b>	70.46	68.25	46.96	78.75	73.75	57.28	85.00	79.68	64.75	90.62	84.00	82.53	98.68	86.78	93.31
<b>SE</b>	0.61	0.61	0.81	0.61	0.61	0.61	0.60	0.61	0.61	0.81	0.81	0.86	0.61	0.61	0.60
<b>CD @ 0.5</b>	1.84	1.82	2.43	1.84	1.82	1.83	1.82	1.84	1.82	2.45	2.43	2.58	1.82	1.83	1.82

**Table 1(Contd.): Effect of Acetone, Alcohol & Aqueous leaves extract of *Datura stramonium* on *Alternaria alternata***

I.P days	Concentration (%)											
	Percentage inhibition (%)											
	3.0			3.5			4.0			4.5		
	Ac	Al	Aq	Ac	Al	Aq	Ac	Al	Aq	Ac	Al	Aq
<b>1day</b>	100	92.72	77.27	100	100	90.90	100	100	100	100	100	100
<b>2day</b>	100	93.93	83.03	100	100	92.72	100	100	100	100	100	100
<b>3day</b>	100	96.12	88.70	100	100	95.80	100	100	100	100	100	100
<b>4day</b>	100	96.66	89.76	100	100	96.42	100	100	100	100	100	100
<b>5day</b>	100	98.31	92.52	100	100	98.21	100	100	100	100	100	100
<b>6day</b>	100	98.54	92.72	100	100	98.74	100	100	100	100	100	100
<b>7day</b>	100	98.75	93.48	100	100	99.06	100	100	100	100	100	100
<b>8day</b>	100	99.06	93.71	100	100	99.31	100	100	100	100	100	100
<b>SE</b>	-	0.61	0.61	-	-	0.61	-	-	-	-	-	-
<b>CD @ 0.5</b>	-	1.84	1.82	-	-	1.83	-	-	-	-	-	-

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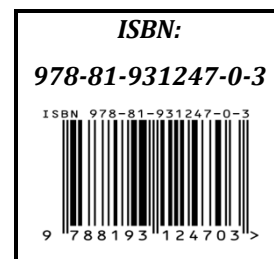
# CHAPTER 18

## ETHNIC INFORMATION ON TREATMENTS FOR SCORPION STING IN AMBEGAON TEHSIL, PUNE DISTRICT, MAHARASHTRA

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### ABSTRACT

An ethno-botanical survey was undertaken to collect ethnic information on the use of plants for the treatment of scorpion sting by the tribes of Ambegaon Tehsil, Pune District, Maharashtra. Tribals of this area have authentic information about to cure scorpion sting. They have been using different plant parts like roots, stem, leaves, fruits, bulbs and tubers. In majority of cases, paste from the plant parts were used for scorpion sting. The indigenous knowledge of local traditional healers about the native plants used for medicinal purposes was collected by questionnaire and personal interviews during field trips. A field walk with the healers enabled plant collection and documentation relating to the ethnic information of plants used for the treatment of scorpion sting. In the present investigation, 21 plant species, belonging to 17 different families used by the tribals for treatment of scorpion sting are documented.

**KEY WORDS:** ethno-botanical, healers, scorpion sting, treatment.

### INTRODUCTION

Ethno-botany is becoming a well established science due to increasing realization of health hazards and toxicity caused by synthetic drugs. Plants are used extensively for treatment of different ailments. The knowledge of medicinal plants has been accumulated in the course of many centuries based on different medicinal systems such as Ayurveda, Unani and Siddha. The traditional healers provide considerable information about the use of many plants or plant parts as medicine. Many of the life saving drugs in present day of allopathic system are obtained from plant origin. Today according to the World Health Organization (WHO), as many as 80% of the world's people depend on traditional medicine for their primary healthcare needs. Scorpions are found in terrestrial habitat, including high-elevation mountains, below stones in rainy seasons. Scorpion may be ground-dwelling, tree-living, lithophilic (rock-loving), psammophilic (sand-

loving).Scorpions don't actually bite, and they only sting. Many people use the word bite to describe a sting. Scorpions use their sting to capture prey and to defend themselves. All scorpions use their stings as a defense mechanism or a weapon to incapacitate prey. But the potency to humans of stings varies, depending on the scorpion species. One thing that all scorpions have in common is that the sting possesses venom, which usually is neuro toxic in nature. Scorpion sting are a cutaneous condition caused by the stinging of scorpion, usually resulting in pain, paresthesia and variable swelling. Most scorpion stings that occur only minor signs and symptoms such as pain, redness and warmth at the sting site. However, the venom of the bark scorpion is very toxic and can be deadly for those highly sensitive to the sting, particularly children. Most scorpion sting symptoms are mildly painful and involve numbness, tingling and swelling around the sting site. More severe symptoms include muscle twitching, unusual head, neck and eye movements, drooling, sweating, vomiting, high blood pressure, low blood pressure, accelerated heart rate, restlessness or excitability. Stings can cause immediate pain or burning, and produce small swellings that are sensitive to the touch. Symptoms of Bark Scorpion sting result in numbness or tingling, blurry vision and twitching muscles. The present study is an attempt to document different plant species used for the treatments of scorpion sting by tribals in Ambegaon tehsil, Pune district of Maharashtra.

## **MATERIALS AND METHODS**

### **STUDY AREA:**

Ambegaon tehsil is located in the northern zone of the Pune District of Maharashtra state. This region extends between 19°2' 5" north latitudes and 73°50'11" east longitudes. The total villages 142, cities Manchar and Ghodegaon. The human population according to the 2001 census approximate 2,13,842 and tribals population 42,907 percentage of total population to the tribal population 20.06 %. The total area is approximately 87,851 hectares. Adavasi tribes are found in large number in this region. This tehsil falls to the foothill of Sahyadri Mountain range.

The present study has been conducted in two steps:

**Step I-** A survey was conducted among the tribals of Ambegaon tehsil to gather information on plant species used for scorpion sting as used by them.

**Step II-** An efforts have been made to collect the plants which were in flowering and fruiting conditions and were identified by the help of Cooke (1958), Hooker (1872-1897), Razi (1952), Santapau (1957), Varadpande (1966), Shirke (1983). The information regarding the medicinal uses of plants was gathered from the tribals of Ambegaon tehsil to gather information on plant species used for scorpion sting as used by them. This information is collected by following Jain (1991). Medicinal uses were confirmed by following Nadkarni (1927).

## RESULTS AND DISCUSSION

The present study brought knowledge of tribals for the treatment scorpion sting. The collected plant specimens have been identified by the flora, the collected plants species are alphabetically arranged according to their Botanical name, local name, families, parts used and uses.

### ENUMERATION:

- 1) ***Abrus precatorius***, Linn., Family- Fabaceae, Local name- Gunj, Part used- Root. Use-Root powder is taken orally along with cow's milk to treat scorpion sting.
- 2) ***Achyranthes aspera***, Linn., Family-Amaranthaceae, Local name- Aghada, Part used-Root. Use-Roots are crushed with seeds of *Caesalpinia cristata* and externally applied on sting part.
- 3) ***Allium cepa***, Linn., Family- Liliaceae, Local name-Kanda, Part used- Bulb. Use- Bulb paste applied externally for scorpion sting.
- 4) ***Andrographis paniculata***, Nees., Family- Acanthaceae, Local name-Mahatiti, Part used-Leaves. Use-Leaf paste is applied for scorpion sting.
- 5) ***Bauhinia racemosa***, Lamk. Family- Caesalpiniaceae, Local name-Apta, Parts used- Fruit, leaves. Use- Paste of fruit is applied on sting part also leaf juice is applied on sting part.
- 6) ***Bombax ceiba***, Linn., Family-Malvaceae, Local name- Semar, Part used- Stem bark. Use- Stem bark paste used in scorpion sting.
- 7) ***Brassica juncea***, Hook.f.and Thoms., Family- Brassicaceae, Local name- Mohari, Parts used- Stem, leaves. Use- Little hot juice of leaf, stem and branches is applied on the sting part.
- 8) ***Butea frondosa***, Konig, Family- Fabaceae, Local name- Palas, Part used-Seed. Use-Seed powder is used in scorpion sting.
- 9) ***Calotropis gigantea***, R. Br., Family- Asclepiadaceae. Local name- Rui, Parts used-Leaves, stem. Use- Latex is applied over scorpion sting.
- 10) ***Carissa carandas***, Linn., Family- Apocynaceae, Local name- Karvand, Part used- Root. Use-A piece of root is kept on molar tooth, chewed and its remnant is applied on sting part.
- 11) ***Citrullus colocynthis***, (L.) Schrad. Family- Cucurbitaceae, Local name-Kadu indrayan, Part used- Seed. Use- Seed paste applied on the sting part.
- 12) ***Cyperus rotundus***, Linn., Family-Cyperaceae, Local name- Nagar-motha, Part used-Tuber. Use- Paste of dried tuber is applied on sting part.
- 13) ***Diospyros melanoxylon***, Roxb., Family-Ebenaceae, Local name-Temru, Part used- Root. Use-Root paste used in scorpion sting.
- 14) ***Euphorbia glauca***, Roxb., Family-Euphorbiaceae, Local name- Dudhi, Parts used- Stem, leaves. Use-Stem and leaves latex applied on sting part.
- 15) ***Gloriosa superba***, Linn., Family-Liliaceae, Local name- Khadyanag, Part used-Root. Use-Root paste is applied on the sting part.

- 16) *Haplophyllum vermiculare*, (Forssk.)Hand.-Maz. Family-Rutaceae, Local name- Tiwermit Parts used- Stem, leaves. Use- Stem and leaves paste applied on the sting part.
- 17) *Hemidesmus indicus*, R. Br., Family-Asclepiadaceae, Local name- Anantvel, Part used-Leaves. Use- Leaf paste is applied on scorpion sting.
- 18) *Luffa acutangula*, Roxb., Family- Cucurbitaceae, Local name- Kadudodka, Part use-Leaves. Use-Juice of the leaf is applied on the sting part.
- 19) *Madhuca latifolia*, Roxb., Family- Sapotaceae, Local name- Mohua, Part use-Bark. Use-Dried fruits bark with leaves of *Ipomea stramonium* made in to paste and applied on the sting part.
- 20) *Martynia diandra*, Linn., Family- Martyniaceae, Local name- Vichuacha jhar, Part use-Seed. Use-Seed soaked in water and made paste, applied on the sting part.
- 21) *Shorea talura*, Roxb., Family- Dipterocarpaceae, Local name- Jalaranda, Part used- Fruit. Use-Fruits are used for scorpion sting.

### CONCLUSION

The present research paper is an attempt to enlist the medicinal plants treatment of scorpion sting with the help of tribals. The tribals in the area are dependent on limited agriculture land and local plant products. In this investigation 21 plants belonging 17 families have been documented.

### ACKNOWLEDGMENTS

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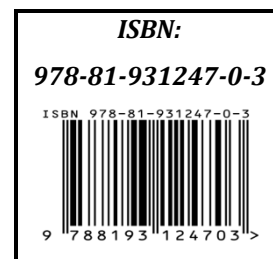
# CHAPTER 19

## EFFECT OF WATER STRESS ON PHOTOSYNTHETIC PIGMENTS OF *BASELLA ALBA* L.

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### ABSTRACT

Photosynthetic pigments in a medicinally important plant *Basella alba* with respect to its two cultivars were estimated during water deficit stress and water logging stress. It was found that the ratio or content of chlorophylls and carotenoids decreased with the increase in the water deficit and water logging stress conditions.

**KEYWORDS:** Basella, water stress, photosynthetic pigments

### INTRODUCTION

Stress is an altered physiological condition caused by factors that tend to disrupt the equilibrium (Gaspar et al., 2002). The term stress is used with various meanings, the physiological definition and appropriate term as responses in different situations (Jaleel et al., 2009). Water stress is one of the major abiotic stresses which influence metabolism, physiology and morphology in plants (Passioura 1982). *Basella alba* L. is a genus of family Basellaceae. It is originated in Asia, more particularly in India (Roy et al., 2010). The plant is commonly known as Indian spinach (Anandarajagopal et al., 2011). It is a perennial climber; stem is twining, succulent, glabrous. Leaves are alternate, thick. Flowers are sessile, produced in lax pedunculate spikes. Fruits are globose, enclosed in fleshy, enlarged persistent perianth. Seeds are black (Yadav and Sardesai 2002). The plant show stem forms (two cultivars) i.e. green stemmed and red stemmed respectively. According to Almeida (2003), the plant with green stem and green petiole is *Basella alba* L. and the other with red stem and red petiole is *Basella alba* L. var. *cordifolia* (Lamk.) Almeida. Detailed account of the taxonomy, ethnobotany, phytochemistry and pharmacology of the plant has been reviewed by Deshmukh and Gaikwad (2014). Photosynthetic pigments involve chlorophylls and carotenoids. The chlorophylls are green pigments of plants which are actively involved in the process of photosynthesis. Both the chlorophyll a and chlorophyll b are found in all autotrophs except pigment containing bacteria (Devlin and Witham, 1983). The photosynthetic pigments get affected by the water stress conditions which ultimately affect the

photosynthetic efficiency, henceforth present studies were made to find out the effect of water stress on photosynthetic pigments.

## MATERIALS AND METHODS

The plant cultivars were collected from various localities in the Kolhapur District and identified with the help of standard literature. The seeds were collected from each plant form, sown in pots and regularly watered. The seeds germination begins after 8 days. The pots plants were watered regularly up to 60 days and then the plants were treated for the water stress conditions. i.e. both the water deficit treatment as well as the water logging treatment. The leaves from each treatment were randomly selected, washed thoroughly with water, blotted to surface dry. The chlorophylls and carotenoids were estimated as per the method of Arnon (1949) and Kirk and Allen (1965) respectively and expressed in terms of mg/100g fresh weight. All analyses were carried out in triplicate and the averages recorded.

## RESULT

Effect of water logging stress on chlorophyll a, chlorophyll b, total chlorophylls, chlorophyll a/b ratio and carotenoids in two cultivars of *Basella alba* (i.e. Green and Red) are shown in figure 1, 2 while figure 3 and 4 represents the results during water deficit stress.

Fig. No. 1: Effect of water logging stress on chlorophyll content in leaves of *Basella alba* (Green)

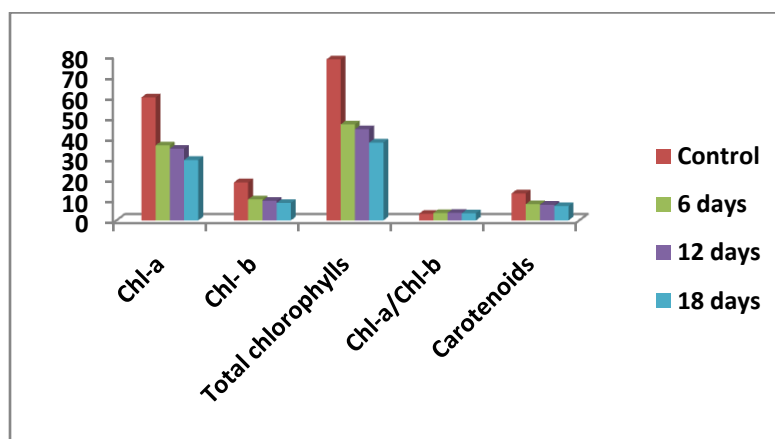


Fig. No. 2: Effect of water logging stress on chlorophyll content in leaves of *Basella alba* (Red)

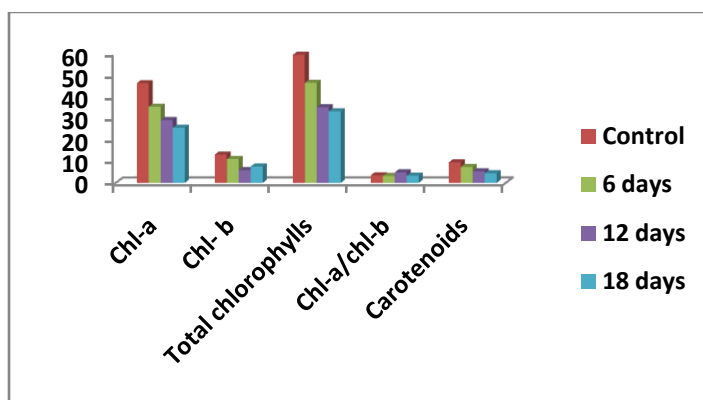


Fig. No. 3: Effect of water deficit stress on chlorophyll content in leaves of *Basella alba* (Green)

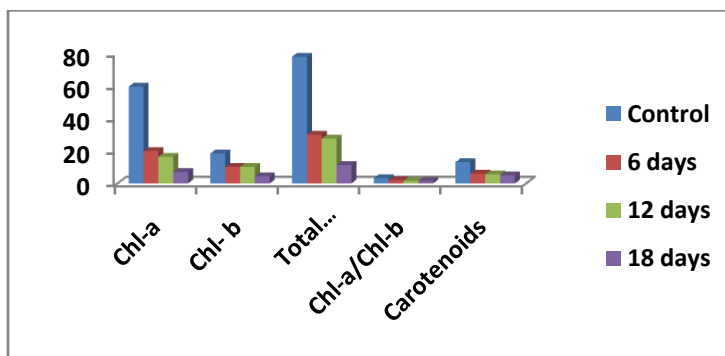
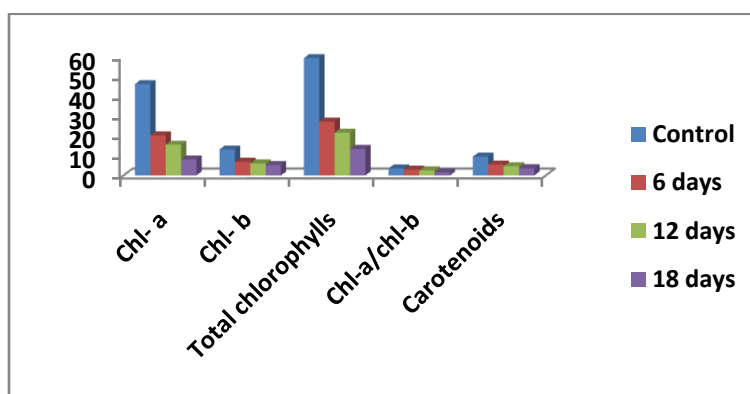


Fig. No. 4: Effect of water deficit stress on chlorophyll content in leaves of *Basella alba* (Red).



## DISCUSSION

The content of chlorophyll a, chlorophyll b, total chlorophylls, chlorophyll a/b ratio and carotenoids in leaves were more at control and decreased with increase in water stress period in both the cultivars. Such results are may be due to photo oxidation of the photosynthetic pigments when exposed to the water deficit

stress conditions while water logging leads to less soil aeration and rapid oxygen depletion in soil which causes physiological and biochemical changes in plants (Kozlowski, 1984).

In green cultivar of *Basella alba*, the chlorophyll-b content in water logging stress decreases up to 12 days treatment but the 18 day waterlogged plant show more chlorophyll-b content than the 12 day stressed plant. The chlorophyll a/b ratio also showed slight fluctuations, highest in 12 days stressed plant and lowest in 6 day water logged plant. It is also concluded from the studies that the green cultivar showed slightly more amount of chlorophylls and the carotenoids in comparison with the red cultivar of *Basella alba*.

### ACKNOWLEDGEMENT

Authors are thankful to Dr. P. D. Chavan, Dr. A. S. Nigvekar, Head, Department of Botany, Shivaji University, Kolhapur, Head, Department of Botany, The New College, Kolhapur and the Principal, The New College, Kolhapur for their support and encouragement.

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# CHAPTER 20

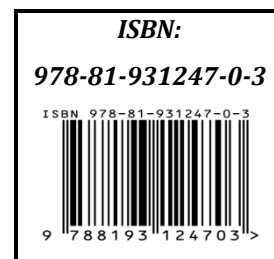
## ADDITIONS OF TETRASPORALES TO MARATHWADA REGION OF MAHARASHTRA

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### ABSTRACT

A total of 12 taxa under 05 genera of tetrasporales were encountered during an extensive studies on algal taxonomy of Beed district in the Marathwada region of Maharashtra (January 2006-December 2008) The algal samples were collected from various habitats like pools ,ponds ,puddles, cisterns, talaos, streams, streamlets, dams, rivers, dipping rocks, polluted water passages, nursery ponds and moist soils. The recorded genera were *Sphaerocystis*, *Gloeocystis*, *Tetraspora*, *Schizochlamys* and *Elakatothrix*. Seasonal variation studies reveals that Tetrasporales were found dominant in winter season.

**KEYWORDS:** Tetrasporales, Marathwada, Maharashtra

### INTRODUCTION

India has rich and diversified algal flora. In present century great advances have been made in the investigation of fresh water algae,marine algae,atmospheric micro-algae and soil algae in many parts of the world and particular attention has been paid to their taxonomy,ecology and applied aspects.In Marathwada region of Maharashtra (Kamat 1962, 1963a,1973,Ashtekar,1979,Talekar,2009) very rare attention has been paid towards algal taxonomy,although the climatic conditions of Marathhwada region are most suitable to grow algae luxuriently and in diverse form,therefore to fulfill this lacuna the present investigation was carried out.

### MATERIALS AND METHODS

The algal samples were collected for the period of three years from January 2006 to December 2008. The algal collections were made regularly from various habitats (above cited) of Beed district. Acid washed collection bottles were used for the collection of algal samples. Field note book was maintained in which the

color of the algae, habit, habitat and dates of collection were noted, the pH of the water of the collection spots was recorded by studying at least three samples of water from three different places of the collection spots.

#### **LABORATORY WORK:**

All collections were preserved in 4% commercial formalin added with 5% glycerine. Generally 5 to 10 random temporary mounts were made from each collection for microscopic observations. Identification of algal taxa was performed by referring to the standard literature on algae and monographs. The systems of classification followed here is substantially that Prescott (1951), Philipose (1967).

## **RESULTS**

#### **TAXONOMIC DESCRIPTION:**

##### **1. *Sphaerocystis schroeteri* Chodat:**

Smith 1920, P. 101, Pl. 19, F. 3,4; Prescott 1951, P. 83, Pl. 3, F. 6,7; Tiffany and Britton 1952, P. 21, Pl. 3, F. 26,27; Forest 1954, P. 64, F. 44.

Colony often including both undivided and recently divided cells which form small spherical clusters of 4 cells within the colonial envelope; cells spherical, 7.5-12.5 $\mu$  in diameter; chloroplast cup shaped, covering most of the wall, containing 1 pyrenoid; colonies 70-80 $\mu$  in diameter.

##### **2. *Gloeocystis ampla* (Kuetzing) Lagerheim:**

Prescott 1951, P. 84, Pl. 3, F. 17; Tiffany and Britton 1952, P. 21, Pl. 3, F. 23.

Cells in a colony of 2-8, ovoid or oblong, enclosed in a copious, unlamellated, gelatinous envelopes; sheaths of each cell or group of cells not confluent but distinct; cells 7.5-10 $\mu$  in diameter, 10-13.2 $\mu$  long.

##### **3. *Gloeocystis gigas* (Kuetzing) Lagerheim:**

Prescott 1951, P. 84, Pl. 3, F. 16; Tiffany and Britton 1952, P. 21, Pl. 3, F. 24.

Cells solitary or in a colony of 4-8, spherical, enclosed in copious, gelatinous, lamellate envelopes; cells with brownish green contents, 6.5-9 $\mu$  in diameter.

##### **4. *Gloeocystis major* Gerneck ex Lemmermann:**

Prescott 1951, P. 84, Pl. 52, F. 9,10.

Colonies consisting of 4 cells, ovoid, enclosed by a wide lamellate or unlamellate sheath, in which individuals are surrounded by concentric layers; chloroplast massive, completely covering the wall, with a pyrenoid; cells 12.2-15 $\mu$  in diameter, 18.5-21.5 $\mu$  long.

##### **5. *Gloeocystis planctonica* (West et West) Lemmermann:**

Prescott 1951, P. 85, Pl. 3, F. 10,11; Tiffany and Britton 1952, P. 21, Pl. 3, F. 25.

Cells spherical or ovoid, united in free-floating gelatinous colonies, which are angular or pyramidal; sheaths of each group of cells distinct; cells 4-9 $\mu$  in diameter.

##### **6. *Gloeocystis vesiculosa* Naegeli:**

Prescott 1951, P. 85, Pl. 3, F. 15.

Cells spherical or ovoid, arranged in large amorphous masses, usually attached, enclosed by copious lamellate mucilage; cells 4-6.5 $\mu$  in diameter.

**7. *Tetraspora cylindrica* (Wahl.) C.A. Agardh:**

Prescott 1951, P. 88, Pl. 5, F. 1,2; Tiffany and Britton 1952, P. 22, Pl. 4, F. 32; Forest 1954, P. 66, F. 46.

Thallus macroscopic, attached, irregularly lobed cylinder of firm mucilage, narrowed at the point of attachment; cells spherical to nearly spherical, scattered, 6-10.5 $\mu$  in diameter.

**8. *Tetraspora lacustris* Lemmermann:**

Prescott 1951, P. 88, Pl. 5, F.11; Smith 1920, P. 102, Pl. 19, F 5,6.

Thallus microscopic, free floating, spherical or elongate; colony containing relatively few spherical cells; cells arranged in groups of two or four; cells 4-8 $\mu$  in diameter.

**9. *Schizochlamys compacta* Prescott:**

Prescott 1951, P. 90, Pl. 4, F. 12-14.

Thallus microscopic, the mucilage firm and homogeneous and bounded by a definite tegument; cells globose, with a conspicuous gelatinous cap like concretion at one side, after division, 1 fragment (rarely 2) of the mother cell wall remains, the mucilage cap persisting on the old wall; daughter cells with apposed caps of mucilage; cells 5.7 $\mu$  in diameter. [The cells are smaller in diameter than those of the type, in type 7.4-11 $\mu$  in diameter]

**10. *Schizochlamys gelatinosa* A. Braun:**

Prescott 1951, P. 90, Pl. 4, F. 15.

Thallus microscopic, extensive; mucilage soft and amorphous; cells spherical, 4.8-7 $\mu$  in diameter, dividing by a splitting of the cell wall into 2, rarely 4, portions, these persisting and partially enclosing the daughter cells in pairs or in 4's; chloroplast solitary, parietal.

**11. *Elakatothrix gelatinosa* Wille:**

Prescott 1951, P. 93, Pl. 3, F. 13,14.

A colony of 8, fusiform cells with longitudinal axes parallel, arranged end to end in pairs, broad at the adjoined poles, tapering to a blunt point at the opposite pole; cells 3.5-5.2 $\mu$  in diameter, 15-17 $\mu$  long; 8 celled colony 14.8-16.5 $\mu$  in diameter, upto 70-80 $\mu$  long.

**12. *Elakatothrix viridis* (Snow) Printz:**

Prescott 1951, P. 93, Pl. 4, F. 1,2.

A broadly ellipsoid colony of 4 fusiform cells, arranged in pairs; dividing transversely, but daughter cells with longitudinal axes of oblique angles to one another; cells 4-7 $\mu$  in diameter, 19-21 $\mu$  long.

## DISCUSSION

A total of 12 taxa under 05 genera were recorded as Tetrasporales, among which the species of *Gloeocystis* were found dominantly and followed by *Tetraspora*, *Schizochlamys* and *Elakatothrix*. The results are agreed with Ashtekar 1980, Talekar 2009.

## ACKNOWLEDGEMENT

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# CHAPTER 21

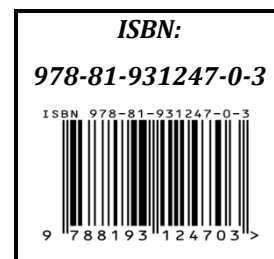
## INFLUENCE OF PHYSICAL FACTORS ON THE ANTAGONISTIC POTENTIAL OF *TRICHODERMA KONINGII* AGAINST THE *FUSARIUM EQUISETI* CAUSES BLOSSOM BLIGHT DISEASE OF *POLIANTHES TUBEROSA* L.

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### ABSTRACT

*Polianthes tuberosa* L. is commercially important plant suffering from blossom blight disease caused by *Fusarium equiseti* Corda Sacc.. In present work biocontrol agent (*Trichoderma koningii*) is used to manage the blossom blight disease of *Polianthes*. For the better growth of bioagents we have to know the environmental physical factors requires for the growth of bioagents. Therefore in the present work the antagonistic potential of *Trichoderma koningii* Oudemans against *Fusarium equiseti* in the presence of physical factors (pH, Temperature, Light spectra) was carried out. In the result it was found that the antagonistic potential of *Trichoderma koningii* was maximum in the blue light (80.00%) and minimum in pink light (65.55%). It was also found that pH range 5-6 is favourable , pH above 9 and below 3 inhibits the growth of bioagents. 30<sup>o</sup> C temperature shows the good antagonistic potential against the *Fusarium equiseti*.

**KEYWORDS:** Biological Control, *Fusarium equiseti*, *Polianthes tuberosa*, *Trichoderma koningii*.

### INTRODUCTION

*Polianthes tuberosa* L. is an ornamental and medicinal plant which belongs to family Amaryllidaceae, cultivated in the gardens, polyhouses and in the field . It is perennial, night blooming plant. For cut flower trade and fragrance *Polianthes* grown in the tropical and subtropical areas. It is commonly known as Nishigandha, It has a great economic and ornamental value. It's attractive and scented flowers has great potential for export. Oil is extracted from flowers is raw material for high grade perfume . Flowers are also used as diuretic and gonorrhoea. *Polianthes* suffers from blossom blight disease caused by *Fusarium equiseti*. Some workers done the chemical management of disease but indiscriminate use of fungicides created

resistance in pathogen (Waghmare and Kamble,2010), It also disturb the ecological balance. Therefore ecofriendly management of diseases is gaining an importance. *Trichoderma* is one of the most effective biocontrol agent against plant pathogenic fungi (Chet ; Harman and Baker,1981). It is reported that *Trichoderma* is best alternative to the fungicides (Eziashi; Omamor and Odigie, 2007). Therefore in the present study investigation was made to study the effect of physical factors on the antagonistic potential of *Trichoderma koningii* against the *Fusarium equiseti*.

## MATERIALS AND METHODS

### 1. Isolation of pathogen (*Fusarium equiseti*):

Naturally infected blossom blight samples of *Polianthes tuberosa* were collected from Kolhapur district (Radhanagari (Rashiwade), Karveer (Haladi), Panhala, Kagal, Gaganbawada, Bhudargad, Shahuwadi, Hatkanangale and Shirol) during 2011-2012. Infected samples brought to the Botany laboratory of The New College, Kolhapur in the sterile polythene bags. Surface sterilization of infected samples was made with 0.1% mercury chloride, washed the material with sterile distilled water and removed the traces of mercury choride. Samples were cut into small pieces and cultured on the Czapek Dox Agar (CDA) medium. After 4-5 days different fungal colonies were observed in the petriplates. Pathogen was identified with the help of standard mycological literature (Bilgrami *et al.*,1981; Subramanian,1971) Pure culture of *Fusarium equiseti* was maintained on Czapek Dox Agar medium in BOD incubator.

### 2. Isolation of *Trichoderma koningii* Oudemans:

Rhizosphere soils were collected from Kolhapur district. *Trichoderma koningii* Oudemans was isolated by dilution plate technique (Johnson,1957). Isolate was grown on PDA medium (Ricker; Ricker,1936). The isolated species was identified (Kubicek and Harman, 2002; Nagamani and Manoharachary, 2002). Pure culture of *Trichoderma koningii* was maintained on the PDA medium for further study.

### 3. Effect of pH levels:

Czapex Dox Agar (CDA) media was made separately and their pH was adjusted either with Sodium hydroxide (0.1 N NaOH)or Hydrochloric acid (0.1 N HCL) to get the required pH level. Sterilize the media in autoclave at 121°C. 20 ml media was poured in each sterilized petriplate. Antagonistic potential of *Trichoderma* spp. was evaluated against *Fusarium equiseti* by dual culture technique (Morton; Stroube, 1955) 8mm disc of freshly growing mycelium of *Trichoderma koningii* and *Fusarium equiseti* were kept in the solidified petridishes in the opposite direction at polar region . After six days of inoculation radial growth of *Trichoderma koninssgii* and *Fusarium equiseti* were measured. The antagonistic potential was calculated by using the formula (Vincent ,1947).

$$I = C - T / C \times 100$$

Where, I = Inhibition of growth

C = Radial growth of pathogen in control plate.

T = Radial growth of pathogen in treated plate.

#### 4. Effect of light spectra:

Effect of light spectra was studied by exposing the petriplates to seven coloured lights. 20 ml CDA medium was poured in each sterilized petriplate. Kept to solidified the petriplates. 8mm disc of freshly growing mycelium of *Trichoderma koningii* and *Fusarium equiseti* were kept in the opposite direction at polar region. Then seven petriplates was exposed to seven coloured lights. After six days of inoculation radial growth of *Trchoderma koningii* and *Fusarium equiseti* were measured and antagonistic potential was calculated by using the formula (Vincent ,1947).

#### 5. Effect of Temperature:

This factor was studied by exposing the petriplates at different ranges of temperature. 20 ml CDA medium was poured in each sterilized petriplate. Allow to solidified the petriplates. 8mm disc of freshly growing mycelium of *Trichoderma koningii* and *Fusarium equiseti* were kept in the opposite direction at polar region. Then petriplates were exposed to different temperatures. After six days of inoculation radial growth of *Trchoderma koningii* and *Fusarium equiseti* were measured and antagonistic potential was calculated by using the formula (Vincent ,1947)..

## RESULT

In the present study effect of different physical factors on antagonistic potential of *Trichoderma koningii* against *Fusarium equiseti* were studied.

#### **Effect of Hydrogen ion concentration (pH) on antagonistic potential of *Trichoderma koningii*:**

Acidic pH is favorable for the growth of fungus. *Trichoderma koningii* shown High antagonistic potential in range of 5.00-6.00 pH, while least antagonistic potential was found in 3.00 pH. The pH above 9.00 and below 3.00 was noticed to be inhibitory for antagonistic potential of *Trichoderma koningii*. The results obtained in the present study are in accordance with the earlier results (Manjunath *et al.*, 2010; Kolli *et al.*,2012; Rousk *et al.*,2009; Miguel *et al.*2007; Benitez, 2004).

#### **Effect of light spectra on antagonistic potential of *Trichoderma koningii*:**

Light is most effective factor on growth of fungus. In the result it was found that the antagonistic potential of *Trichoderma koningii* was maximum in the Blue light (80.00%) and minimum in Pink light (65.55%).

#### **Effect of temperature on antagonistic potential of *Trichoderma koningii* :**

30<sup>0</sup> C temperature shows the good antagonistic potential against the *Fusarium equiseti*.

**Table 1: Effect of different levels of pH on Antagonistic potential of *Trichoderma koningii* against *Fusarium equisetii***

Sr. No.	pH level	Radial growth of mycelium of <i>Fusarium equisetii</i> (in mm)	Radial growth of mycelium of <i>Trichoderma</i> spp. (mm)	Antagonistic potential (%)
1.	3	34	56	62.22
2.	4	33	57	63.33
3.	5	29	61	77.77
4.	6	32	58	64.44
5.	7	35	55	61.11
6.	8	37	25	58.88
7.	9	38	00	00.00
8.	10	00	00	00.00

**Table 2: Effect of different light spectra on Antagonistic potential of *Trichoderma koningii* against *Fusarium equisetii***

Sr. No.	Colour of light	Radial growth of mycelium of <i>Fusarium equisetii</i> (in mm)	Radial growth of mycelium of <i>Trichoderma</i> spp. (mm)	Antagonistic potential (%)
1.	Red	30	60	66.66
2.	Pink	31	59	65.55
3.	Yellow	28	62	68.00
4.	Green	26	64	71.11
5.	Blue	18	72	80.00
6.	Dark	25	65	72.00
7.	Normal light (Control)	28	62	68.00

**Table 3: Effect of different ranges of Temperature on the Antagonistic potential of *Trichoderma koningii* against *Fusarium equiseti***

Sr. No.	Range of Temperature	Radial growth of mycelium of <i>Fusarium equiseti</i> (in mm)	Radial growth of mycelium of <i>Trichoderma</i> spp. (mm)	Antagonistic potential (%)
1.	05 <sup>o</sup> C	00	00	00.00
2.	10 <sup>o</sup> C	00	00	00.00
3.	15 <sup>o</sup> C	30	60	66.66
4.	20 <sup>o</sup> C	25	65	72.22
5.	25 <sup>o</sup> C	20	70	77.77
6.	30 <sup>o</sup> C	14	86	84.44
7.	35 <sup>o</sup> C	33	57	63.33
8.	40 <sup>o</sup> C	00	00	00.00

## DISCUSSION

*Trichoderma koningii* is used as a biocontrol agent. It is a best alternative to the fungicides. It helps to control the fungus *Fusarium equiseti* with out disturbing the ecological balance.

## CONCLUSION

*Trichoderma koningii* shows good antagonistic potential in the blue light (80.00%), also the pH range 5-6 is favourable for the the growth of *Trichoderma koningii*, hence it shows the high antagonistic potential in this pH. 30<sup>o</sup> C temperature shows the good antagonistic potential against the *Fusarium equiseti*.

## ACKNOWLEDGEMENT

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# CHAPTER 22

## PHYCOLOGICAL SURVEY AND PHYSICO-CHEMICAL STUDIES OF VOTI RESERVOIR

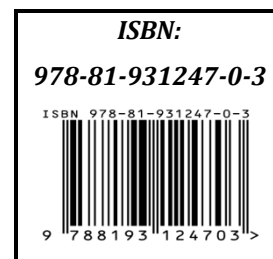
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### ABSTRACT

Voti reservoir is constructed on Manyad river in 1972 in Renapur tehsil of Latur district in the Marathwada region of Maharashtra. An attempt has been made to assess the quality of water and to carry out the preliminary survey of algal abundance. During present investigation, surface water samples were collected from selected sampling stations during March-2013 to February -2014 and analyzed for water quality by examining various parameters like pH, Temperature, dissolved oxygen, free CO<sub>2</sub>, Total alkalinity, Carbonate, Bicarbonate, Sulphate, Phosphate, Nitrate, Total hardness, Chlorides, Magnesium, Calcium, Total solids, total dissolved solids. The preliminary phycoecological survey reveals that the total of 82 taxa under 35 genera were encountered of which Chlorophyceae (18/40), Cyanophyceae (13/29), Euglenophyceae (3/12) and Xanthophyceae (1/1). The parameters studied were within the limits and therefore water was found to be suitable for drinking and irrigation purpose.

**KEYWORDS:** Phycology, Physico-chemical, Parameters, Voti-reservoir.

### INTRODUCTION

Today the most serious problem faced by man is water pollution. The algae play important ecological role and are being extensively used as indicator of water pollution because they are natural inhabitants of water. The algae has been the object of little applied research because they do not cause as many problems for human as do bacteria and fungi but in future this situation is likely to change as human and algae interact more often in desirable and undesirable ways. The fresh water sources like lakes, rivers, streams, dams, and reservoirs get polluted due to waste from cities, agriculture and industries and also due to extensive increase in algal forms. Now a days limnological and hydrobiological studies have attracted by many workers in Maharashtra Gunale and Balkrishnale [1981], Patil and Nandan [1998], Mahajan [1988], to fulfill this lacuna from the Marathwada region the present investigation were carried out.

## MATERIALS AND METHODS

Voti reservoir is constructed on Manyad river at Voti village in Renapur tehsil of Latur district in Marathwada region of Maharashtra. The reservoir is mainly constructed for irrigation and drinking purpose.

### A] Collection of water samples:

For analysis of physico-chemical parameters, collection of water samples were made at monthly intervals from the selected sampling station during March-2013 to February-2014. The water samples were collected in acid washed plastic cans with 2 liters capacity from sampling stations. For the estimation of dissolved oxygen separate water samples were collected in 250ml BOD glass bottles. Water temperature of each site was recorded by using mercury centrigade thermometer. pH of water was examined in the field and also checked in laboratory by using pH meter. The physico-chemical analysis of water samples from the sampling stations was carried out by standard methods of APHA [1985] for 17 physico-chemical parameters

## RESULTS

**Table 1: Physico-chemical parameters of Voti reservoir**

Sr. No.	Parameters	SS-1	SS-2	SS-3	SS-4	SS-5
1	pH	7.90-8.80	7.72-8.90	7.60-8.30	7.80-8.90	8.10-8.91
2	Temperature	16-28 0C	17-29 0C	18-28.5 0C	19-29 0C	18-28.5 0C
3	Dissolved Oxygen	3.20-7.50	3.30-7.60	3.60-7.80	3.22-7.25	3.32-7.66
4	Free CO <sub>2</sub>	15.2-18.9	16.6-45.5	8.2-51.9	15.3-44	8.8-52.4
5	Total alkalinity	128-430	132-350	190-460	155-445	130-435
6	Carbonate	18-80	30-110	25-85	30-130	30-145
7	Biocarbonate	50-390	40-330	40-420	60-385	50-410
8	Sulphate	1.8-5.6	1.7-6.3	1.6-5.8	1.6-9	1.6-10
9	Phosphate	0.01-0.014	0.01-0.013	0.01-0.012	0.01-0.08	0.01-0.06
10	Nitrate	0.03-0.12	0.04-0.12	0.04-0.60	0.03-0.20	0.07-0.30
11	Total hardness	70-110	78-112	82-128	80-116	76-108
12	Chloride	40.6-115.05	50.10-110.76	60.6-110.5	48.8-110.70	58.6-115.2
13	Magnesium	0.44-22.88	1.90-15.60	2.40-21.90	2.60-18.60	3.12-17.10
14	Calcium	8.70-35.20	10.20-35.27	11.20-36.5	12.80-46.80	13.55-38.50
15	Total Solids	180-1200	100-1250	160-1400	168-1300	140-1100
16	T.D.S.	50-590	52-620	50-540	50-650	60-680

[SS=Sampling Station] All parameters are expressed in mg/lit, except pH and temperature



### **B]Collection of Algal samples:**

Algal samples were collected at monthly intervals from all the possible locations of the reservoir. The collected samples were preserved in acid washed collection bottles in 4 percent formalin and added with 5 percent glycerine. The quantitative and qualitative study of 4 groups of algae i.e. Chlorophyceae, Cyanophyceae, Bacillariophyceae and Euglenophyceae were made. As far as quantitative analysis concerned the members of Chlorophyceae shows dominance followed by Cyanophyceae.

**Table 2: Total occurrence of Algal taxa from Voti reservoir**

Sr. No.	Class	Genera	Species
1	Chlorophyceae	18	40
2	Euglenophyceae	03	12
3	Xanthophyceae	01	01
4	Cyanophyceae	13	29
	Total	35	82

**Table 3: Total occurrence of Algal taxa from Voti reservoir**

**1. CHLOROPHYCEAE:** *Sphaerocystis schroeteri*, *Gloeocystis ampla*, *Gloeocystis major*, *Gloeocystis planctonica*, *Gloeocystis vesiculosa*, *Elakatothrix gelatinosa*, *Elakatothrix viridis*, *Ulothrix zonata*, *Oedogonium inconspicuum*, *Oedogonium pisanum*, *Trochiscia granulata*, *Micractinium pusillum*, *Pediastrum duplex v. cohaerens*, *Pediastrum duplex v. gracilimum*, *Pediastrum duplex v. reticulatum*, *Pediastrum tetras v. tetradon*, *Oocystis eremosphaeria*, *Nephrocytium limneticum*, *Nephrocytium lunatum*, *Ankistrodesmus falcatus*, *Ankistrodesmus falcatus v. mirabilis*, *Selenastrum bibraianum*, *Selenastrum gracile*, *Kirchneriella lunaris*, *Coelastrum proboscideum*, *Crucigenia tetrapedia*, *Scenedesmus acutiformis*, *Scenedesmus bijugatus*, *Scenedesmus longus v. dispar*, *Scenedesmus opoliensis*, *Scenedesmus quadricauda*, *Scenedesmus quadricauda v. longispina*, *Scenedesmus quadricauda v. parvus*, *Scenedesmus quadricauda v. quadrispina*, *Mougeotia floridana*, *Cosmarium laeve v. westii*, *Cosmarium pseudoprotuberans*, *Cosmarium schmidtianum*, *Cosmarium sexangulare*, *Cosmarium tetragonum*.

**2. XANTHOPHYCEAE:** *Ophiocytium bicuspidatum*

**3. CYANOPHYCEAE:** *Microcystis flos-aquae*, *Chroococcus giganteus*, *Chroococcus minor*, *Aphanocapsa banaresensis*, *Aphanocapsa pulchra*, *Gomphosphaeria aponina v. cordiformis*, *Merismopedia tenuissima*, *Arthrospira*, *Khannae*, *Spirulina major*, *Spirulina meneghiniana*, *Oscillatoria claricentrosa f. bigranulata*, *Oscillatoria martini*, *Oscillatoria ornata v. crassa*, *Oscillatoria rubescens*, *Lyngbya confervoides*, *Lyngbya hieronymusii*, *Lyngbya laxespiralis*, *Lyngbya major*, *Lyngbya majuscula*, *Lyngbya*

*martensiana*, *Lyngbya perelengans*, *Lyngbya semiplena*, *Lyngbya spiralis*, *Anabaenopsis circularis*, *Cylindrospermum sphaerica* f. *cylindricum*, *Calothrix clavatoidea*, *Calothrix thermalis*, *Gloeotrichia raciborskii* v. *bombayense*, *Gloeotrichia raciborskii* v. *longispora*.

## DISCUSSION

The minimum pH 7.60-8.30 was recorded at sampling station 3 and maximum 8.10-8.91 was at site 5. The temperature range was between 16-28 °C-19-29 °C. The dissolved Oxygen range between 3.20-7.50mg/lit. upto 3.60-7.80mg/lit. at site 3. The values of total alkalinity ranges between 128 to maximum 460mg/lit. at site 3. The minimum values of carbonate 18-80mg/lit. were recorded at site 1 and the maximum values upto 30-145mg/lit. at site 5. The values of sulphate ranges between 1.6 to maximum 10mg/lit. The values of total hardness ranges between 70 to maximum 128mg/lit. The values of chlorides ranges between 40.6 to maximum 115.5mg/lit. The values of magnesium ranges between 0.44 to maximum 22.88mg/lit. The values of calcium ranges between 8.70 to maximum 46.80mg/lit. The values of total solids ranges between 100 to maximum 1400 mg/lit. and the values of total dissolved solids ranges between 50 to maximum 680 mg/lit.

A total of 82 taxa under 35 genera were encountered from the study area, of which 40 species under 18 genera belonged to Chlorophyceae. The genera like *Scenedesmus* were found dominantly followed by *Cosmarium*, *Gloeocystis* and *Pediastrum*. [Ashtekar, 1980], among the Euglenophyceae *Phacus* shows dominance, *Ophiocytium bicuspidatum* represents the Xanthophyceae and among the Cyanophyceae *Lyngbya* shows the dominance and followed by *Oscillatoria*

## CONCLUSION

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## ACKNOWLEDGEMENT

Authors are thankful to Principal Dr. Awashti R. S. for his valuable guidance and for providing all the necessary facilities to carry out this investigation, because of him I could complete this piece of work.

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# CHAPTER 23

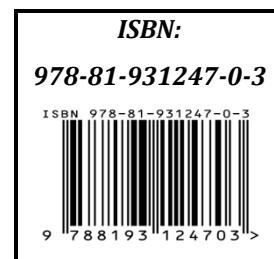
## EVALUATION OF DIFFERENT PHYTOEXTRACTS TO MANAGE *ALTERNARIA* BLIGHT OF CHILLI CAUSED BY *ALTERNARIA SOLANI* ELL. MART

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### ABSTRACT

Experiment was conducted in Departmental Laboratory to evaluate the performance of aqueous and alcoholic phytoextracts of three medicinal plants like *Polyalthia longifolia*, *Justicia adhatoda* and *Eugenia Jambolana* against leaf spot of chilli caused by *Alternaria solani* in three different concentrations i.e. 25%, 50%, 75% and 100%. All the alcoholic phytoextracts play important role in managing the blight disease caused by *Alternaria solani* on chilli.

**KEY WORDS:** Alcoholic extract, aqueous extract, chilli, *Alternaria solani*.

### INTRODUCTION

Botanical Name of chilli is *Capsicum annum*. Chilli is an important cash crop in India and is grown for its pungent fruits. Both green and red (Ripe) Chillies are used to impart pungency to the food. Red chilli powder is used as condiment in every Indian household. Green chillies of some varieties are used as vegetable. It is also used for preparation of chutneys, masala, sauces and pickles. It is rich source of vitamin C. There is demand for export of raw chillies and chilli powder. Extract of green chillies can be used as bio-insecticide. Damping off, Anthracnose, Bacterial leaf spot, Leaf curl, *Phytophthora* blight, *Alternaria* blight, Leaf spot of chilli, *Fusarium* wilt of chilli, Frog eye leaf spot, Chilli mosaic, among that *Alternaria* blight is serious, so selected for research work.

The plant kingdom is a house of potential drugs and there has been an increasing awareness about their importance of medicinal plants. They are used locally in the treatment of infections caused by fungi, bacteria, viruses and parasites. Drugs from the plants are easily available, less expensive, safe, and efficient and rarely have side effects. During this investigation alcoholic and aqueous leaf extracts of three medicinally important plants i.e. *Polyalthia longifolia*, *Justicia adhatoda* and *Eugenia Jambolana* were used.

## MATERIAL AND METHODS

Healthy, disease free leaves of *Polyalthia longifolia*, *Justicia adhatoda* and *Eugenia Jambolana* were collected from college campus area. The leaves were air and shade dried for two weeks at room temperature and pulverized to powder using mortar and pestle. 100 gm powder was added in 500 ml 95% ethanol for alcoholic extract and for aqueous leaf extract 100 gm leaf powder of each plant was mixed with 500 ml sterile distilled water.

Boil the extract to its half quantity and Filtered through Whattman Filter no. 1 and used as 100% concentration from that Four concentrations are prepared i.e. 25, 50, 75 and 100%. Anti-fungal studies were carried out by using food poisoning technique against *Alternaria solani* by using these concentrations .The mycelial growth was measured after 7 days by comparing with control plate.

## RESULT AND CONCLUSION

The alcoholic extracts of all the three plants completely inhibit the growth of the pathogen and the aqueous extract of *Polyalthia longifolia* at concentration 100 % completely inhibit the growth of the pathogen as compare to the other two plant extracts.

**Table 1: Effect of phytoextract in the management of *Alternaria* blight of chilli caused by *Alternaria solani***

Sr. No.	Name of plant and concentration (%)	Mycelial Growth (mm) Alcoholic Extract	Mycelial Growth (mm) Aqueous Extract
1	<i>Polyalthia longifolia</i>		
	25	---	24 .33
	50	---	22 .66
	75	---	10 .66
	100	---	---
2	<i>Justicia adhatoda</i>		
	25	---	22 .33
	50	---	20 .66
	75	---	20 .33
	100	---	19 .33
3	<i>Eugenia Jambolana</i>		
	25	---	27 .33
	50	---	20 .66
	75	---	15 .66
	100	---	10 .33
4	Control	80 .00	80 .00

## ACKNOWLEDGEMENT

Authors are very much thankful to Dr. I. H. Pathan, Principal, M. H. Shinde Mahavidyalaya, Tisangi, Tal: Gaganbawada, Kolhapur for providing the laboratory facilities.

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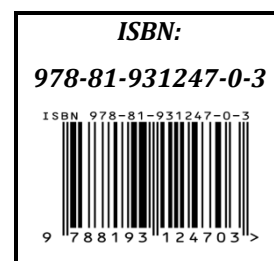
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# CHAPTER 24

## INIMICAL POTENTIAL OF *SYZYGIUM CUMINI* (L) SKEELS LEAF EXTRACT AGAINST *FUSARIUM OXYSPORUM* *F.SP.CHRYSANTHEMI* CAUSING WILT OF *CHRYSANTHEMUM*

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### ABSTRACT

In the present study leaf extract of *Syzygium cumini* (L) Skeels screened against the pathogen. In the result it is found that 25% alcoholic leaf extract inhibited the growth of pathogen as compared to the control while aqueous leaf extract reduced the growth of pathogen as concentration increased.

**KEYWORDS :** *Syzygium cumini*, *Chrysanthemum indicum*, *F. oxysporum* , leaf extract.

### INTRODUCTION

*Chrysanthemum indicum* Linn. is one of the most beautiful and commercially important ornamental plant cultivated in different parts of world. It is small herbaceous annual plant belonging family Asteraceae.

*Chrysanthemum* is at 2<sup>nd</sup> position in the rank after Rose in use. In India *Chrysanthemum* is traditional and religious flower. In India, a flower of *Chrysanthemum* has been constant demand. However, it is very difficult to produce good quality of flowers because it suffered from number of fungal diseases like leaf blight, leaf spot and wilt disease. Among these fungal diseases wilt caused by *Fusarium oxysporum f. sp. chrysanthemi* is very destructive and pathogenic to the plant. Therefore there is urgent need to manage the disease for getting the high yield. Previous workers studied the effect of different chemicals on growth of pathogen, but indiscriminate use of fungicides affects on human health and ecosystem. Other workers reported the antifungal properties of the plants (Khan and Kumar, 1990; Bansal and Gupta, 2000; Kamalakannan et al.,2001; Dhavale et al., 2008).

Therefore in the present work efforts were taken to eco friendly disease management. In the present study different concentration of alcoholic and aqueous leaf extracts of *Syzygium cumini* (L.) Skeels was screened against the pathogen.

## MATERIAL AND METHOD

Fresh and healthy leaves of *Syzygium cumini* (L.) Skeels were collected from Gaganbawada region. The leaves were washed under tap water followed by sterilized water, shade-dried and pulverized to obtain dry powder. Leaf extract of plant was prepared with 95 % ethanol (1: 5 w/v) in a beaker and boiled in hot water bath. The material was homogenized and filtered through double layered muslin cloth. This was taken as 100 % basic stock extract and further diluted to desired concentrations (25%, 50% and 75 %) with sterile distilled water before use.

The toxicity of stock extracts was determined against *Fusarium oxysporum f. sp. chrysanthemi* by food poisoning technique (Mishra and Tiwari, 1992). Petri plates (80 mm diameter) containing Czapek Dox agar (medium supplemented with different plant extracts at five concentrations. A 8 mm culture disc of *Fusarium oxysporum f. sp. chrysanthemi* from 7 day old colony was placed upside down in the centre. Three replications were maintained for each treatment. The plates were incubated at room temperature ( $26\pm 3^{\circ}\text{C}$ ). Medium without any plant extract was served as control. The radial growth of the mycelium was measured. Above procedure was also repeated for aqueous extracts of same plants instead of alcoholic extracts.

## RESULTS AND CONCLUSION

Alcoholic leaf extract of *Syzygium cumini* (L.) Skeels against *Fusarium oxysporum f. sp. chrysanthemi* showed 100% percentage control efficacy (PCE) at 25% concentration. Aqueous leaf extract reduced the growth of pathogen as concentration of extract increased.

**Table 1: Effect of *Syzygium cumini* (L.) Skeels leaf extracts on linear growth (mm) on *Fusarium oxysporum f. sp. chrysanthemi* causing wilt of *Chrysanthemum***

Sr. No.	Concentration in percentage	Mycelial growth in mm	
		Alcoholic leaf extract	Aqueous leaf extract
1	25%	00.00	51.33
2	50%	00.00	44.66
3	75%	00.00	34.66
4	100%	00.00	31.33
5	Control	80.00	80.00

## DISCUSSION

Result is agreement with the following workers (Waghmare, 2010; Bhale, 2005; Patil, 2009; Jagtap, 2010; Ramteke, 2011; Bhowmick and Chodhary, 1982.)



## ACKNOWLEDGEMENT

Authors are very much thankful to Dr. N.V. Nalawade principal, The New College, Kolhapur for providing the laboratory facilities.

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# CHAPTER 25

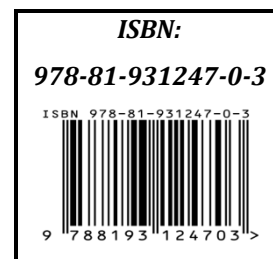
## **BLUMEA LACERA L. (ASTERACEAE): A BIOCONTROL OF WHITEFLIES**

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### **ABSTRACT**

Now a day spiraling Whiteflies *Aleyrodicus dispersus* are creating a serious problem to horticultural, agricultural as well as ornamental plants. This pest is highly poly-phagous infesting about 280 plant species in India. Eggs are laid in a typical spiral pattern from which the whitefly derives its common name. Nymphs and adults suck the sap from the leaves causing damage to several crops in peninsular India. Development of spiraling whitefly from egg to adult occupies 20 to 30 days.

The control of Whiteflies was very difficult previously. But we observed that the 10% alcoholic leaf extract of *Blumea lacera L.* is very much effective Bio-pesticide to control the Whiteflies on guava plant i.e. *Psidium guajava*. It kills the whiteflies and repellent property lasts for more than 45 days.

**KEYWORDS:** Whiteflies, *Blumea lacera L.*, Biocontrol.

### **INTRODUCTION**

The spiraling whitefly *Aleyrodicus dispersus* Russell poses threat to many agricultural and horticultural crops both in the green house and field conditions in India. *Aleyrodicus dispersus*, native to Caribben islands and Central America, is reported to occur in North America, South America, Asia, Africa, Australia and several Pacific Islands (Anon., 2003). In India, it was first reported in 1993 at Thiruvananthapuram, Kerala on tapioca (Palaniswami et. al., 1995) and Sathe, (1999) recorded Whitefly, *Aleyrodicus dispersus*, a new pest of guava (*Psidium guajava*) in Kolhapur, Maharashtra and later in several locations of all the five states in peninsular India (Mani et. al., 2001., Bhavani and Narasimha Rao, 2013).

Whiteflies are small hemipterans belongs to family Aleyrodidae. They are sap feeder pest. These are usually occurring in group on underside of leaves. They feed by tapping into phloem of plants, introducing toxic saliva. They have piercing & sucking type of mouth parts. The excess of phloem is excreted by nymphs known as honeydew. The honeydew leads to growth of sooty mold (Fungus) which leads to decrease in rate

of photosynthesis. In turn decreases the plant yield. Severe infection of white flies causes yellowing of plants and finally plant dies (Islam et. al., 2003).

**Systematic position:**

**1) *Blumea lacera* L. :**

Kingdom - Plantae  
Sub kingdom - Tracheobionta  
Division - Magnoliophyta  
Class - Magnoliopsida  
Order - Asterales  
Family - Asteraceae  
Genus - *Blumea*  
Species - *lacera*

**2) Whiteflies :**

Kingdom - Animalia  
Phylum - Arthropoda  
Class - Insecta  
Order - Hemiptera  
Family - Aleyrodoidea  
Genus - *Aleyrodicus*  
Species - *dispersus*

**Host plants of Whiteflies:** The whiteflies are highly poly-phagous infesting about 280 plant species in India. In our area it is common pest of several plants like Guava, Sugarcane, Soyabean, Banana, Cotton, *Hibiscus*, *Citrus*, Tomato, Mango, Coconut, Legumes, Cabbage, Garlic, *Nerium*, Croton, Rose, Tobacco, *Calotropis* etc.

**Infestation:** Whiteflies are polyphagous pest; they feed on phloem sap and secrete honeydew resulting in the growth of sooty mold (Fungus). It results in the yellowing of leaves due to chlorosis. In infested plant stunted growth is observed, premature fall of leaves is predominant, causing decrease in the yield and finally plant dies.

## MATERIALS AND METHODS

**Plant Identification:** The collected specimens of *Blumea* were identified with the help of Flora of Maharashtra State (Shirodkar et al., 2001). The herbarium specimens were deposited in Botany Department.

**Extraction method:** The washed fresh leaves of known weight (Table 1) of *Blumea lacera* L. were taken in a mortar. Then it crushed by using a 50 ml 70% alcohol for 30 minutes. Entire content (extract) was filtered through muslin cloth and the filtrate was collected. This filtrate was used as a Bio-pesticide to control the Whiteflies. By using simple hand sprayer or pump, the extract was sprayed on the infected leaves of plant.

## RESULT

The alcoholic extract of various concentrations of *Blumea lacera* L. was sprayed on the infected part of the guava plant and the observations were recorded. The details of effect of this bio-pesticide are mentioned in table no. 1.

When the 2% alcoholic extract applied to whiteflies it resulted in the death of whiteflies and pest repellent property was last for 7 days only, for 4%, 6%, 8% and 10% all flies were dead and pest repellent

property last for 15, 24, 30 and more than 45 days respectively. The mortality of whiteflies observed is might be due to the phytochemicals present in leaf extract of *Blumea lacera* L. it contains chemicals like Terpenoids, Saponins, Tannins, Anthraquinone, Glycosides and Steroids. Terpenoid is a active compound responsible for the death of organism (Tiwari et. al., 2012, Patewara et. al., 2012 and Khandekar et. al., 2013).

**Table 1: Effect of various concentrations of Leaf extract on white flies**

Sr. No.	Weight of leaves	Volume of 70% alcohol	Conc. (%)	Effects
1	1 gm	50 ml	2%	Whiteflies dies & repellent effect lasts for 7 days
2	2 gm	50 ml	4%	Whiteflies dies & repellent effect lasts for 15 days
3	3 gm	50 ml	6%	Whiteflies dies & repellent effect lasts for 20-25 days
4	4 gm	50 ml	8%	Whiteflies dies & repellent effect lasts for 30 days
5	5 gm	50 ml	10%	Whiteflies dies & repellent effect lasts for more than 45 days

**Table 2: Effect of various concentrations of Leaf extract on white flies**

Sr. No.	Phytochemicals	Alcoholic Extract
1	Tannins	++
2	Saponin	++
3	Anthraquinone glycoside	++
4	Steroids	++
5	Terpenoids	++

**Source:** Patewara *et al.*, (2012). Indo Global Journal of Pharmaceutical Sciences, 2012; 2(4): 390-396.

## CONCLUSION

The 10% alcoholic leaf extract of *Blumea lacera* L. is very much effective Bio-pesticide to control the Whiteflies. It is cheapest & user friendly method. It is safe and non toxic hence Eco-friendly. The *Blumea lacera* L. is easily available as weed plant and by using this plant as Biopesticide the eradication of weed is possible.

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# CHAPTER 26

## EVALUATION OF NUTRIENT AND SOIL FERTILITY STATUS FROM SOIL OF GADHINGLAJ TAHSIL, MAHARASHTRA, INDIA

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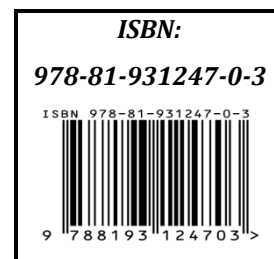
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### ABSTRACT

The study deals with the evaluation of nutrient and soil fertility status from soil of Gadhinglaj Tahsil, Kolhapur district, Maharashtra. Surface soil sample from 20 different villages of Gadhinglaj Tahsil were collected and analyzed for different parameters and some nutrients during January 2015. The remarkable variations in nutrient and other parameters were found, some of which affects adversely on the soil fertility. During the study it has been revealed that the lack of proper agricultural practices, intensive farming, over use of chemical fertilizers, monoculture cropping pattern, over irrigation, continuous addition of sewage, industrial, municipal and domestic wastes into the water bodies are responsible for loss of soil fertility. Most of the soil samples are rich in available nitrogen and phosphorus, along with available potassium, which resulting in the adverse effects. To overcome these problems, proper agricultural practices, balanced use of chemical fertilizers, avoidance of over irrigation and implication of alternating cropping pattern, application of organic manure, and use of bio-fertilizers should be implemented.

**KEYWORDS:** Gadhinglaj Tahsil, Nutrients, Parameters, Soil fertility

### INTRODUCTION

Soil pollution is the serious problem due to the excess amount of nitrates along with other soil pollutant. The soil analysis plays an important role in nutrient management, selection and production of crops. Soil contains variable layers which include minerals and organic matters. To know the soil profile and

is need of present day for agricultural advancement the present study was carried out so as to evaluate the nutrient status of soil from Gadhinglaj Tahsil.

### MATERIALS AND METHODS

Soil samples were collected from 20 different villages of Gadhinglaj Tahsil during January 2015 and various nutrients were evaluated as per the standard procedures(USDA, 1954; Hesse, 1971; Gupta, 2009). The moisture content was analyzed by weighing, pH by pH meter, electrical conductivity by digital conductometer, organic carbon, available nitrogen and phosphorous by titrometry, zinc by atomic absorption method, magnesium by EDTA method and manganese by atomic absorption spectrophotometry (Choydhary and Jichakar, 2012; Deskmukh, 2012).

### RESULTS AND DISCUSSION

The present study was carried out to evaluate the nutrient and soil fertility status of Gadhinglaj Tahsil.

**Table 1: Soil fertility and Nutrient parameters of soil from Gadhinglaj Tahsil**

Sr. No.	Moisture (%)	pH	E.C. (dS/m)	Organic Carbon (%)	Available nutrients (Kg/ha)			Zinc (ppm)	Magnesium (%)	Manganese (ppm)
					N	P	K			
S <sub>1</sub>	6.32	8.5	46.00	1.57	601	18.40	1020	0.27	1.50	5.60
S <sub>2</sub>	4.32	7.9	03.90	0.64	629	10.80	930	0.25	1.70	4.10
S <sub>3</sub>	2.31	7.6	02.16	0.75	544	11.80	400	0.25	2.90	4.20
S <sub>4</sub>	1.22	8.0	0.10	0.88	688	28.40	837	0.20	1.20	4.80
S <sub>5</sub>	1.51	8.4	05.50	0.78	735	26.20	900	0.35	1.60	8.90
S <sub>6</sub>	5.24	8.0	0.52	0.46	505	18.20	1002	0.40	0.60	2.60
S <sub>7</sub>	6.32	8.8	0.71	0.60	688	22.10	1030	0.60	0.70	8.00
S <sub>8</sub>	4.00	8.2	01.80	0.93	598	24.20	988	1.00	0.80	7.20
S <sub>9</sub>	8.01	8.5	02.00	0.68	588	34.20	978	1.20	1.00	7.00
S <sub>10</sub>	4.00	8.5	11.60	0.58	600	40.20	903	1.00	1.60	3.80
S <sub>11</sub>	3.01	8.5	11.20	0.45	606	18.20	1022	0.90	1.20	4.11
S <sub>12</sub>	1.70	8.2	11.80	0.78	520	26.10	1011	0.35	2.00	5.10
S <sub>13</sub>	2.21	8.3	08.10	1.20	606	11.90	602	0.45	1.20	7.20
S <sub>14</sub>	3.33	8.5	20.20	1.64	540	28.40	821	1.20	0.60	8.20
S <sub>15</sub>	6.24	8.9	25.20	0.20	568	26.20	502	2.00	0.75	8.00
S <sub>16</sub>	1.02	8.0	12.00	0.24	519	07.40	515	1.00	0.80	4.20
S <sub>17</sub>	7.20	8.0	20.10	0.39	644	48.20	657	0.35	0.90	4.10
S <sub>18</sub>	6.30	8.4	13.00	0.36	630	14.20	993	1.95	0.25	4.20
S <sub>19</sub>	5.00	8.2	18.00	0.27	650	28.70	1008	2.30	0.90	4.90
S <sub>20</sub>	6.60	7.6	05.40	1.47	532	04.92	901	2.00	1.20	6.20

During the investigation moisture content, pH, electrical conductivity, organic carbon, available nitrogen, available phosphorous, available potassium, zinc, magnesium and manganese were estimated from soil samples and presented in Table 1.

### Moisture

The moisture content value ranged from 1.02 % to 8.01 %. The soil sample S<sub>16</sub> was found lower while the sample S<sub>9</sub> contains higher moisture content.

### pH

The pH values were observed in between 7.6 to 8.9. The soil sample S<sub>15</sub> was shown high pH i.e. alkaline while the sample S<sub>3</sub> and S<sub>20</sub> shown lower pH.

### E.C.

Electrical conductivity ranges from 0.1 dS/m to 46.0 dS/m. The sample S<sub>5</sub> was shown lower electrical conductivity and S<sub>1</sub> shown very high value.

### Organic Carbon

The organic carbon values were recorded in the range of 0.20 % to 1.64 %. The soil sample S<sub>15</sub> was with less organic carbon and S<sub>14</sub> with high carbon. Status of organic content from the study area was presented in Table 2.

**Table 2: Classification of the soil samples on the basis of organic carbon content<sup>[6]</sup>.**

Category	Organic carbon %	Soil samples
Low	<0.50	S6, S11, S15, S16, S17, S18, S19
Medium	0.50 to 0.75	S2, S3, S7, S9, S10
High	>0.75	S1, S4, S5, S8, S12, S13, S14, S20

### Available Nitrogen

The available nitrogen content in the soil samples ranged from 106 kg/ha to 288 kg/ha. The soil sample S<sub>13</sub> exhibited less available nitrogen content while S<sub>7</sub> shown high. Status of available nitrogen from the study area was presented in Table 3.

**Table 3: Classification of the soil samples on the basis of available nitrogen<sup>[6]</sup>.**

Category	Available Nitrogen (kg/ha)	Soil samples
Low	<280	-
Medium	280 to 560	S3, S6, S12, S14, S16, S20
High	>560	S1, S2, S4, S5, S7, S8, S9, S10, S11, S13, S15, S17, S18, S19



### Available Phosphorus

The available phosphorus content in the soil samples ranged between 4.92 kg/ha and 48.2 kg/ha. The soil sample S<sub>20</sub> shown less available phosphorus content and S<sub>17</sub> shown high content of available phosphorus. Status of available phosphorus from the study area was presented in Table 4.

**Table 4: Classification of the soil samples on the basis of available phosphorus<sup>[6]</sup>.**

Category	Available Phosphorus (kg/ha)	Soil samples
Low	<10	S16, S20
Medium	10 to 24.6	S1, S2, S3, S6, S7, S8, S11, S13, S18,
High	>24.6	S4, S5, S9, S10, S12, S14, S15, S17, S19

### Available Potassium

The available potassium content in the soil samples ranged from 400 kg/ha to 1030 kg/ha. The soil sample S<sub>3</sub> with less available potassium content and S<sub>7</sub> with high potassium (Muhr et al, 1965). Status of available potassium content from the study area was presented in Table 5.

**Table 5: Classification of the soil samples on the basis of available potassium**

Category	Available Potassium (kg/ha)	Soil samples
Low	<108	-
Medium	108 to 280	-
High	>280	S1, S2, S3, S4, S5, S6, S7, S8, S9, S10, S11, S12, S13, S14, S15, S16, S17, S18, S19, S20

### Zinc

Zinc content in the soil samples ranged from 0.20 ppm to 2.30 ppm. Higher amount of zinc was noted at sample S<sub>19</sub> while lower at S<sub>4</sub>.

### Magnesium

Magnesium content in the soil samples ranged between 0.25 % and 2.90 %. The amount of magnesium content was noted higher at sample S<sub>3</sub> and lower at sample S<sub>18</sub>.

### Manganese

Manganese content in the soil samples ranged from 2.6 ppm to 8.9 ppm. Soil sample S<sub>6</sub> shown less amount of Manganese while sample S<sub>5</sub> shown higher amount of manganese

## CONCLUSION

On the basis of present study it can be concluded that Most of the soil samples from Gadhinglaj tahsil are rich in available nitrogen, phosphorus, and available potassium.

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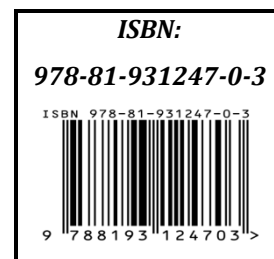
# CHAPTER 27

## PHYSICOCHEMICAL AND MICROBIOLOGICAL ANALYSIS OF SOIL FROM SELECTED REGION OF SHIRALA TAHASIL OF SANGLI DISTRICT

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### ABSTRACT

Soil is the most abundant ecosystem on Earth but the vast majority of organisms in soil are microbes a great many of which have not been described. The total number of organisms and species can widely according to soil type, location and death, plants, animals, fungi bacteria and human affect soil formation. The fertility of Soil depends upon various properties such as physicochemical and microbiological so its analysis become necessary to get more economical gain by growing the suitable cash crops. The various parameters of soil are studied from villages from Shirala tahasil. Most of the soil region of these tahasil shows the good soil quality index. The present investigation brought to focus on agriculture regions the studied areas are suitable for agricultural purposes and can be used to increase the soil fertility.

**KEYWORDS:** Soil, Ecosystem, Physicochemical & Microbiological parameters, fertility.

### INTRODUCTION

India is one of the largest countries in Asia with a large population, land and with great opportunities offered in various areas. The good soil quality, access to sufficient water, a suitable climate, and hard-working farmers, all make for a successful agricultural sector. In addition, a broad range of crops can be raised because of the variety of different climates throughout the land. Soil is a natural body comprised of solids, liquids, and gases that occurs on the land surface, occupies space, and is characterized by horizons or layers that are distinguishable from the initial material as a result of additions, losses and transformations of energy and matter and the ability to support plants in a environment (Gardiner and Miller, 2004).

The different from of earth on the surface on the rock, formed by the breaking down or weathering of rocks Soil formation is the combined effect of physical, chemical, soil formation is the combined process on soil parent material resulting in the formation of soil horizons. The long periods over which change occurs and the multiple influences of changes mean that simple soils are rare. Soil organic carbon is an important

soil constituent that frequently attenuates microbial degradation. Insecticide degradation rates have been found to be positively correlated to soil organic carbon as well as to microbial plate counts (Johnson et al., 2007). Soil texture is determined by the relative proportion of sand, silt and clay found in a given soil. Soil become acidic when basic elements such as calcium, magnesium, sodium, and potassium held by soil collides are replaced by hydrogen ions. Rain-fall contributes to soil acidity because water combine with carbon dioxide to weak acid,  $H_2CO_3$ . The pH value of a soil is influenced by the kinds of parent material from which the soil was formed. Soil developed from basic rocks generally have higher pH vales than those formed from acid rocks. Soil organic matter is a complex and varied mixture of organic substance. Soil pH represents a major determinant of soil microbial distribution and activity as microbes have different pH requirements (Margesin, 2000). Soil organic matter is any material produced originally by living organisms returned to the soil and goes through the decomposition process. Soil organic matter is closely associated with microbial activity as it serves as substrates and energy sources for soil microbes (Rokade and Mali, 2012). Most soil organic matter originates from plant tissue plant resides contain 60-90 % moisture. The remaining dry matter consists of carbon, Oxygen, hydrogen and small amount of sulphur, nitrogen phosphorus, potassium, calcium and magnesium, The transformation and movement of materials, within soil organic matter pools is a dynamic process influenced by climate, soil type and vegetation and soil organisms. The benefits of a soil that is rich in organic matter and hence rich in living organisms are many. Clay or organic soils are more adsorptive than coarse, sandy soil due their increased surface areas. The colour of the ground cover and its insulating ability have a strong influence on soil temperature. Soil biological investigations can give information on the presence of viable microorganisms as well as on the effects of pollutants on the metabolic activity of soil (Bhardwaj and Garg, 2012). Soil resistivity is a measure of a soil's ability to retard the conduction of an electric current. The electrical resistivity of soil can affect the rate of glavanic corrosion of metallic structures in contact with the soil. Soil fertility get affected due to unscientific management including use of excess fertilizers, insecticides etc. Additions of insecticides affect the microbial components of an ecological niche and thus a simultaneous effect is observed on biotransformation reaction occurring in soil (Aziz et al., 1997). Increasing use of different pesticides and its additives plays important role in deteriorating the quality of soil (Lakshmikantha, 2000). The congregation of human being's into the small areas of villages, town & cities improved the possibilities of social & increased the risk of parasitic insects & disease caused by it to spread in urban communities. Today pesticides have become on essential in gradients of our life & it becomes necessary for every conscientious citizen to know something about this valuable chemicals. Insecticide additives shows a marked effect on the growth of soil microorganisms they not only reduces their number but also responsible for inhibition of germination of seeds. Certain fungicides and insecticides are readily translocated by plants and affect the microbial population and activities of rhizosphere (Liu et al., 2007). The growth of symbiotic nitrogen fixing bacteria is also getting hampered due to the excessive use of insecticide in the agriculture field (Maiti, 2001). By considering all these focused points related to soil fertility and ecotoxicity. We investigate here the physicochemical and microbiological properties of soil in various regions of Shirala Tahsil.

## MATERIALS AND METHODS

**Collection of soil samples:** Soil samples from rhizosphere regions of four different villages of Shirala Tahsil of western Maharashtra. The villages from where the soil samples were collected include Mangle, Sagav, Kande and Shirala.

**Physiochemical analysis:** Physicochemical analysis was carried out as per the methods described (Dobereiner, 1997).

**Isolation of Microorganisms:** To study and isolate the microbial diversity among the collected soil samples we take 1gm of soil and dissolved in nutrient broth then It was allowed to incubate at room temperature on a rotary shaker at 120rpm for 24 hrs. After incubation different dilutions of the microbial enriched nutrient broth were carried out. The dilution scheme used for the study includes  $10^{-1}$ ,  $10^{-2}$ ,  $10^{-3}$  upto  $10^{-10}$ . To study the microbial diversity 0.1ml of each dilution was spread on Nutrient agar. Also, so as to isolate the effective phosphate solubilizing and nitrogen fixing microorganisms 0.1 ml of different dilutions was spread on Pikovskaya's agar and Congo red yeast extract agar. After incubation at 37°C for 24hrs the isolated colonies of different bacteria were studied by subculturing them on respective culture medium. All the isolates were studied as per the methods mentioned in Bergeys Manual of Systematic bacteriology (Kennedi and Islam, 2001). The phosphate solubilizing ability of the isolated microbial strains were studied by growing them on Pikovskaya's agar and nitrogen fixation by Acetylene reduction assay (Reis et al., 2000).

**Statistical analysis:** Analysis of the variants was carried out on all data at  $P < 0.05$  using Graph Pad software (Graph Pad Instat version 3.00, Graph Pad software, San Diego, CA, USA). All the experiments were carried out in triplicate manner.

## RESULT

**Microbiological analysis:** The soil samples collected from Mangle, Sagav, Kande and Shirala areas was found to contain highest  $4.3 \times 10^5 \text{g}^{-1}$  microbial count of nitrogen fixing bacteria. Microbial diversity was observed in the soil of selected areas, the average population of nitrogen fixing bacteria was found to be  $4 \times 10^5 \text{g}^{-1}$ . Similar results were observed in case of phosphate solubilizing bacteria. However lowest amount of microbial count with respect to nitrogen fixing and phosphate solubilizing microorganisms was observed in soil sample collected from Shirala area. The average population of Phosphate solublizers in the normal soil was  $142.1 \times 10^4 \text{g}^{-1}$ .

## CONCLUSION

As we know, Soil texture affects soil behavior in particular its retention capacity for Nutrients and water. The pH value of a soil is influenced by the kinds of parent's material from which the soil was formed. Many plant diseases are caused or exacerbated by extremes of pH. Sometime this makes essential nutrients unavailable crops or because the soil itself is unhealthy. The decomposition of organic matter also adds to soil acidity. The transformation and movement of materials, within soil organic matter pools is a dynamic process

influenced by climate, soil type and vegetation and soil organisms. By studying the different physicochemical parameters of soil improvement in the agriculture practices with respect to application of fertilizers and pesticides in soil is possible. Microbiological parameters are useful as microorganisms are responsible to increase the fertility of soil.

**Table 1. Physicochemical properties of soil from Shirala Tahsil of Sangli District.**

Values are mean of  $\pm$ SEM of three experiments. N- Nitrogen, P-Phosphorus, K-Potassium.

Sr. No.	Village	pH	Moisture (%)	Organic Carbon (%)	Organic matter (%)	N (%)	P (%)	K (%)	Leachability (ppm)	
									Ca <sup>2+</sup>	Mg <sup>2+</sup>
1	Shirala	6.5 $\pm 0.333$	4.7 $\pm 0.333$	0.67 $\pm 0.333$	1.6 $\pm 0.333$	0.77 $\pm 0.333$	0.10 $\pm 0.577$	19.8 $\pm 0.01$	0.096 $\pm 0.333$	0.02 $\pm 0.333$
2	Mangle	7.5 $\pm 0.333$	4.8 $\pm 0.333$	0.81 $\pm 0.333$	1.9 $\pm 0.333$	0.48 $\pm 0.333$	0.38 $\pm 0.577$	19.5 $\pm 0.01$	0.072 $\pm 0.333$	0.04 $\pm 0.333$
3	Sagav	7.7 $\pm 0.333$	5.5 $\pm 0.333$	0.67 $\pm 0.333$	1.4 $\pm 0.333$	0.54 $\pm 0.333$	0.38 $\pm 0.577$	20.1 $\pm 0.01$	0.102 $\pm 0.333$	0.03 $\pm 0.333$
4	Kande	7.6 $\pm 0.333$	6.2 $\pm 0.333$	0.86 $\pm 0.333$	1.8 $\pm 0.333$	0.65 $\pm 0.333$	0.39 $\pm 0.577$	19.3 $\pm 0.01$	0.08 $\pm 0.333$	0.04 $\pm 0.333$

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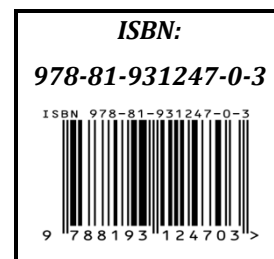
# CHAPTER 28

## ROLE OF ENVIRONMENTAL EDUCATION IN CONSERVATION OF NATURE

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### ABSTRACT

Environmental degradation is a global problem and is directly related to natural resource depleting in quantity. Lack of environmental awareness and concern in the society is basically responsible for degradation etc. environment. The environmental awareness with common many must be based scientific understanding and ethics of conservation. This awareness about environmental protection and nature conservation should reflect in everybody since man is the cause at environmental degradation seen today but he is also solution for improving the conditions. There is no shortcut for improving environment, even with new technologies or strict legislation, unless well informed public taken conscious decisions to restore the degraded environmental by changing personal attitudes & adopting Eco-friendly life style

**KEYWORDS:** Environmental awareness, degradation, attitudes, environmental science.

### INTRODUCTION

The subject Environmental studies have been compulsory to for student from primary to graduation under the order of Hon'ble Supreme Court to acquire basic knowledge of environment. Rapid loss of environmental quality today is perhaps the most serious threat humanity has ever faced in the history of mankind environmental degradation is global problem. This problem is related to nature resource.

Lack of environmental awareness concern in the society is basically responsible for the degradation of environment. Wrong priorities and overexploitation encouraged initially in the developed and now in developing societies is causing socio-economic stress and even eco-political conflicts.

It is often forgotten that human existence and also life of other creatures is solely dependant On the health of the plan earth. It is therefore essential for every person to know about the impacts of his daily acts on environmental healthy, locally as well as globally.



Environment degradation is global problem. In the pursuit to achieve faster economic & materialistic development, nations across the world have maintained the highest rate of exploitation of natural resource without much concern for inter-generational equity is natural resource use as well as environmental 'bads' that have huge social costs. A gain the background the need for sustainable development assumes significance and hence general awareness of the environmental aspect of socio-economic development need for environmental presentation etc becomes the need of the hour. The security of problem is evident from the initiative taken by Hon'ble Supreme Court of India by directing the UGC to introduce the compulsory Environmental studies course at the under graduate level all over the country.

Virtually all human endeavors can be justified to have environmental consequence. We can cite for example, that technologically mediated improvement in any industry will influence population growth and individual longevity both of which will have an environmental impact. Similarly, development of new crop plants and crop protestants will influence the use of land , its availability and our ability to feed growing population and replacement of unwanted production practices by cleaner production strategies which can be considered as environmental vital. The objective of this research paper is to provide a perspective on the various issues on environmental and its consequence, removal, circumventing or reducing the damaging consequence that human activities have on the environment with people participation.

## **OBJECTIVES**

1. To create awareness regarding environment studies.
2. To promote interest in the environment studies.
3. To create awareness regarding protection and conservation environment.
4. To give opportunities in doing various courses in environment studies.
5. To do study about environment Criticism

### **Definition, Scope and Importance**

Environmental degradation is the server and growing problem faced by the modern humanity today the world over. Though there has been gradual increase in the awareness about the causes and impacts of environmental decline on human life in the developed countries, such awareness and resultant actions are grossly lacking in the developing countries. This is being attributed to the different developmental priorities of these countries, mainly fighting population growth,poverty and illiteracy.

However, the recent studies have shown that these factors are more interlinked and responsible to further damage of the environment. Knowing about the nature around us and human interaction with it, is therefore essential for every human being. Our existence depends on the health and the well being physical and living environment around us. Every action of ours individually or collectively, directly on indirectly, leaves some impact on the environment. Therefore, it is necessary for everyone to understand the functioning, structure, associations of natural phenmenon and their role in our daily life.

The trends of environmental changes suggest that unless serious, committed and consistent actions are taken by everyone today to protect and improve the environment around us, the future generations will have to face difficult scenarios of resource crunch, pollution, population explosion and resultant socio-economic and political stress. It is therefore recommended by the environment and education experts and thinkers that the younger generation, need to be made aware of the entire gamut of the man and environment interrelationship. This can best be achieved by exposing the students to environmental studies at an early age. So by the time they grow they will take more eco-friendly decisions and make long term sustainable use of the then available resources for every one ensuring a more just and sustainable and peaceful human society.

The different perspectives of the environmentally conscious society about the human development from the physical, social and spiritual angles will look at the environment in different dimensions and views. In the modern industrialised society, with the technology advancement, the perception of environment has changed drastically away from the traditional view about the man and environment interrelationship where the traditional wisdom about nature and coexistence has been ignored or even forgotten. Environmental studies are expected to bring all these aspects in brief into notice of students.

### **Multidisciplinary nature of Environmental Studies**

Though, man has known about nature a great deal since its early existence, this knowledge was restricted to only a few species of useful organisms as food, fiber, fodder, medicine or aesthetic value. Subsequently, the understanding about environmental forces was added but still limited to various forces of nature and the seasons. Later, it was more about domestication of plants and animals. In the last few centuries it revolved around discovering new resources for the industrial development. However, till recently the holistic nature of ecology or environmental science was not recognised. Only in the mid twentieth century environment became a matter of concern due to the problems of pollution and other environmental issues the world over.

Now, it is well accepted that environmental studies has to have multidisciplinary approach for better understanding of the environmental issues as well as for effective actions to protect it. This approach requires better knowledge of the concepts from various disciplines, such as science, social science and even humanities, as man and environment interactions are many folds, at different levels and are also complex. Therefore, environmental studies is a holistic study of man and his environment, which includes interrelationship of all the living and non-living components of nature. This basic knowledge is must for every human for his healthy life today and for the future generations.

### **Need for Public Awareness**

Environmental degradation is basically a result of negative impact of human activities on environment. Most of the human activities for daily life as well as long term developmental activities, without consideration for environmental health, have altered the environment to a great extent. It is revealed that in most cases this change in environmental quality and quantity is long term, permanent and irreversible. Even today with the technological

advancement our understanding about nature and its dynamics is very limited, People in general are not aware about the facts of day to day human activities, which are slowly, and gradually eroding the life support systems.

Therefore, it is essential that the public, a common man, is made aware of the impact of the human activities on environment. This awareness is particularly of the changing lifestyles which are not Eco-friendly, and adopted under the disguise of 'development'. People should also be made aware of the immediate priorities and available resources and the development possible under the concept of 'carrying capacity' of the earth. They should also be made aware of the limitations of technology as well as laws of nature, which can not be violated by man beyond a certain limit. The concern for the future generations, their needs and options left to them need to be cleared in the efforts to make people aware about human impact on environment at personal, local as well as global level.

Since environmental degradation is the collective impact of human activities on nature, every component of the society must know the consequences of its activities on nature and other fellow species. Today due to the revolution in information technology, huge amount of information related to environmental issues is made available by print and electronic media. Also due to satellite and other technologies there better understands of the environmental processes at regional and global level than ever before.

### **Constitutional Provisions About Environment**

India is the first country which has made provisions for the protection and improvement of environment in its Constitution. In the 42<sup>nd</sup> amendment to the constitution in 1976, provisions to this effect were incorporated in the Constitution of India with effect from 3<sup>rd</sup> Jan,1977. In the Directive Principles of state Policy in Chapter IV of the Constitution, Article 48 A was inserted which enjoins the state to make endeavor for protection and improvement of the environment and for safeguarding the forest and wild life country. Another landmark provisions in the Duties of every citizen Of India. This is the provision in Article 51 - A (g) of the constitution. It stipulates that it shall be the duty of every citizen of India to comparison for living creatures.

There were provisions already existing in various enactments to tackle environmental pollution. The Indian Penal Code, The Criminal Procedure Code, The Factories Act, The Indian Forest Act, The Merchant Shipping Act etc. have provisions for regulation and level action for some specific environmental issues.

### **CONCLUSION**

The environmental awareness with common man must be based on scientific understanding and ethics of conservation. This awareness about enviromental protection and nature Conservation should reflect in every day, personal and collective,positive actions. Since man is the cause of environmental degradation seen today, he is also the solution for improving the conditions. There is no short cut for improving environment, even with new technologies or strict legislation, unless well informed public takes conscious decisions to restore the degraded environment by changing personal attitudes and adopting Eco-friendly lifestyles with people participation.

Virtually all human endeavors can be justified to have environmental consequence. We can cite for example, that technologically mediated improvement in any industry will influence population growth and individual longevity both of which will have an environmental impact. Similarly, development of new crop plants and crop protestants will influence the use of land , its availability and our ability to feed growing population and replacement of unwanted production practices by cleaner production strategies which can be considered as environmental vital. The objective of this research paper is to provide a perspective on the various issues on environmental and its consequence, removal, circumventing or reducing the damaging consequence that human activities have on the environment.

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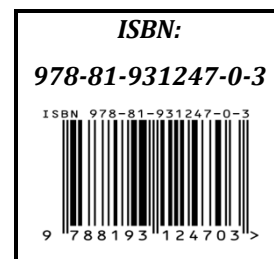
# CHAPTER 29

## PREPARATION OF A LOCAL ENVIRONMENTAL AWARENESS PACKAGE FOR CONSERVATION OF ENVIRONMENT AND BIODIVERSITY AMONG 10<sup>TH</sup> STD. STUDENT

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### ABSTRACT

“Environment means not only biotic & non biotic components but it also includes poverty, population, cleanliness, illiteracy, diseases, terrorism etc.” This definition clears that environment consists of mutual interaction between biotic & abiotic components. The natural environment consists of lithosphere, hydrosphere, atmosphere as well as animals, plants & microorganism. On the other hand population, economic, social, political & religious environment is included in man-made environment. So it is times need for happy & luxurious life we have to maintain healthy & beautiful environment.

**KEYWORDS:** Local Environmental Awareness Package, Environment & Biodiversity conservation

### INTRODUCTION

For sustainable development it is needed to conserve the environment and biodiversity. After industrial revolution the problems of environmental degradation have become so fast that there was an urgent need to hold national & international conferences & workshops to think over preservation & conservation of environment. In the conferences & workshops held after 1972 different ways of environmental management were discussed. Nowadays there is increase in industry, population, pollution, diseases, cement jungle, mental stress, lack & peacefulness, chemical fertilizers. Because of all these things environment is totally disturbed & drawn in danger by man. So its current needs of sustainable development & conservation of environment & biodiversity. It will happen if there is awareness about environment. So in this study researcher has tried to prepare package for creating local environmental awareness among 10<sup>th</sup> std. students.

## OBJECTIVES

- 1) To analyze 10<sup>th</sup> Std. Curriculum with reference to environment.
- 2) To find out features of local environment.
- 3) To find out awareness about local environment among the 10<sup>th</sup> Std. students.
- 4) To prepare local environmental awareness package for 10<sup>th</sup> Std. students.

## ASSUMPTIONS

- 1) The student gets the knowledge of local environment then there is change in behavior of students about environmental conservation.
- 2) It is possible to prepare a local environmental awareness package for 10<sup>th</sup> Std. students.

## SCOPE & DELIMITATIONS OF RESEARCH

- 1) The present research includes the students of the 10<sup>th</sup> Std. studying in Dault Vidhya Mandir, Madilage Bk, Tal- Bhudargad, Dist- Kolhapur (MS) 2013-14
- 2) These students come from local area of Madilage (BK), Malwadi, Ganeshnagar, Madilage Kh, Kalanakwadi, Malwadi (Tal- Bhudargad, Dist- Kolhapur)
- 3) Twenty person from each of those local places. Thus total 120 persons were included in the sample. Sarpanch & other experienced persons were included in the sample.

## RESEARCH METHOD

The Researcher has used survey method for this research.

### Sampling-

Purposive sampling method has been used in the present research study.

Tools of the Research- The researcher has used observation schedule, Questionnaire, Interview as tools of data collection.

### Analysis of the data-

The researcher has calculated percentage for quantitative data analysis. Qualitative data analysis has also been done wherever necessary.

## RESEARCH FINDINGS

Main findings according to the objectives

### Objective- 1

- 1) The 10<sup>th</sup> std curriculum of languages, mathematics, science History, Civics, Geography, work experience and physical education has been planned to create environmental awareness in the students.

- 2) The Govt. has been giving training primary and secondary teachers through sarvashiksha Abhiyana to study environmental problems and to know the relationship among various subjects and the present scenario.

#### **Objective- 2**

- 1) The local environmental study for 10<sup>th</sup> std. students can be studied regarding forest resources, Animal life Fuels, Water resources, Soil, Population problems, Health, environment protection and preservation.

#### **Objective- 3**

- 1) Very less No. 10<sup>th</sup> class students are found aware about environment problems.

#### **Objective- 4**

- 1) The Local environmental awareness package (EAP) has been prepared by the researcher, the EAP has based on all the inferences.

## **RECOMMENDATIONS**

#### **A) Local Visits :**

- 1) The students should be informed through Botanical exhibition of medical plants and further motivated by prizes and awards.
- 2) The students should be reinforced through field trips to Nurseries and local forestation areas.
- 3) Solar lantern, Solar hitter, Solar Cooker etc. are the Need of the days. The home visits should be conducted to such houses using all these solar resources so that as students could understand the importance of energy saver appliances.

#### **B) Lectures and Discussion :**

- 4) The lectures of developed and advanced farmers, Agri. officers, doctors etc. should be conducted in the schools.
- 5) Lectures of bird friends, environmental experts, Naturemitras should be arranged in the schools.
- 6) Guidance on Various Schemes of the Govt. Should be given by the help of forest dept., Agri Unit, Eregation unit through visits of such related officers.

#### **C) Business Guidance :**

- 7) The lectures and Guidance should be imparted about veterinary enterprises through district trade centers.

- 8) Agree officer should be invited to facilitate information on fruit tree, Plantation, Trading i.e. local & seasonal utility based businesses.

**D) Competition, Tours, co curricular Activities :**

- 9) The essay writing and Environmental location contests should be arranged on various topics like Need of environment protection & preservation, Vrukshavalli Amha Soyare Vanchare, Nadi Amachi Mata, Jamin Hech dhan, Pradushan Rokha Anarogya Tola, Population explosion, Modernization & environment etc.
- 10) Environmental problem and remedies should be focused by means of cocurricular activities like gatherings, science exhibition, Quiz contest etc.
- 11) Highly motivated personalities like environment experts, bird comrades, Nisargamitras etc. should be interviewed in the school. This will orient students and teachers to preserve the local environment.

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Kolhapur



# CHAPTER 30

## USER STUDY OF AYURVEDIC MEDICAL COLLEGE LIBRARIES IN KOLHAPUR DISTRICT

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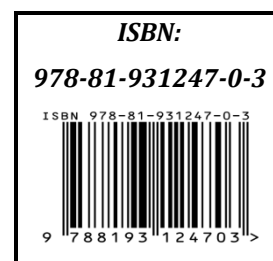
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### ABSTRACT

The present study shows that the readers are satisfied to some extent for general information needs. But not fully satisfied for nascent information appearing through Reprographic services (Xerox) and non-print materials as well as computerized services like Network, Online, E-mail, E-journals, Down load facilities, MEDLINE, and MEDICUS which are not available in the library. This collection should be developed in future to improve with the latest developments in information media and information technologies. The computerized library services may be also introduced by installing a computer system in the library.

**KEYWORDS:** Ayurvedic Medical College Libraries, User Study, Kolhapur District.

### INTRODUCTION

In the library there are important factors responsible for working of the library i.e. user, library collection and librarian. Librarian is the mediator and playing a important role and bringing users and it's reading material together. Librarians develop the collection as per the desired goal of organization / institution, whereas user requirement (needs) to be given proper attention while fulfilling the goal of the institution.

General, in the context of the library the term 'Reader' is called as "Who reads the book is reader", whereas the users defined as "Who makes the use of large verify of documents of the library." Such as periodicals, Standard, Report, Thesis, Microforms, Tapes, CDs, Floppies and computer database etc. Out of these some documents or reading materials are not used. They are not permitted to read with naked eyes. To use or browse these, some kinds of equipment are required other than eyes. In this context the term 'Users' is

fully employed to represent the seekers of information. Users are continuously imparting the information as per requirement.

Therefore, it needed to understand the users of the library systematically. For the purpose of the study the term users and reader taken in the context of use of library and the meaning of both are the same.

## **MATERIALS AND METHODS**

The following methodology has been employed to make the users study of Ayurvedic Medical College libraries in Western Maharashtra. Research methodology is a way to solve the problem and to unfold the probable answer, and to test the hypothesis stated in order to reach to certain conclusions. As there are many methods of research the researcher has to select one of them which are appropriate.

According to Sadhu and Singh, "There are different approaches to research of which the main are:

1. Historical Approach.
2. Case Study Approach
3. Descriptive Approach and
4. Experimental Approach"<sup>2</sup>

**Objective of the study:** The library its devices and operations aim to serve the needs and demands of that the librarians must know his users in order to be able to save them effectively in this direction. The purpose of the can be categorized as.

- A] To know what are the information requirements of the user.
- B] How does the obtain information and keep track of the latest idea.
- C] What need to be done make effective use of the library resources services.
- D] To know the adequacy of library collection for the needs of users.
- E] To get suggestion from the users for the improvement of library services.

### **Scope of the study:**

Research is an endless process. The scope of the present study is confined to study the users of Ayurvedic Medical College libraries in Western Maharashtra viz Doctors, Teachers, and medical students as the users of the library. The efforts are made to study their users from the view point of their satisfaction about their requirements from the library. The area of the study is cover to five district in Maharashtra state it's called Western Maharashtra these are Kolhapur, Sangli, Solapur, Satara and Pune. Its area in kilometer near about 400. The scope of this study is limited to the health science faculty of Ayurvedic college libraries in Western Maharashtra and this is limitation of the study.

## RESULT

### INFORMATION USER

**Concept of User** : The term 'User' in the context of information chain may be at the end. The generator of information, who comes in the beginning of the chain, may also be an 'End User' of information. In the context of database, he is the 'Searcher', a user may be a 'Researcher' he may be a middle man or liaison officer in the dissemination of information. Thus, the term 'User' is complex, varied and unclear.

In a library or information centre environment, the users are the last link or the recipients of the information in the communication cycle. There are a number of terms used as synonyms or near synonyms to user such as patron, reader member, customer etc. The user is an important component in an information system. This vital fact was not recognized for a long time by our information managers. It was revealed from the library and information science literature that for a long time information workers focused their students only on components of information system except users."<sup>1</sup>

The users are an important component in any information system. The user community in academic library system constitutes teachers, students and educational administrators. To create information awareness and to promote the use of information, it is necessary to know the needs of users. Assessment of user needs has been developed by the present age of information explosion.

### Definition of User

"An Information User is the person responsible for viewing / amending / updating the content of the information assets. This can be any user of the information in the inventory created by the Information Owner."<sup>2</sup> The two other definitions of information User is given as further.

"A person permitted to use an electronic database or other online resource under the provisions of the vendors licensing agreement signed by the library or information service providing access called as User."<sup>3</sup>

"The person for whom any search requiring the use of library resources or other information services is performed."<sup>4</sup>

### Types of User

"It is very difficult to different types of library users. In general, the library users may constitute of the students, teachers, and researchers, scholars, authors and writers, planners and policy makers, business managers and executives, entrepreneurs and industrialists, bureau crafts, and the general public."<sup>5</sup>

The basic groups of users can be distinguishing according to the different kinds of activities in which the users are engaged. The main types of users are as follows.

1. The academic activities: the users like students, teachers, researchers, academicians etc.
2. The operational / development activities in the fields like agricultural, industrial, medicine etc. the users can be technicians, practitioners, manufacturers, scientists etc.

3. The development activities in private and public sectors: the users can be managers, planners, decision makers, executives, etc.

### **The Role of the User**

The user continuously interacts with the information unit. In fact, the very existence of information units owes to its users. The user is involved in most operations of the documentary chain: He knows certain sources of information which he is able to weigh up and communicate. He can contribute to the selection of and sometimes even decide on conventional literature about which he is more directly informed. He can and in fact should help develop some of the working tools, such as the documentary language, analysis grids, file structure and formats; and he may or may not be closely associated with contents description, the information of search strategies and the evaluation of search results. He utilizes the products and services of the information unit and states what he wants and how it should be presented. He also plays a key role in the circulation of information.

**USER STUDY:** For a long time, the users even in a scientific library were considered a neglected component by librarians. But today the situation has changed. The librarians have recognized the significance of users as the most vital component in the communication cycle. In fact modern libraries are becoming more and more user oriented. The present trend towards national information system has made the need for user studies more significant.

Users are the last time or recipient of information in the communication cycle. It is therefore necessary to conduct from time to time user's studies in order to determine the use of need for and demand of information and also to be acquainted with users behavior. In fact that user studies in necessary for meaningful library service for realized in western countries half – a – century ago.

In India however, it is a new phenomena. The present trend to the Indian universities and colleges is that the number of students, researchers and teachers are increasing year after year. But the resource allocation to the university and college libraries is not commensurate with increased rate of users and cost escalation of documents especially scientific documents. The aforesaid problems are forcing librarians to think more and more in terms of need based acquisition of documents and providing appropriate information services. Considering this point in mind a user study is conducted among the users in the Ayurvedic Medical College Libraries of Kolhapur district, In Maharashtra State (Devarajan, 2000).

### **Definition of User Study:**

The term 'Users' refers to the users of the library / Information / Documentation center and its resources users are individuals. In designing information system users are indifferent and classified into types of users, does not, refer to a 'group or class of persons' in the present context, but means a set of particular information need.

Information needs refers to individual needs of users reading information, which should be satisfied by the information system used by him. Line defines a "User study as a systematic collection of data from the users about the use of libraries" (Line, 1987).

For social phenomena a survey method is an effective and sensitive instrument for collecting relevant data. Since libraries and information centers are social institutions, the survey method has been adopted with success as a basis for many investigations in to library services and users. The accurate data and quantifiable fails generated by the investigations can be used for making policy decisions or for implementing long range plans.

**Purpose of the study:** The main purpose to the study is to examine the users approaches to information in their fields of interest clue purpose of users study may briefly be stated as fallows.

- A] To assess the existing situation of a library or information center.
- B] To check the effectiveness of the existing library and information center.
- C] To evaluate an area of librarianship or information service with a view to removing inadequate or shortcomings or to plan the next step.
- D] To achieve advancement in study as well as in the field of practical application of library and information science.
- E] To examine the users approach to information in different types of information sources.
- F] To examine the3 nature of search done by sciences for current information.
- G] To get suggestion from the users for the improvement of the library services.

**Importance of the user study:**

The user is the key person in any information system. All the luxuries of information, revolution and problems of information explosion are cantered round the user and his convenience. Understanding the user is fall the battle in providing information services. The success of any information system depends considerably on how best the system design is based on a close and accurate understanding of the users. In fact information system is not concerned with just demand. It was to stretch its hands to know the information needs, the motives and purpose of seeding information ways and means of gathering information and the entire user attitudes and practices in relation to information (Sridhar, 2004)

Library and information centers are maintained for use of information services exists for the sake of users. To make the library and information services effective, an adequate knowledge about the users, their need wants and demands are necessary.

It is importance for an information scientist or librarian to know.

- A] Who among the potential users makes the use of the library and information services?
- B] What services are being used?
- C] What is the frequency of their use?
- D] For what purpose there services are being used.

Equally important for the librarians or information scientist to know is as to how the non users of the library and information centers (IBID).

For Planning library and information services or for their improvement or maximizing the imparts of their services it is necessary to find out about the users and their information requirements and also their

habits. It is believed that any libraries or information scientist become aware of the requirement of his reader. It is because deals with them daily hears them, talk together and observes to them making use of the library and information services. So that he can collect together the information regarding the requirement and behavior of his client (IBID).

However a large number of the users it is believed are shy and they refrain from making comment on the library services are from approaching the librarian for their requirements on their own under normal circumstances. To ascertain the opinions and requirement of data as well as shy users a systematic study through user's survey is indispensable. Considering this vital point in mind a user studies must be conducted among the users in the library(Prasher, 1971).

### **CONCLUSION**

In the questionnaires distributed there was a much scope to verify the user's opinion. Through the present study was found that some of the users did not know about how the library could help them. There were a few users who were interested in discussing their problems regarding the library use realizing the importance of the study undertaken.

The study reveals that the many of the users are not able to use the library effectively because they do not know what exactly to be expecting from the library. They feel frustrated in their use of the library due to certain shortcomings in the library services rendered. Therefore it is necessary that the users must be communicated to the librarian from time to time their interests and their library needs. It must be noted without fail that the well equipped catalogues both dictionary and classified of the library certainly help to the users to search their reading materials by themselves in a very short time.

However in order to make the maximum use of available library resources and services. It is essential that the library users should be educated by the library for library use with the use of user education. They should be instructed for the use of the library from time to time. Addition to library should be published and which should be distributed among the users. Users orientation programmed should be also conducted during beginning of academic terms for new users.

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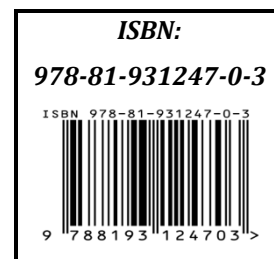
# CHAPTER 31

## ROLE OF COMPUTER IN ENGLISH LANGUAGE TEACHING

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English has become an integral part of India. As well as in most of the countries in the world we find the demand for learning English as an important foreign language. Therefore, English is recognized as a link language in all the counties in the world. English language was introduced to produce what Lord Macaulay called “a class of people, in opinions, in morals and in intellect”. English has also greatly contributed to the growth of knowledge in India particularly in the field of science and technology. It has brought home to us the different developments in the international scene and helped us in properly understanding the world situations.

Teaching is a process. Any process must be tend to a certain direction. It is a fact that the success of the teaching-learning process depends upon how far teacher fix up the aims and objectives of teaching properly. So, the aims and objectives of the language teaching are what we except behavioral change in the students. Teaching language means performing activities in order to achieve the expected change among the students. English being a foreign language in India should be taught as a language and not as a literature. Therefore, to study, English language means to develop practical command of English. Learning language is learning skills and skills are learnt only through practice. Emphasizing the role of English one of the educational commission has emphatically asserted, “For a successful completion of the first degree course a student should possess an adequate command of English. Be able to express himself with reasonable ease and felicity, understand lectures in it and avail himself of its literature. Therefore, adequate emphasis will have to be laid on its study as a language right from the school stage. English should be most useful library language in higher education and our most significant window on the world.”

The history of language teaching presents a fascinating variety of methods. They are as follows: a) Grammar translation, b) The Direct Method, c) The Bilingual Method, d) The Structural- Oral Method. These above methods concentrate on the components of the English language, namely words, structures, word-order, grammar etc. But language is means of communication and our students must acquire communicative competence rather than linguistic. In Britain, scholars like Christopher Candling and Henry widdowson advocated a functional approach to language learning that gradually gained currency and came to be known as communicative language teaching.

- Communicative activities: The teacher has to demonstrate some activities then the students imagine himself for example as a prime minister and the other students as him his daily routine, his work etc.

Explanation and demonstrations are the two simple things which provide an opportunity to use English. It creates for real language practice and creates an English language atmosphere in the class. Even more important, it establishes contact with the class, and helps students to feel relaxed and ready to learn.

- Macro Environment for Students: It is now possible to make classrooms and computer room, educational macro-environments connected to the rest of the world and provided with multiple complementary resources. Actually, learning is considered as a journey, rather than a mere destination. The major role of the computer is to enable the students to explore the ways of learning. The teacher do not seek to feed information into their minds in a passive and receptive manner, rather they equip them with tools that may allow them to cope with further learning once the lesson finishes. There are many significant consequences of this conception.
- Role of Computer: Computers have been used for language teaching since 1960s in the United States. The computer was viewed as a mechanical tutor who never grew tired or judgmental and allowed students to work at an individual pace. Learning is a process of discovery, expression and development. According to Jones and Fortescue, 1987. "Computer-based activities should focus more on using forms than on the forms themselves, teach grammar implicitly rather than explicitly, allow and encourage students to generate original utterances rather than jus manipulate prefabricated language and use the target language predominantly or even exclusively." Task-based, project-based and content-based approaches all sought to integrate learners in authentic environments and also to integrate the various skills of language learning and use. This led to a new perspective on technology and language learning. In integrative approaches students learn to use a variety of technological tools as an ongoing process of language learning and use rather than visiting the computer lab on a once a week basis for isolated exercises.

The multimedia networked computer with a range of informational, communicative and publishing tools now potentially at the fingertips of every student-provides not only the possibilities for much more integrated uses of technology, but also the imperative for such use, as learning to read, write and communicative via computer has become an essential feature of modern life in the developed world.

- Role of a Teacher: Teachers role have also changed with the times. Teachers are rarely the sole source of language information in these days of global interconnectedness, and the literary corpus that may have been the basis of their foreign language training is not the only body of knowledge worth learning. The assumption from cognitive theory is that teachers do not pour information from their store into the heads of waiting and willing students but that students actively interpret and organize the information they are given, fitting it into prior knowledge or revising prior knowledge in the light of what they have learned. As a result of all these changes the teacher has become a facilitator of learning rather than the font of wisdom, and will find select and offer information in a variety of ways on the basis of what the students must learn in order to meet diverse needs. Having



and manipulating language data in multiple media provides learners with the raw material they can use to re-create the language themselves, using their own organizing schemes. Activities that encourage students to explore and be creators of language rather than passive recipients of it.

Many dictionaries incorporate some grammar help and some like the Longman Multimedia Dictionary; have sound and video clips to help learners recognize a word. Teacher support software's language Experience Recorder, as well as a number of word-processors, has text-to-text speech capability. For accurate translation into speech, the computer also generally needs to be running the appropriate language. Specific operating system. Having discovered the linguistic rules themselves students are more likely to remember and use them. Some software programs help the students to use a particular word or grammatical structure.

For English language teaching and learning the computer plays a central role. The different software applications are used. Such as:

- a) Generic software – This is specifically used for modern foreign languages.
- b) Communications software – This includes email software and web browsers.
- c) Natural Language Processing – Speech synthesizers and speech analyzers.

The above software's are used in teaching languages.

Thus use of ICT is motivating both for students and for teachers. It makes the learning process more enjoyable. It also offers access to a rich resource of authentic materials on the Internet. Unlike paper based documents, digital materials can include not only text and images, but also audio video clips, and animations. This facility provides a rich environment within which to create activities for students. So far the overall development of the student's computers plays a vital role.

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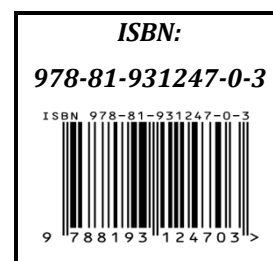
# CHAPTER 32

## IMPACT OF ENGLISH LANGUAGE ON SCIENCE

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### INTRODUCTION

“Language is a human speech, either spoken or written. Language is the most common system of communication.” (World Book Encyclo., Vol. 12, p.64) English language has universal importance because it gives birth to feeling of internationalism, it can serve as a means of communication at international level, it can help in establishment of world peace, it helps the development and generation of human outlook and of our balanced personality, and it helps the development of stability on our lives. Late Education Minister of India, Maulana Abdul Kalam Asad quotes, “English has today become one of the major languages of the world and Indians can neglect its study only at the risk of loss to themselves. I am convinced that in future as well the slandered of teaching English should be maintained at as high a level as possible.” For Indians English has a special place, the increasing awareness of the importance of English in the world should compel us to learn it for a special purposes and for widening our intellectual horizon.

In Maharashtra English is a second language but it is used differently by the different people in the state. The state is divided in to rural, urban and cosmopolitan areas. Marathi is commonly used in the offices but Hindi and English are used in cosmopolitan cities. Nearly sixty percent of the people read newspapers in Marathi while 40% read English papers, 40% in the cosmopolitan areas are bilingual. English is widely used for educational purposes in schools & colleges & other institutions providing higher education, at conferences, meetings private offices & big hotels in Maharashtra. Sometimes English is used by educated people for communicating with an outsider. Without knowledge of English it is not easy to get remarkable success in these days. English language plays a very important role in education. In India we need English to serve us as a vehicle of knowledge especially of Science & Technology. It is necessary to learn English as a second language because it increases the range of communication of the learner, one can get knowledge of the customs & ways of life of other nations. It also helps learner to add the general knowledge & it is a key to unlock new fields of knowledge in Science & Technology.

We live in the world of science and technology, when information has taken an advantage over knowledge. Information and the knowledge in different fields and in different parts of the world can be

obtained by way of communication and for better communication fluency over English is very necessary. English language is considered as the international language as it is spoken throughout the whole world, however, in India English language is treated as the secondary language. English language is used not only as a compulsory subject in schools & colleges but it is also used as a medium of communication in all private & government sectors in India. English language is gift given by white people when they left India. At present English language has become part & parcel of every Indian person. Modern Science & technology is totally dependent on English language & scientific experiments, competitive examinations & administrative communication is related to English language. English language has great importance in modern period.

### **HISTORY OF ENGLISH LANGUAGE IN INDIA**

Although the history of English language in India can be traced back to the 31<sup>st</sup> Dec 1600, the day on which queen Elizabeth 1<sup>st</sup> of England granted a charter to the governor & company of merchants of London trading with the East India, English education was in fact introduced in India in the middle of the 19<sup>th</sup> century. If we confine our discussion to universities alone, three universities were established, one each at Calcutta, Bombay & Madras in 1857. The senate of university of Calcutta adopted a resolution in 1861 that all examinations should be conducted in English. Needless to say this compelled all schools & colleges to introduce English as a subject at a very early stage. Thus over a hundred years ago, i.e. when the British introduced the modern system of English education in India, the study of English language was an important part of the liberal & the humanistic discipline. Sir Henry Maine, the vice-chancellor of the university of Calcutta in the 1860's, noticed the ambition of all its graduates to write the finest English possible. Sir Henry was one of the rare English men of old days who recognized the importance of English language in India & he also recognized well that the English of some of us was very good & he raised his voice against the chorus of jeers of Babu English in the Indian universities, however, followed a set pattern. For all we know then the University of London provided as the model of English language. However traditional approach to the teaching of English came in for severe criticism later. Gradually teaching of English language in Indian schools & colleges was flourished all over India & this foreign language acquired much importance in the life of every Indian person next to our national language. It is needless to say that, now a day's English language has occupied highest place not only in schools & colleges but in every field of the society.

In 21<sup>st</sup> century science & technology made a marvelous progress in all over the world, various new inventions & discoveries are being taken place in this field which helped to change the face of the world drastically. However, the whole credit of this progress goes to English language as all the experiments in science & technology are done in English language. English language is the main foundation of science & technological progress. Science & scientific developments have opened a new vista in the world. Science has made unbelievable progress under the ground, on the ground & over the ground means in the space. This progress is brought to the notice of the people in the world by way of different medias like English

newspapers, magazines radio & television & different channels. The medium of communication of all these medias is of course English language.

English language and its present status in the every field of society is one of the most discussing issues In India. Though there are many opinions on the use of this language, no Indian can ignore the importance of English language in Indian society. English is the only language through which Maharashtrian can communicate with the people in the other states or the other countries. It means, it is the language of communication of all over the world. If English would be replaced by any other provincial Indian language, the unity in India would be in trouble. Among the languages in the world, English has gained world acceptance. It is rich in literature, science, technology, industry, medicine, law and social science etc. according to media reports, fifty percent of newspapers and scientific and technological periodicals in the world are published in English language. More than sixty percent of the radio stations of the world use English as their medium of communication. Apart from this, it is the language of International politics, trade, commerce, industry and travel, and in academic ground it serves as a liberal language. English is thus deserves to be a world language and it helps linking humans across the countries.

Modern age is the age of science & technology, computer and competition. There is a rat-race means tough competition in every field in the world. In order to sustain in this tough competition, one must get fluency over English language. The knowledge of computer & e-learning is very necessary. Unless we get enough knowledge of English, we can't get knowledge of computer. English and science & computer can go hand in hand. No one can separate English from science or vice-versa. In order to get good success in life every person should be perfect in English as well as in science. The future of the world depends on science, technology and English.

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