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Ph.D. Thesis, Dissertation and Reports
Bhutiani, R., 2004. Limnological status of river Suswa with reference to its mathematical modeling, Ph.D. Thesis submitted to Gurukul Kangri University, Haridwar, Uttaranchal, India.

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Three lignicolous macrofungi from District Doda of Jammu Province (J&K), India

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Abstract

Three lignicolous macrofungal species, namely, *Fomes fomentarius* (L.ex Fr.) Fr., *Fomitopsis pinicola* (Fr.) Kar and *Fomes igniarius* (L.) Fr. belonging to aphyllophorales, collected from Kishtwar and Bhadarwah regions of district Doda of Jammu province (J&K), India, have been described in the present communication. Their taxonomic details, macro and micro-morphological characters have also been included. Critical microscopic observations and perusal of literature revealed that *Fomes igniarius* is new addition to the macrofungal flora of Jammu and Kashmir while as *Fomes fomentarius* and *Fomitopsis pinicola* are the first authentic records for the Jammu province.

Keywords:- *Aphyllophorales, Taxonomy, Fomes fomentarius, F. igniarius, Fomitopsis pinicola*

Introduction

Doda, the largest district in Jammu Province of Jammu and Kashmir state of India, lies in the Pir Panjal range of North-West Himalaya (Kashmir Himalaya) between 74º 30' - 76º 30' E longitude and 32º 30'- 34º 15' N latitude covering an area of 11,691 sq km of which 5,555 sq km comes under forest cover (DOS, 2002). The region is mainly mountainous and vegetation is dominated by coniferous and mixed forests with sub- tropical to temperate climate with average annual rainfall of 107-150 cm. The predominant plant species are *Cedrus deodara* (Roxb.) G. Don, *Pinus wallichiana* A.B. Jackson, *Picea smithiana* (Wallich.) Boiss., *Abies pindrow* Royle, *Quercus* spp. L., *Juglans regia* L., *Alnus nepalensis* D. Don, *Ulmus wallichiana* Planch. etc. Though the study area is endowed with vast phytodiversity including macrofungal resources wealth, hardly any report on the occurrence and distribution of lignicolous macrofungi from this region exists in the literature. Therefore, the present study was carried out with an objective to find out the lignicolous macrofungal species in the study area and thus provide more data on the lignicolous macrofungal flora of the region.

Materials and Method

The collected specimens have been described and illustrated based on the field study of the fresh specimens. For the collection of these fungi, standard methods of collection, preservation, macro and microscopic studies were followed (Atri *et al*., 2003; Kumar *et al*., 1990; Major, 1974; Smith *et al*., 1981) the shape, size, and colour of fresh specimens were recorded before preservation. All the measurements were taken and illustrations were made with the aid of Camera Lucida (Erma, Japan). Reagents used during microscopic analysis were 3% KOH, lactophenol, cotton blue, 1% phloxine and Melzer's Reagent. Crystals

of 1,4-dichlorobenzene were used against insect infestation. The examined specimens have been deposited in the herbarium of Botany Department, University of Jammu, Jammu with accession numbers. For three-dimensional photography, the stereo Nikon camera (SMZ 800, Japan) was used.

Results and Discussion

1. *Fomes fomentarius* (L.ex Fr.) Fr.
Synonymy:
***Agaricus fomentarius* (L.) Lam.,** (1783)
***Boletus fomentarius* L.,** Sp. *Plantarum* : 1176 (1753)
***Polyporus fomentarius* (L.) Fr.,** *Syst.mycol*. (Lundae) 1: 374 91821)
***Ungulina fomentaria* (L.)** Pat., *Essai Tax. Hymenomyc.* : 102(1900)
Collection examined: Jammu and Kashmir, Kandail forest area, Paddar, Kishtwar, lignicolous, growing on wood of *Cedrus deodara* (Roxb.) G. Don, scattered to gregarious, coniferous forest, Sanjeev Kumar and Y.P. Sharma, JUH 9637, July 18, 2006.
Carpophore 14-20 cm, bracket shaped or hoof shaped, dimidiate to ungulate, sessile, upper surface smooth, greyish to grey brown with faint semi-circular markings, margins cream coloured, hazel or light brown, perennial; Context antique brown to cinnamon brown; hyphal system trimitic, generative hyphae 1.6-3.2 µ, branched, clamped, rarely septate, skeletal hyphae 3.2-8.0 µ, thick walled, hyaline, branched, binding hyphae 4.8-6.4 µ, thick walled, branched, pores 150-240 x 120-255 µ, small, round, light brown, flesh brown, thick, suberose, soft, a hard thick crust, shiny below, blackish gray in cross section, basidiospores 4.8-12.8 x 3.2-8.0 µ, ellipsoidal, smooth, hyaline (Fig.1-7).


Fig.1


Fig.2

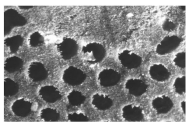
Fig.3

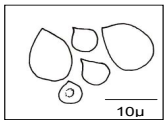

Fig.4

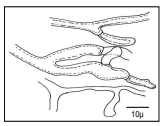

Fig.5

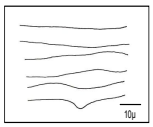

Fig.6

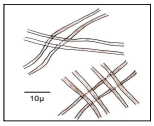

Fig.7

Habitat and Distribution: *Fomes fomentarius* is inedible, worldwide in distribution and has been reported from Africa, Asia, Europe and North America (Sinclair *et al.* 1987). In India, it was recorded growing on twig of *Aesculus indica* Coleb. ex Cambess and *Juglans regia* from Dehradun (Bakshi *et al*., 1971); on *Cedrus deodara* and *Pyrus* sp. L. from Himachal Pradesh (Thind and Rattan, 1971); and on *Betula* sp. Tourn. from Kashmir, Jammu and Kashmir (Abraham, 1991; Llyod, 1898-1925); This fungus is very well used by local population for fire production, decorative items etc. On comparing the taxonomic details of the present specimen with Teng (1988) and Schwarze (1994), it was close to their description except spore length.

2. *Fomes igniarius* (L.) Fr.
Synonymy:
***Phellinus igniarius* (L.) Quel.** (1886)
Collection examined: Jammu and Kashmir, Bhadarwah, Ramtund forest area, lignicolous, growing on wood of *Cedrus deodara*, scattered, Sanjeev Kumar and Y.P.Sharma, JUH 9641, January 10, 2006.
Carpophore 15x16.5 cm, applanate, woody, hard, cinnamon brown, sessile, bracket like, perennial, pores 135-225 x 210-300 µ, oval to elongated; margins obtuse, sterile, ochraceous tawny to sudan brown; context argus brown, hard woody; hyphal system dimitic, generative hyphae 2.4- 8.0 µ, wide, thin to thick walled, septate, clamped, hyaline, skeletal hyphae 1.6-6.4 µ, wide, thick walled, aseptate, branched, basidiospores 4.8-6.4 x 1.6-3.2 µ, ellipsoidal to subglobose with thick walls (Fig.8-12).

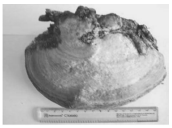
Fig.8

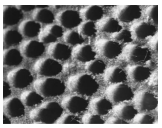
Fig.9

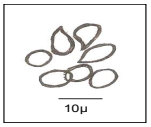

Fig.10

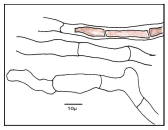
Fig.11

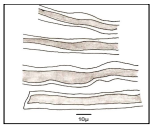
Fig.12

Habitat and Distribution: Recorded on dead trees of *Picea morinda* Link. and *Abies pindrow* from Darjeeling, West Bengal Berkeley (1856). The above examined specimen resembles with the taxonomic details given by Natrajan and Kolandavelu (1998) and differs only with respect to basidiospore length.
3. *Fomitopsis pinicola* (Fr.) Kar.
Synonymy:
Antrodia tuber (P.Karst.) P.Karst., *Finl. Basidsvamp*. (11) : (1898)
Boletus fulvus Schaeff., *Fung. Bavar. Palat*. 4: 89 (1774)
Boletus pinicola Sw., *Sevenska Vet.Acad.hand*., 1852 : 88 (1810)
Fomes pinicola (Sw.) Fr. *Summa veg. Scand.,* Section Post. (Stockholm) (1849)
Polyporus pinicola (Sw.) Fr., *Syst.mycol.* (Lundae) 1: 372(1821)
Ungulina marginata (Fr.) Pat., *Essi Tax. Hymenomyc*.: 103 (1900)
Collection examined: Jammu and Kashmir, Kishtwar, Chishoti village of Machail Padder, solitary, lignicolous, on wood of *Juglans regia* L. in mixed forest of *Juglans regia* L. and conifers, Sanjeev Kumar and Y.P. Sharma, JUH 9638, July19, 2006.
Carpophore 12 cm long and 11cm wide, hoof shaped, sessile, thick and flattened, yellowish turning slightly reddish brown and finally brownish black with semi-circular concentric markings, blackish crust shiny or pruinose, margins yellowed, perennial, pores 105 x 210 µ, irregular, cream or light brown sometimes reddish when rubbed, hyphal system dimitic, generative hyphae 4.0-20.0 µ wide, septate, thin walled to thick walled, branched with clamp connections, skeletal hyphae 1.6-6.4 µ wide, thick walled, branched, without clamps, slightly flexuous, binding hyphae 3.2-8.0 µ,
wide, hyaline, aseptate, unbranched, basidiospores 4.8-11.2 x 2.4-6.4 µ, pale yellow to white, smooth, elliptical, chlamydospores 4.8 -14.4 x 3.2-11.2 µ, thick walled (Fig.13-19).
This species resembles with the taxonomic details given by Natrajan and Kolandavelu (1998) and differs only with respect to basidiospore length.


Fig.13


Fig.14

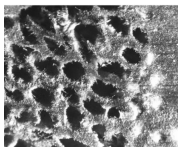
Fig.15

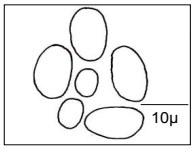

Fig.16

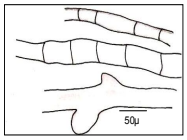

Fig.17

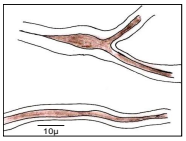

Fig.18

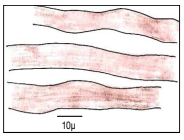

Fig.19

Habitat and Distribution: *Fomitopsis pinicola* is inedible and has been reported only from Kashmir in India by Abraham (1991). It is usually parasitic on broad–leaved and coniferous species but also grows as a saprophyte on dead tree trunks..

Survey of literature (Bilgrami *et al.* 1979, 1981, 1991; Jamaluddin *et al*., 2004) shows that out of these three species, *Fomes igniarius* is new from Jammu and Kashmir state, whereas, *Fomes fomentarius* and *Fomitopsis pinicola* constitute the first authentic reports from the Jammu Province.

Lagend

Fig.1- *Fomes fomentarius* on treetruk of *Cedrusdeodara*
Fig.2- Carpophore of *Fomesfomentarius*
Fig.3- Pores of *Fomes fomentarius*
Fig.4- Basidiospores of *Fomes fomentarius*
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Fig.18- Skeletalhyphae of *Fomitopsis pinicola*
Fig.19- Binding hyphae of *Fomitopsis pinicola*

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Spectrophotometric determination of manganese (II) in *Sida spinosa* Linn.

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Abstract

Manganese is of universal occurrence in plant and has been identified as forming metallo-enzymes as superoxide dismutase (mitochondrial), arginase, pyruvate carboxylase and glycosyl transferase. It also appears to be directly involved in the enzymic machinery of carbohydrates metabolism with a possible link to lipid metabolism. It is also essential for normal bone structure, reproduction and the normal functioning of central nervous system (Bhagi and Chatwal, 2003).

Knowing the biological significance and uses of this essential ultra trace metal, it was determined spectrophotometerically in the various parts viz; stems, roots, leaves, seeds and flowers of the medicinal plant *Sida spinosa* Linn. The method used is simple, sensitive, selective and economical which is based on the oxidation of small amounts of manganese present in the drug either by potassium peroxide or ammonium persulphate. The former is usually preferred since it gives a true permanganate colour. Here manganese converts into potassium permanganate in acidic solution and absorbance for the colour thus obtained is compared with the concentration absorbance curve of the various dilutions of the standard solution, for calculating the concentration of manganese in the various parts of the plant understudy (Peach and Tracey, 1939). The concentration of manganese in the various parts of *Sida spinosa* thus calculated is 2.4 ppm in stems, 1.4 ppm in roots, 1.1 ppm in leaves, 3.7 ppm in seeds and 4.6 ppm in flowers.

Keywords:- *Manganese, Metallo-enzyme, Oxidation, Sida spinosa, Spectrophotometric study*

Introduction

Sida herbs (Bala) were used over 2000 years ago by ancient peoples in the traditional system of medicine. In India *Sida* species generally occur as weeds of waste places, open scrub forests and along road sides through the tropical and subtropical plains. Some of these species including *Sida acuta* Burm.f., *S. humilis* Wilid., and *S. spinosa* Linn. were used in the ancient system of medicine for a varity of therapeutic purposes (Sen Gupta, 1984; Sivarajan and Balachandran, 1994). Antipyretic, antirheumatic, antimicrobial, antitumor and anti-HIV activities of *Sida* species have been reported (Sen Gupta, 1984), along with several well known therapeutically active phytochemical such as β-phenethylamine, ephedrine, ψ-ephedrine, N-methyl-ψ-ephedrine, N-methyl ephedrine, vasicinol, vasicinone, vasicine, choline and betaine. Thus, the genus *Sida* possesses great potential for the development of various formulations on modern parameters. The mineral elements present in the animal body are essential for various body functions. The importance of the inorganic salts can be understood from the fact that salt starvation causes death much earlier than food starvation (Chatterjee, 1972). Most of the medicinal herbs have been found to be rich in one or more elements under study. Elemental analysis of some herbal plants used for the control of diabetes has been done by the techniques of Neutron Activation Analysis (NAA) and atomic Absorption Spectroscopy (AAS). The elements Mn, Cl, Al, Cu, Pb, Ni, Cr, Cd, Fe, Ca, Zn and Hg were found to be present in different plants in various proportions. Calcium is essential for functional integrity of nervous, muscular and skeletal systems. Magnesium is necessary for proper functioning of over 300 enzymes

including several in glycolysis and Krebs's Cycle. Phosphate is necessary for bone formation, for maintaining calcium balance and for the metabolism of carbohydrates. Potassium and chloride ions are important components of all biological fluids. Zinc is an essential element of nutrition and is a versatile component of metallo-enzymes. Copper is necessary for proper functioning of many metallo-enzymes. Manganese is necessary for normal bone structure, reproduction and normal functioning of Central Nervous System. Above examples are just good enough to highlight the importance of minerals in biological syatem (Bhagi and Chatwal, 2003). Determination of mineral elements in 16 medicinal plants including *Sida rhombifolia* have been carried out using AAS, ICP and flame photometer. Mineral elements Ca, Cu, Fe, Mg, Zn, Ba, K, Na and Al were common in all the medicinal plants analysed, which directly relate their importance in the maintenance of health, and for the treatment of cough and vomiting, pyorrhea and rheumatic and allied disorder (Jain *et al.*, 1993; Nandkarni, 1976). Only elemental findings were reported on *Sida* species. In the light of the above and in continuation of previous work, we reported here-in the spectrophotometric determination of manganese (II) in the various parts of the medicinal plant *Sida spinosa* Linn.

Materials and Method

The plant used for the study was collected from the different localities of Uttarakhand and Utter Pradesh in the month of June to November in the year 2004, 2005 and 2006. It was then identified with the scientific literature and also by matching with the authentic herbarium specimen preserved at Botanical Survey of India (Uttarakhand). Various parts of the plant were washed to remove all the foreign matter from the material, air dried ground and stored in tightly stoppered bottles until needed for analysis. Systronics U.V. visible spectrophotometer 117 equipped with 1.0 cm quartz cells was used for all absorbance measurements.

Standards and sample solutions of different parts of the plants were prepared by following the literature procedure (Paech and Tracey, 1939). The dried sample (1-5 gm) contained in a 500 ml kjeldahl flask is moistened with nitric acid and 10 ml of sulphuric acid . Heat gently and then boil. Add nitric acid in small quantities (about 1 ml) until oxidation of organic matter is completed. Evaporate until sulphuric acid fumes appear. Add 1 gm of potassium persulphate, dilute with approximately an equal volume of water and heat until white fumes again appear. Allow to cool and transfer after dilution to a 250 ml conical flask, total volume after washing-out should be 100 ml. Boil for a few minutes. After cooling add 3 ml of phosphoric acid (85%) and 0.3 gm of potassium periodate. Boil for a few minutes and place in a boiling water bath for 15-30 min to develop full colour of potassium permanganate. Cool and dilute to a suitable volume (e.g. 200 ml) and note down the absorbance with the help of U. V. spectrophotometer to calculate the concentration with the help of absorbance-concentration curve of the standard.

A standard solution can be prepared by dissolving 0.2878 gm of pure potassium permanganate in 250 ml water in a 1 liter volumetric flask; adding 20 ml concentrate suphuric acid and sodium metabisulphite solution slowly until the solution becomes just colourless. Any excess of sulphur dioxide can be removed by addition of a few drops of nitric acid. Dilute to 1 litre (1 ml= 0.1 mg Mn). To prepare standard solution, put appropriate amount of this manganous sulphate solution into volumetric flask, add 10 ml sulphuric acid and 3 ml phosphoric acid. Dilute to about 60 ml add 0.3 gm potassium periodate and proceed as above. When the colour is fully developed, cool and make volume 1 liter.

Results and Discussion

Mean absorbance for various dilutions of standard solution was measured which is graphically presented in Fig.1 and tabulated in Table-1. The absorbance of sample solution was referred to the calibration plot and the amount of manganese was determined in each of the sample. The results are depicted in Table-2. The value of manganese is found to be higher in flowers (4.60 ppm) and very low in leaves (1.10 ppm) and root (1.4 ppm). Quantity of manganese is found to be moderate in stems and seeds, which is 2.4 ppm and 3.7 ppm respectively.

Table-1: Mean absorbance shown by standard solution at different dilution

Sample Label	Concentration (mg/l)	Mean Absorbance (nm)
Blank	-	0.000
Standard 1	0.800	0.020
Standard 2	1.600	0.042
Standard 3	2.400	0.064
Standard 4	3.200	0.083
Standard 5	4.000	0.102
Standard 6	4.800	0.125

Table-2: Mean absorbance shown by different manganese sample

Sample Label	Concentration (mg/l)	Mean Absorbance (nm)
Sample 1	1.400	0.036
Sample 2	2.400	0.062
Sample 3	1.100	0.026
Sample 4	3.700	0.096
Sample 5	4.600	0.120

Sample 1- Root sample, Sample 2- Stem sample, Sample 3- Leave sample, Sample 4- Seeds sample, Sample 5- Flower sample

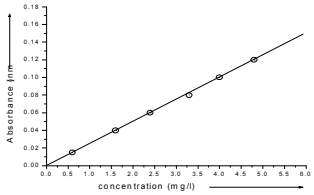

Fig.1: Calibration curve for manganese (II)

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Impact of dust pollution on photosynthetic pigments of some selected trees grown at nearby of stone-crushers

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Abstract

A significant reduction in chlorophyll 'a', 'b' and carotenoid of all the selected trees were observed in polluted site as compared to their control site. There was maximum (30.99%) reduction in chlorophyll 'a' on the leaves of *Psidium guajava* L. and minimum (6.52%) on *Eucalyptus citriodora* Hook. while maximum chlorophyll 'b' contents (43.43%) was depleted in *Syzygiun cumini* L. and minimum (11.11%) in *Eucalyptus citriodora* Hook..

Keywords:- *Dust pollution, Chlorophyll-a, Chlorophyll-b, Stone-crushers, Carotenoid*

Introduction

Over the years there has been a tremendous increase in human population, road transportation, vehicular traffic and industries in Haridwar region, has lead to increased concentration of gaseous and particulate pollutant (Chauhan and Joshi, 2007). Air pollution, both gaseous and particulate (dust) pollutants are known to produce serious hazards to plants and animals. According to an estimate, dust pollutants comprise around 40% of the total air pollution problem in our country. The particulate dust falling on the leaves said to cause foliar injuries, change in the rate of photosynthesis, transpiration and uptake and accumulation of mineral element from soil (Lerman and Darley, 1975).

Materials and Method

The leaves of *Syzygiun cumini* L., *Psidium guajava* L., *Dalbregia sisso* Roxb., *Eucalyptus citriodora* Hook., *Cassia fistula* L. and *Mangifera indica* L. were collected from nearby of stone-crushers (referred to as polluted site) and also from 2 km far from the polluted site, near agricultural land (referred to as control site). Stone-crushers are located on Haridwar-Laksar road, Haridwar. The chlorophyll 'a', chlorophyll 'b' and carotenoid were estimated using standard method. For the plant materials two-way-analysis of variance (ANOVA) was performed as per standard method of Gomez and Gomez (1984). Variations in photosynthetic pigments of the selected economically plant species are given Table-1.

Results and Discussion

***Syzygiun cumini* L.**: The concentration of chlorophyll 'a' content was 28.57% less, chlorophyll 'b' content was 43.43% less and carotenoid content was 17.21% less in leaves sample from polluted site as compared to control site.

***Psidium guajava* L.**: In case of *Psidium guajava* L. the reduction recorded was 30.99% in chlorophyll 'a' content, 38.54% in chlorophyll 'b' content and 15.97% in the concentration of carotenoid in the leaves from polluted sites as compared to their control site.

***Dalbregia sisso* Roxb.:** The concentration of chlorophyll 'a' content was 22.69% less, chlorophyll 'b' content was 21.21% less and carotenoid was 19.10% less in the leaves sample from polluted site as compared to control site.

***Eucalyptus citriodora* Hook.:** The reduction recorded in the leaves of *Eucalyptus citriodora* Hook. sampled from polluted site was 6.52%, 11.24% and 11.95% in the concentration of chlorophyll 'a', 'b' and carotenoid, respectively.

***Cassia fistula* L.:** A reduction in the concentration of different pigments were also recorded in the leaf samples collected from polluted site as compared to samples from control site which was 6.80%, 15.18% and 12.95% in chlorophyll 'a', 'b' and carotenoid, respectively.

***Mangifera indica* L.** : The reduction recorded in the leaves of *Mangifera indica* L. sampled from polluted site was 14.09%, 16.67% and 28.36% in the concentration of chlorophyll 'a', 'b' and carotenoid, respectively. Mishra and Gupta (1993) reported that dusted or encrusted leaf surface is responsible for reduced photosynthesis and thereby causing reduction in chlorophyll content. Agarwal *et al.* (1988) found that cement dust adversely affected and reduced the chlorophyll content of *Mangifera indica* L. and *Psidium guajava* L. Pandey and Simba, (1989) reported that the concentration of chlorophyll a, chlorophyll b and total chlorophyll in the leaves of polluted gram were lower than those of control. Bhorney *et al.* (2002) reported a decrease in chlorophyll content of different trees due to the dust pollution from stone-crushers. Mandre and Tuulmets (1977) found that dust pollution reduces the chlorophyll 'a', 'b' and carotenoid of Norway spruce. The carotenoids are red, orange, and yellow pigments synthesized by all green plants and some microbes. Both chlorophyll and carotenoid occur in all green leaves, but chlorophylls mask the carotenoid to the human eye. When the chlorophyll break down as leaves senesce (mature), the yellow and orange carotenoids persist and the leaves turn yellow. The carotenoids occur in photosynthetic tissues along with chlorophyll to protect them from photo-oxidative damage. Thus it helps in the protection of the photosynthesis reaction of the plants from phyto-oxidative damage.

Table-1: Effect of pollution on photosynthetic pigments in different plant

Plant species	Chlorophyll 'a' (mg/gm)		Chlorophyll 'b' (mg/gm)		Carotenoid (mg/gm)	
	C	P	C	P	C	P
Syzygiun cumini L.	1.47 ±0.08	1.05 ±0.09***	0.99 ±0.09	0.56 ±0.12***	1.22 ±0.06	1.01 ±0.04***
Psidium guajava L.	1.42 ±0.12	0.98 ±0.14***	0.96 ±0.08	0.59 ±0.07***	1.44 ±0.07	1.21 ±0.09***
Dalbregia sisso Roxb.	1.41 ±0.15	1.09 ±0.19***	0.66 ±0.11	0.52 ±0.13***	0.89 ±0.09	0.72 ±0.07***
Eucalyptus citriodora	1.38 ±0.22	1.29 ±0.20***	0.63 ±0.15	0.56 ±0.17*	1.59 ±0.12	1.40 ±0.15***
Cassia fistula L.	1.91 ±0.12	1.78 ±0.09***	1.12 ±0.14	0.95 ±0.11***	1.39 ±0.07	1.21 ±0.09***
Mangifera indica L.	1.49 ±0.21	1.28 ±0.18***	1.02 ±0.22	0.85 ±0.17***	1.34 ±0.11	0.96 ±0.14***

(Mean of 10 replicate ± SE)

Significant at: *$p < 0.05$, ***p<0.001, C= control site, and P= polluted site

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Assessment of pollution level in Hindon river in the stretch of Meerut – Greater Noida due to rapid industrialization

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Abstract

This paper deals with the study of pollution trend in Hindon river between Meerut and Greater Noida stretch along with change in their population density, types of industries and living standards. It was observed that heavy metal pollution increases when we move from Meerut to Mohan Nagar and decreases when we further move towards Greater Noida. Organic pollution and BOD level increased many folds then the permissible limits in Meerut and Greater Noida. Concentration of inorganic ions gradually increases from Meerut to Greater Noida. Where population density is high, organic pollution dominates and where industries are more, heavy metal and inorganic ions load is more. With increase in pollution level, risk of exposure to diseases also increased so, we should emphasize on pollution treatment and control.

Keywords:- *BOD, Heavy metal, Pollution, Meerut, Greater Noida*

Introduction

Water has become the most commercial product of the 21st century. This may sound bizarre, but true. In fact, in the closing decades of the 20th century environmental pollution emerged as a major concern for the survival of mankind through out the world. Modern civilization, armed with rapid advancing technology and fast growing economic system is under threat due to its own activities. Water is the basic component of life and therefore it is of vital importance. Water is to the 21st century, oil was to the 20th century. The stress on the water resources are results of multitude of factors. On one hand, the rapid increasing population and changing lifestyles have increased the need for fresh water and on the other hand, intense competitions among agriculture practitioners, industrial sectors and domestic sectors are pushing the ground water table deeper. This study throws light on the physico-chemical properties of Hindon river in the Meerut-Greater Noida, Uttar Pradesh, stretch. This area is highly populated, have major industries and their number increases as we move towards Greater Noida. A polluted river is severely restricted in its ability to meet any of the above functions. Hindon river is of much importance as it is a major tributary of the Yamuna river. Deteriorated water quality of rivers, reflects lack of respect not only for environmental and health factors, but also for the river's religious significance.

The severe contamination of the Hindon river is not an isolated incidence of river water quality degradation but heavy bacteriological and chemical contamination of rivers are occurring through out India. The following are just a few of these sites, while many other rivers remain just as polluted, as yet uninvestigated. The Hindon river, a tributary of the Yamuna, is heavily used for discharge of chemically contaminated effluents from large number of industries within the vicinity. Groundwater within the region is also subjected to high level of chemical contamination. Groundwater contamination is not only result of hydraulic continuity with the contaminated river, but also as a result of dumping industrial effluents

directly to the groundwater through boreholes. Groundwater contamination in Hindon river has been identified to a depth of 185 meters in Meerut (Janhitfoundation, 2007). Increased industrialization and chemical based agriculture within the western U.P. is identified as a responsible factor for considerable pollution in the river and underlying groundwater aquifer.

Materials and Method

Hindon river originating in Saharanpur and terminating in Yamuna river (Delhi) is located at Lat. 28º40' North and Long. 77º25' East and 268 m above mean sea levels. Water was collected from different locations in this stretch in sterilized bottle. pH and temperature were measured at spot.

Sampling Sites

1. Baleni bridge on road from Meerut to Ghaziabad
2. Hindon Bridge at Mohan Nagar Ghaziabad
3. Greater Noida near Momnath village before confluence with River Yamuna.

Sample collection analysis

Water sample were collected once in a month for one year from above mentioned sampling sites and were tested for various physical and chemical parameters like total solids, turbidity, hardness, heavy metal concentration (Cd, Cr etc.), inorganic ions etc by method mentioned in Khanna and Bhutiani (2005).

Results and Discussion

Study carried on different stretches of Hindon river showed mixed results in its physico-chemical conditions. Table-1 represent results of various physico-chemical parameters at different sampling site in this river. The metal pollution in Hindon river water was assessed for Cd, Cr, Fe and Pb. The metal concentration in water showed wide temporal variation compared with bed sediment because of variability in water discharge and variations in suspended solid loadings. Metal ratios for the bed sediments of the River Hindon were determined and the general trend of relative mobility was observed as Cr > Pb >fe> Cd. The analytical results of various physico-chemical parameters have been compared with the Bureau of Indian Standards (BIS) (1991) – Drinking water desirable / permissible limits are given in the Table-1.

The water quality monitoring results obtained indicate that the organic and heavy metal contamination are continued to be critical in water body and this is mainly due to discharge of domestic waste-water and industrial waste mostly in untreated form. As we go from Meerut to Greater Noida, the form of pollution shifts from organic to heavy metal due to increase in industries in the vicinity the Hindon river. Ghaziabad is a growing industrial city, its population had increased from 5,81,886 (in 1901) to 27,03,933 (in 1991) and still continue to grow mainly on account of its rapid industrialization and its proximity to Delhi. A large number of people reside here but carry on their trades in Delhi or are employed there. The municipal corporations are unable to treat this increasing load of municipal sewage flowing into river water. Secondarily receiving river water also do not have adequate water for dilution. Therefore, the oxygen demand and bacterial population is increasing day by day. This is mainly responsible for water borne diseases. Since, discharge of untreated domestic waste-water is the predominant source of pollution of aquatic resources in India, – the CPCB is regularly monitoring the status of water supply, waste-water generation, collection, treatment and disposal in class I cities (Population> 1,00,000) . The urban areas are responsible for more than 25% of the sewage generation in the region. The small towns and rural areas do

not generate significant amount of sewage obviously due to low per capita water supply. The waste-water generated from such areas, percolate into the soil or evaporate, and thus does not contribute to the pollution of water resources. Hence the focus was laid on large urban and industrialized areas.

Table-1: Comparision between the standards of BIS (1991) and the value of physico-chemical parameter observed within Meerut- Greater Noida stretch.

S. No.	Parameters	Desirable Limits	Meerut	Mohan Nagar	Greater Noida
1.	Color	-	brownish	Muddy	Muddy
2.	pH	6.5 - 8.5	7.44	7.56	7.42
3.	Turbidity (NTU)	5.0	0.83	5.06	5.77
4.	DO (mg/l)	-	6.60	6.80	7.22
5.	COD (mg/l)	250	175.72	177.24	176.22
6.	BOD (mg/l)	-	29	42	48
7.	Total Solid (mg/l)	-	200	235	182
8.	TDS (mg/l)	500	563	570	578
9.	Conductivity (m s)	-	0.34	0.67	1.22
10.	Chloride (mg/l)	250	153.98	152.66	157.66
11.	Nitrate (mg/l)	45	10.45	15.01	15.78
12.	Fluoride (mg/l)	1.00	0.197	0.295	0.285
13.	Hardness (mg/l)	300	210.00	330.00	356
14.	Calcium (mg/l)	75	114.2	118.23	118.75
15.	Magnesium (mg/l)	50	60.71	78.9	78.4
16.	Phosphorus (mg/l)	-	0.878	BDL	BDL
17.	Iron (mg/l)	0.3	0.269	0.233	0.264
18.	Chromium VI (mg/l)	0.05	0.0068	0.065	0.062
19.	Lead (mg/l)	0.01	0.03	0.08	0.1
20.	Cadmium (mg/l)	0.003	0.006	0.017	0.001

Conclusion

The pollution increasing trend indicates that as the population density and number of industries increases from Meerut to Greater Noida heavy metal load in river becomes more alarming. High level of pollution at

Mohan Nagar site is probably due to presence of discharge from industries around it as well as occurence of heavy soil erosion due to less vegetation in this region which contributes lot in raising of organic contaminants in the river. Heavy metal accumulation in human beings are detrimental to his health as, heavy metals causes following defects in human body:

Cadmium: Toxic to humans, it can enter through ingestion, intraperitoneal, subcutaneous, intramuscular and intravenous routes. Highly toxic to freshwater and marine organisms. Increased exposure can increase risk of lung cancer.

Chromium: The metal exists in two forms, i.e. trivalent and hexavalent. Hexavalent chromium in high doses has been implicated as the cause of digestive tract cancers, cutaneous and nasal mucous membrane ulcers.

Lead: Affects human central nervous system, moderate irritation occured when ingested. Lead is a cumulative poison. Increased amount in the body eventually cause disability. Lead can cause irreversible behavioral disturbances, neurological damage and other developmental problems in young children and babies.

The contribution of different point sources to the River Hindon has also been assessed. The highest metal loads were related to the highest flow of the river and thereby increased both by surface runoff and sediment resuspension. Industries producing inorganic chemicals, fertilizers, dyes, paints, pharmaceuticals and battery were identified as hazardous as their waste is non-degradable and tedious to recycle (CPCB 1982-83).

The Biochemical-Oxygen demand (BOD) is one of the most important indicators of pollution level, between Meerut and Greater Noida stretch was within 19-59 mg/l.

Hindon is a major source of water to the highly populated and predominantly rural population of western Uttar Pradesh. It drains a catchment area of about 5,000 km of farmland while also flowing through a number of towns and villages. About 60 functional industrial units are located along the vicinity of River Hindon and its two main tributaries, the Kali and Krishni rivers. These industries abstract large volumes of water from the river for their manufacturing process, and discharge their industrial effluents, often with nominal or without treatment, directly into the river.

Major industries in this area include paper and textiles, dairy units and slaughter houses. “Hindon river no longer serve for domestic purposes as it is too polluted,” says the study. The river is now only used for the watering and washing of livestock. Use of the river for disposal of untreated human sewage is one of the primary cause of poor water quality within the Hindon river. The river receives large volumes of untreated sewage and municipal waste. The river receives a high load of degradable and non-degradable domestic litter. The river water is odorous and become the breading house for disease causing pathogen and vector. The Hindon as well as its tributaries are consistently and massively exceeding the permissible limits provided for surface water and for potable water. Water from the river and tributaries is unable to support a functioning aquatic ecosystem nor is safe for drinking due to the presence of toxic heavy metals, as the entire length of the river apparently has only one water treatment plant, but this does not have adequate capacity. Any person using this water for domestic purposes will exhibit symptoms of heavy metal poisoning. Because of the contaminated river and ground water, villagers along the Hindon river suffer from serious illnesses such as cancer, neurological disorders, stomach and digestive disorders, skin lesions and respiratory disorders.

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Study of noise pollution level in different places of Haridwar and Dehradun City (India)

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Abstract

Noise level was studied in four different categories of area in Haridwar and Dehradun city viz. residential, commercial, silent and industrial zones. Study was carried out at 32 locations with sound level meter to asses day and night time noise levels of Haridwar and Dehradun. However, noise level in all the areas were found to be above the ambient noise standards level. In residential areas of Haridwar and Dehradun the noise ranged between 77.40±4.52 to 89.90±8.87 dB (A) and 70.70±8.55 to 92.30±10.41 dB (A), respectively, while in commercial areas of Haridwar and Dehradun the noise ranged between 80.20±10.61 to 96.60±10.23 dB (A) and 80.90±6.63 to 89.10±9.81 dB (A), respectively.

Keywords:- *Noise pollution, Residential zone, Commercial zone, Silent zone, Industrial zone*

Introduction

The word noise is derived from Latin word, nausea. Noise may be defined as 'wrong sound in the wrong place, at the wrong time'. Unwanted sound i.e. noise happens to be one of the major pollution problem identified in the past couple of decades in urban environment. Under the Air Act (Preservation and Control of Pollution, 1981) noise has been notified as a pollutant (Deka, 2000). Major cities of the world are now facing problem of rise in noise pollution due to very high population rise, transport congestion and associated commercial and industrial activities. Noise is one of the constituents of environmental pollution. It has been established that excessive noise not only adversely affect the health of human but also a health hazard to all living beings. Even the non-living things are not left unaffected by high intensity of noise (Trivedi, 1999). Noise has a significant impact on the quality of life (WHO, 1980). Noise pollution affect the physical and psychological behaviour of the individuals. It may cause nausea, vomiting, pain, hypertension, high blood pressure, cardiovascular problems, sleep disturbance, restlessness, depression, fatigue, allergy, mental stress and annoyance (Rehm, 1983). Chief sources of traffic noise are motors and exhaust systems of automobiles. In addition to this, noise from the roadway is generated by commercial activity, construction, religious activities, ceremonials, festivals etc. (Kisku *et al.*, 2006). Intermittent sounds appear to be somewhat less damaging to hearing than continuous sounds because of the ear's ability to regenerate during the intervening quiet periods (Kisku *et al*., 2002; Lusk, *et al.,* 2002; Vardhan, 2003).

Haridwar is one of the most important holy cities of India, it extendes from latitude 29° 58' in the north to longitude 78° 13' in the east and has subtropical climate. It is about 60 km in length from east to west and about 80 km in width from north to south. District Haridwar lies in the foot hills of Shivalik range. Total area of district Haridwar is 2,360 km^2 with a population of 14, 44,187 (as per 2001 census). It receives millions of tourists every month, sometimes in a day. Dehradun is the capital of Uttarakhand. Dehradun is famous for its beauty, basmati rice and litchi, is a centre of various research institutes as well. It is bounded in the north by the higher range of lesser Himalaya and in the south by the younger Shivalik

range. The river Yamuna and Ganga from the valley's western and eastern boundaries in the NW and SE direction, respectively. Geographically the valley lies between latitude 29° 55'N and 38° 30'N, longitude 77° 35'E and 78° 20'E covering an area of about 3088 sq. km, with a population of 12, 82,143 (as per 2001 census).
Noise level in Haridwar and Dehradun increased noticeably during the past few years due to increase in density of population, increase in number of small and medium vehicles and workshop, increase of road and rail traffic.

Materials and Method

The ambient noise monitoring was carried out almost same type of areas viz. residential, commercial, industrial and silent zone in Haridwar and Dehradun city. The measurement of sound pressure level was carried out at five different times during the day and two times in night between 06:00-24:00 hours, with the help of Sound Level Meter. Monitoring was carried out during Aug 2007 at a height of 1.5 m and 1 m away from the chest. During each sampling of noise, 20 readings of SPL were recorded at an interval of 30 seconds in a period of 10 minutes. The minimum and maximum SPL were also recorded. Ambient sounds levels for different zones in Haridwar and Dehradun city were monitored and compared with that of standard provided by schedule III of Environmental Protection Rules, 1986/CPCB/SPCB in Table-1. Sound levels are measured in decibels.Table-2 and Table-3 shows the noise levels at different zones of Haridwar and Dehradun, respectively.

Table-1: Standards of noise level in some countries

Country	Industrial Area Days/Night	Commercial Area Days/Night	Residential Area Days/Night	Silent Area Days/Night
Australia	65/55	55/45	45/35	45/35
India	75/70	65/55	55/45	50/40
Japan	60/50	60/50	50/40	45/35
U.S. (E.P.A.)	70/60	60/50	55/45	45/35
W.H.O. & E.C.	65	55	55/45	45/35

Results and Discussion

The noise level was recorded in two famous cities namely Haridwar and Dehradun of Uttarakhand state, India. Four different zone within the Haridwar and Dehradun cities were identified for the experiment. The different zones were residential, commercial, silent and industrial zone. Five areas in residential, six areas in commercial zone, three areas in silent and two areas in industrial zone of Haridwar and Dehradun were selected for the study.

Table-2: Noise level (dB) during day and night time of different zones in Haridwar city

Area Type	Place Name	Noise level (dB) day time	Noise level (dB) night time	Range
Resential	Arya Nagar	79.60±9.86	66.40±5.44	94.80-67.30
	Shivalik Nagar	86.40±8.55	69.50±5.31	103.40-78.90
	Jwalapur	88.40±9.85	65.50±6.33	109.30-79.60
	Kankhal	77.40±4.52	60.60±4.47	98.10-62.30
	BHEL Sec. 4	89.90±8.87	72.60±6.98	103.20-68.90
Commertial	Railway Station	80.20±10.61	69.70±8.41	96.30-69.80
	Bus Stand	81.30±8.11	62.30±6.45	94.20-70.80
	Bhoomanand Chowk	88.70±4.99	59.80±3.47	98.00-81.30
	Ranipur More	85.30±7.87	66.10±6.88	97.30-72.10
	Shradhanand Chowk	89.10±9.73	50.30±8.55	96.30-63.40
	Jatwara Bridge	96.60±10.23	72.70±5.87	109.6-69.70
Silent	Harikipauri	72.60±9.94	60.3±5.36	86.20-63.8
	Govt. Hospital	66.80±11.96	45.10±7.48	91.70-52.20
	G.K.V.	50.30±9.58	40.00±6.21	75.60-61.10
Industrial	SIDKUL, Hardwar	89.90±7.16	50.50±6.58	104.90-89.70
	Bahadrabad Industrial area	79.10±5.58	49.50±6.36	94.10-66.60

Table-3: Noise level (dB) during day and night time of different zones in Dehradun city

Area Type	Place Name	Noise level (dB) day time	Noise level (dB) night time	Range
Residential	Basant Vihar	70.70±8.55	45.50±4.31	87.20-59.40
	Subhash Nagar	77.00±7.44	40.40±4.68	90.40-77.40
	Karanpur	82.00±6.77	42.30±4.85	98.40-79.20
	Majra	92.30±10.41	82.60±7.55	103.40-87.30
	Patel Nagar	90.40±8.12	80.2±5.89	104.30-92.40
Commertial	Clock tower	89.10±9.81	72.40±5.33	108.80-89.80
	Railway Station	87.60±6.87	76.30±4.33	102.30-78.30
	Bus Stand	80.90±6.33	76.60±4.64	98.60-77.30
	Chakrata Road	87.60±4.74	55.20±3.93	117.10-93.80
	Rajpura Road	85.90±5.52	56.40±3.11	97.80-77.40
	Prince Chowk	88.30±6.22	52.30±4.85	99.30-80.10
Silent	F.R.I.	45.50±3.12	40.30±2.89	70.10-55.50
	Govt. Hospital	82.20±7.61	55.00±4.77	93.20-59.20
	D.A.V. (PG) College	70.10±5.33	63.40±3.20	83.10-72.10
Industrial	Selaqui Industrial Area	91.30±5.59	79.50±4.26	102.30-72.10
	Patel Nagar Industrial Area	89.40±6.89	80.30±5.66	96.60-72.70

Residential Area

During the study period the average minimum and maximum noise levels recorded during the day were 77.40±4.52 dB (A) (Kankhal) and 89.90±8.87 dB (A) (B.H.E.L. Sec. 4), respectively while during the night the average minimum and maximum noise levels were 60.60±4.47 dB (A) (Kankhal) and 72.60±6.98 dB (A), respectively. At the residential zone of Dehradun the average minimum and maximum noise levels recorded during the day time were 70.70± 8.55 dB(A) (Basant vihar) and 92.30±10.41 dB (A) (Majra), respectively, while during the night the average noise levels were 40.40±4.68 dB (A) (Subhash nagar) and 82.6±7.55 dB (A) (Majra), respectively.

Commercial Area

At Haridwar the average minimum and maximum noise levels recorded during the day period were 80.20±10.61 dB (A) (Railway station) and 96.60±10.23 dB (A) (Jatwara bridge), respectively, while during the night the average minimum and maximum noise levels were 50.30±8.55 dB (A) (Shardhanand chowk) and 72.70±5.87 dB (A) (Jatwara bridge), respectively.

At the commercial zone of Dehradun the average minimum and maximum values recorded during the day period were 80.90±6.33 dB (A) (Bus stand) and 89.10±9.81 dB (A) Clock tower, respectively, while during the night the average minimum and maximum values were 72.40±5.33 dB (A) (Price chowk) and 76.60±4.64 dB (A) (Bus stand), respectively.

Silent zone

During the day the average minimum and maximum noise levels at Haridwar were recorded 50.30±9.58 dB (A) (Gurukul Kangri University) and 72.60±9.94 (Har Ki Pauri) dB (A), respectively while during the night the average minimum and maximum noise levels were recorded 40.00±6.21 dB (A) (Gurukul Kangri University) and 60.30±5.36 dB (A) (Har Ki Pauri), respectively.

However at the Dehradun the average minimum and maximum noise levels during the day were recorded 45.50±3.12 dB (A) (F.R.I. Dehradun) and 82.20±7.61 dB (A) (Govt. Hospital), respectively while during the night the average minimum and maximum noise levels were recorded 40.30±2.89 dB (A) (F.R.I. Dehradun) and 63.40±3.23 dB (A) (D.A.V. College), respectively.

Industrial zone

At the Haridwar the average minimum and maximum noise levels were recorded 79.10±5.58 dB (A) (Industrial area Bahadarabad) and 89.90±7.16 dB (A) (SIDCUL, Haridwar), respectively, while during the night the average minimum and maximum noise levels were recorded 49.50±6.36 dB (A) and 50.50±6.58 dB (A), respectively.

At the Dehradun during the day time the average minimum and maximum noise levels were recorded 89.40±6.89 dB (A) (Industrial area Patel nagar) and 91.30±5.59 dB (A) (Selaqui, Dehradun), respectively, while during the night the average minimum and maximum noise levels were recorded 79.50±4.26 dB (A) (SIDCUL, Dehradun) and 80.30±5.66 dB (A) (Industrial area Patel nagar), respectively.

Singh and Rao (2001), reported 86 dB (A) and 64 dB (A) sound pressure level (SPL) for day and night time, respectively, for commercial area in Patna city. Pawar and Joshi (2005) reported that the noise levels at industrial, commercial, residential and silence zones were higher than prescribed limit during the day and night time. Sagar and Rao (2006) observed noise level at RCD hospital and traffic junction was more than as compared to ambient air quality noise standards (AAQNS). Kisku *et al.*, 2006, also reported that in residential areas, noise ranged between 67.7 to 78.9 and 52.9 to 56.4, in commercial cum traffic areas 74.8 to 84.2 and 68.2 to 74.9 and in industrial areas 76.9 to 77.2 and 72.2 to 73.1 dB (A) during day and night time

respectively at Lucknow city. During the study period we found that all the values of noise level at all the selected site was high than the prescribed limit of CPCB, Delhi.

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Whether optimum pollen germination and tube length attained in the same growth medium (sucrose + vitamin b_6) by five cultivars of Apocynaceae!: Further Evidence of a Criticism of Banerji and Gangulee (1937), Brewbaker and kwack (1963), Sudhakaran (1967-Ph.D.Thesis), Dharurkar (1971 - Ph.D. Thesis), Nair, Nambudiri and Thomas (1973) - A Critical Review*

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Abstract

All the concentrations (10^{-5}-100 mg/ml) of vitamin B_6 stimulated the germination as well as tube growth of all the 5 cultivars of the Apocynaceae.

Keywords:- *Physiology of Pollen, Palylnology, Environmental Sciences*

Introduction

Pollen physiology has attracted the attention of plant breeders and horticulturists ever since the discovery of pollen tube by Amici (1924).

Materials and Method

Pollen of successive flowers (*viz*. F, F-24, F-48, F-72 series *i.e*. open flowers and the flower buds which require 24, 48, 72 hours to open respectively) of 5 cultivars of Apocynaceae *e.g*. red-, pink- and white-flowered cultivars of *Nerium odorum* Soland. and pink- and white-flowered cultivars of *Catharanthus roseus* (L.) G. Don. were collected soon after the dehiscence of anthers in the open flowers. Germination of pollen grains was studied by standing-drop technique in the optimum concentrations of sucrose which acts as control as well as in the optimum concentrations of sucrose supplemented with the wide range of concentrations (10^{-5}-10^{-2}-10^{-3}, 1, 5, 10, 20-20-100 mg/ml) of vitamin B_6 (Hydrochloride). Pollen grains were incubated soon after the dehiscence of anthers. The cultures then transferred to a moist filter chamber, stored at room temperature (29.3-32.5°C) having RH 64% and in diffuse laboratory light. The experiments were run in triplicate and average results were recorded. Observations on the germination of pollen and tube growth were recorded 24 hours after incubation. For each experiment a random count of 200 grains was made to determine the percentage of pollen germination. For measurement of length of pollen tubes, 50 tubes were selected randomly and measured at a magnification of 100x.

Results and Discussion

Pollen viability is a subject that has a great deal of practical as well as theoretical interest. In the present

investigation even the different cultivars of the same species showed the variations in the percentage of their pollen viability (Table 1). Reduced pollen viability has been interpreted as an indication of suspected hybridity in wild populations. Nevertheless, variations in pollen viability may affect the breeding systems of the species concerned, and if the pollen viability can be altered by the environment, then the breeding system itself may be under some degree of environmental control.

As a rule the percentage of pollen germination is always less than the pollen viability. However, Banerji and Gangulee (1937) and Dharurkar (1971-Ph.D.Thesis) reported higher percentage of pollen germination than the pollen viability in *Eichhornia crassipes*. The claim of Banerji and Gangulee (1937) and Dharurkar (1971) is challenged by Salgare (1986b, 95, 2000, 06c, e-g, 07a, c-d, f-g, i) who stated that the observations of Banerji and Gangulee (1937) and Dharurkar (1971) are exaggerating.

Salgare (1983) observed the germination of pollen of F-72 series of pink-flowered cultivar of *Catharanthus roseus in vitro* culture of sucrose. Trisa Palathingal (1990-M.Phil.Thesis) stated that the pollen of F-72 series of pink-flowered cultivar of *C. roseus* did not germinate in Brewbaker and Kwack's (1963) culture medium. This confirms that Brewbaker and Kwack's (1963) culture medium is not perfect. This also proves that the culture medium is also having the bearing on the germination of pollen. This pointed out that Brewbaker and Kwack's (1963) culture medium is not ideal for pollen culture. This was also pointed out earlier by the author (2006c, f-g, 07c, h).

Vitamin B_6 stimulated the germination of pollen as well as tube growth of all the series investigated of the Apocynaceae (Table 1). 10^{-5}-100 and 10^{-5}-0.1 mg/ml proved to be the widest and the narrowest ranges of concentrations of the vitamin B_6 respectively which stimulated the germination of pollen of the Apocynaceae. An optimum concentration produced as high as 740.00% and as low as 13.41% stimulation in the germination of the pollen of the Apocynaceae (Table 1).

Pollen germination stimulation (in %) is in the following proportions in various floral series, F:F-24:F-48:F-72 for vitamin B_6. These are for optimum concentrations of vitamin B_1 only:

315.60±8.20:101.96±6.30:30.77±2.00:740.00±1.88 (Table 1)

This shows that the vitamin produced maximum stimulation in the germination of pollen of F-72 series of the Apocynaceae.

10^{-5}-100 and 10^{-5}-5 mg/ml proved to be the widest and the narrowest ranges of concentrations of the vitamin respectively which stimulated the pollen tube growth of the Apocynaceae (Table 1). An optimum concentration produced as high as 614.29% and as low as 30.70% stimulation in the pollen tube growth of the Apocynaceae.

Proportions of pollen tube growth stimulation produced by vitamin B_6, in optimum concentration, among various floral series, F:F-24:F-48:F-72, are as under:

187.43±4.50:149.26±2.00:614.29±6.00:175.00±3.66 (Table 1)

This shows that the vitamin produced the maximum stimulation in the tube growth of F-48 series of the Apocynaceae.

The tube length *in vitro* culture of the vitamin (in an optimum concentrtion) is 7.86% in F series of red-flowered *Nerium odorum* of the tube length found *in vitro* is the longest of all the cultivars investigated of the Apocynaceae (Table 1).

It should be pointed out that in a few cases the length of the tubes in cultures does equal that in nature (Knight, 1917; Schoch-Bodmer, 1921; Brink, 1924; Branscheidt, 1929, 30; Ehlers, 1951; Vasil, 1960).

Pollen germination and tube elongation are two distinct processes differing in their sensitivity to different concentrations of the herbicide was also confirmed with the present work (Table 1, Salgare, 1986a). However, Nair, Nambudiri and Thomas(1973) stated that it has been significant that the optimum percentage of germination and tube length were attained in the same growth medium. However, with the present work (Table 1) as well as previous extensive work of Salgare (1979, 86c, 2004, 05a-b, 06a, d, g, 07e-g), Salgare and Bindu (2002, 05), Salgare and Tessy Mol Antony (2005a, b) and Salgare and Joshi (2007) it could be concluded that the observations of Nair, Nambudiri and Thomas (1973) are superficial and misleading. In many instances due to hyper- or hypo-nutrition the percentage of germination and length of the tube are considerably reduced. Bursting of pollen also increases and occasionally the pollen tubes were observed to eject their content. In addition to this various pollen tube deformities *viz*. 'bloating' or 'bulla' formation resulting in the swelling of the tip of the pollen tube were also observed. In the pollen tubes that grew in the coiled or zig-zag manner the wall was not straight.

Table-1: Effect of vitamin B_6 on pollen germination and tube growth of successive flowers of five cultivars of Apocynaceae

Cultivars	Series	%PV	SC	V/O	RCPG	RCTG	OCV	SPG	OCV	STG	V/O
N. odorum											
Pink-flowered	F	91±0.42	50	1.53	10^{-5}-100	10^{-5}-40	10^{-2}	+468.75	10^{-2}	+211.41	4.78
White-flowered	F	61±2.87	50	1.20	10^{-5}-100	10^{-5}-10	10^{-3}	+600.00	10^{-3}	+105.12	2.46
Red-flowered	F	61±3.17	20	1.50	10^{-5}-5	10^{-5}-80	10^{-4}	+045.45	0.1	+421.32	7.86
Red-flowered	F-24	61±3.17	20	4.41	10^{-5}-100	10^{-5}-10	10^{-4}	+050.00	0.1	+071.67	3.68
C. roseus											
White-flowered	F	89±0.97	20	1.65	10^{-5}-100	10^{-5}-100	10^{-4}	+282.60	10^{-3}	+168.57	4.42
White-flowered	F-24	89±0.97	50	1.06	10^{-5}-40	10^{-5}-100	0.1	+046.55	10^{-3}	+308.33	4.32
Pink-flowered	F	93. ±0.98	20	4.15	10^{-5}-80	10^{-5}-100	10^{-3}	+181.18	10^{-5}	+030.70	3.24
Pink-flowered	F-24	93. ±0.98	50	1.96	10^{-5}-0.1	10^{-5}-100	10^{-2}	+013.41	10^{-5}	+067.78	3.28
Pink-flowered	F-48	93. ±0.98	50	0.09	10^{-5}-10^{-3}	10^{-5}-20	10^{-5}	+030.77	10^{-3}	+614.29	0.65
Pink-flowered	F-72	93. ±0.98	80	0.08	10^{-5}-20	10^{-5}-5	10^{-3}	+740.00	10^{-2}	+175.00	0.24

iocs, in optimum concentrations of sucrose; OCV, optimum concentrations of vitamin B_6 in mg/ml for germination of pollen and tube growth; pgtgstcv, pollen germination and tube growth in optimum concentrations of vitamin B_6; PV, pollen viability; rcvs, range of concentrations of vitamin B_6 for stimulation of pollen germination and tube growth; RCPG, range of concentrations of vitamin B_6 for stimulation of pollen germination; RCTG, range of concentrations of vitamin B_6 for stimulation of pollen tube growth; SC, optimum concentrations of sucrose in %; SPG, stimulation in pollen germination in %; STG, stimulation in pollen tube growth (in mm) in %; V/O, *in vitro* tube length in compare to *in vivo* in%.

Catharanthus roseus though characterized by the presence of monosiphonous condition at a low frequency bisiphonous and trisiphonous condition was also recorded in the present investigation along with the branched pollen tubes. In this connection it should be pointed out that Sudhakaran (1967) stated that in *Vinca rosea* L. [*Catharanthus roseus* (L.) G. Don.] besides pollen grains which produced single pollen tube, it has also been noticed that tetraploid grains frequently produce more than one pollen tube. Pollen tubes are branched quite frequently. Aberrations of this type in the pollen tube development are not observed in diploid pollen tubes, but quite frequently met with the pollen grains of irradiated plants. Salgare (1983) made it very clear that Sudhakaran(1967) had failed to trace out the branched pollen tubes and polysiphonous condition which is fairly common even in diploid pollen grains. Apart from this Sudhakaran (1967) was not able to report the various types of pollen tube deformities either with diploid or tetraploid grains. Present investigation as well as the extensive work of Salgare (2006b-c, h, 07a-c, f-i) also proved that Sudhakaran's (1967) observations are superficial and misleading.

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A new report of *Characiosiphon* from west Nimar District of Madhya Pradesh

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Abstract

Characiosiphon **belongs to the order Chlorococcales of the class Chlorophyceae. It was reported for the first time from India in 1936 by M.O.P. Iyengar who collected it from a stream situated near Tiruchirapalli (Tamilnadu). Later this green alga was reported from various parts of the country i.e. Gwalior (Agarkar, 1953), Tirupati (Rao, 1954), Jodhpur (Bhandari, 1955) and Idore (Sharma, 1958). The thallus of this algae shows wide variations with respect to its length, width and the number and shape of protoplasts. The material collected from Banihar dam of West Nimar of Madhya Pradesh shows much resembalance with that of** ***C. rivularis*** **Iyengar accept that it possesses larger dimensions. The abnormalities described by Bhandari (1955) in** ***C. rivularis*** **has not been observed in the present material. The occurrence of** ***Characiosiphon*** **is a new report from west Nimar district of Madhya Pradesh.**

Keywords:- *Phycology, Fresh water algae, Chlorophyceae, Chlorococcales*

Introduction

West Nimar is one of the tribal districts of Madhya Pradesh. Khargone is the district headquarter which is situated at 21°45'N lattitude, 75°37' E Longitude and 250.38 m above mean sea level. It has a number of water bodies both of temporary and permanent nature. Very little is known about the algal flora of West Nimar except few reports (Seerwani, 1963; Mahajan, 1986, 1987, 1988 a and b, 1990, 1991 a and b, 1994, 2004, 2005a and b and 2006). As early as in 1936, Iyengar had reported *Characiosiphon* from a stream situated near Tiruchirapalli. Later on it was reported from various parts of India viz. from Gwalior (Agarkar, 1953), Tirupati (Rao, 1954) Jodhpur (Bhandari, 1955) and Indore (Sharma, 1958). This alga generally prefers standing water and temporary stream. Bhandari (1955) has described certain abnormalities in *C.rivularis,* collected from Umed bund near Jodhpur (Rajasthan).The present investigation deals with the occurrence of *Characiosiphon* for the first time from this area.

Materials and Method

During algal collection by Post-graduate students of Botany of Govt.P.G. College, Khargone in 2006-07, this new algae was collected from Banihar dam which is about 5 km away from Khargone bus stand. The material was identified after consulting the standard literature (Philipose,1967 and Fritsch, 1945).The collected material is deposited in the Botany Department, Govt.P.G.College, Khargone for record under Regd. No. PGDB 954.

Results and Discussion

The thallus of the present alga is 560 µ long and 38 µ broad with round apex and gradually tapering towards the base where it is attached to the substratum. Protoplasts in the majority of the thalli are separate from each other and appear round to ellipsoidal in surface view but in few thalli they are compactly arranged in the upper part due to mutual pressure and look angular (pentagonal to hexagonal) in surface view. Cell wall is thick and lamellated. Protoplasts are 14 to 18 µ in diameter. The thallus shows wide variations with respect to the length, width and number of protoplasts. The present material shows much resembalances with that of *C. rivularis* Iyengar accept that it possesses larger dimensions.

Abnormality in shape reported by Bhandari (1955) has not been observed in the material collected from Banihar dam.

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Study on macrophytes in Ramala lake, Dist. Chandrapur (M.S.)

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Abstract

The present piece of investigation deals with aquatic Macrophytes of Ramala Lake, Dist. Chandrapur, Maharashtra during the period May-2006 to April-2007. The lake is in the heart of city receiving sewage from maximum part of city through Mucchi Nala. During the study period, total of 18 species representing families of aquatic macrophytes. Among these, species Eichhornia and Pistia shows their dominance, indicating highly eutrophic condition of lake.

Keywords:-

Introduction

Aquatic Macrophytes are large predominantly angiospermic plants having considerable importance. There are some as good source of food and shelter to periphyton, ichthyofauna and other aquatic invertebrates. They may also serve as good source of fertilizers and some of the aquatic plants are being cultivated for their astonishing diversity of medicinal and aesthetic values (Bardach, 1968). Perusal of literature on macrophytes indicates that, many reports were available particularly from India and abroad, but no such reports are available from this area, so present piece of work was undertaken. Several workers reported on macrophytes diversity in different fresh water bodies of India and abroad. Pearsall (1921), Russel Hunter (1970), Zutshi et al., (1980), Unni (1991) and Okram et al., (1996).

Materials and method

During the period of investigation, macrophytes were collected by hand picking method from three different sites of lake, they were collected, washed and brought to laboratory in polythene bags and preserved in formaline and identified by Edmondson (1959) and Kodarkar (1992)

Result and discussion

During the period of investigation, 18 species of macrophytes were observed, among which 5 were of free floating, 8 submerged, 2 rooted with floating leaves and 3 emergent. The site wise distribution of macrophytes shows presence of 9 species at site 1, 15 species at site 2 and 16 species at Site 3 .Out of 18 species recorded Lemna sp., Azolla sp., Pistia sp., Eichorhia sp., Trapa sp., Wolffia sp., Hydrilla sp. and Vallisreria sp. were found at all the sites throughout the different seasons. Species like Sagittaria and Ipomea shows their presence only at site 3 while Nymphaea sp. at site 1.

The floristic distribution of plant species of present investigation tabulated in Table-1and were catego-

rized into 4 groups i.e. free floating (5 species), submerged (8 species), rooted with floating leaves (2 species) and species emergent (3 species).

Table-1:

Sr. No.	Name of Macrophytes	Site-I	Site-II	Site-III
	Free floating			
1.	Lemna - free floating	+	+	+
2.	Azolla - free floating	+	+	+
3.	Pistia - free floating	+	+	+
4.	Eichornia - free floating	+	+	+
5.	Wolffia - free floating	+	+	+
	Submerged			
6.	Najas - submerged	-	+	+
7.	Typha - submerged	-	+	+
8.	Potamegeton - submerged	-	+	+
9.	Sagittaria aquatica - submerged	-	-	+
10	Hydrilla - submerged	+	+	+
11.	Vallisneria - submerged	+	+	+
12.	Ceratophyllum - submerged	-	+	+
13.	Marsilea - submerged	-	+	+
	Rooted with floating leaves			
14.	Nelumbo - Rooted with floating leaves	-	+	-
15.	Nymphaea - Rooted with floating leaves	+	-	-
	Emergent			
16	Cyperus - emergent	-	+	+
17.	Trapa - emergent	+	+	+
18.	Ipomoea- emergent	-	-	+

The present findings are in conformity with Purushottama et al., (2005) in Kanale tank, Karnataka, who reported 19 species of which 2 were free floating, 5 rooted floating, 6 submerged , 1 emergent and 5 semiaquatic. Mishra and Tripathi (2004) also reported 12 species in the unpolluted site of Ganga river in Varanashi. A comparatively higher number of macrophytes species were reported by Devi (1993) with 86 species in Laktak lake, Manipur. Out of which 73 species were reported from non-phundic floating mat zone of which 6 species were submerged, 4 species free floating and 3 rooted with floating leaves species.
Recently, Devi and Sharma (2007), observed 36 macrophytes species of which 20 emergent, 8 submerged, 4 rooted with floating leaves and 4 free floating species, in Awangsoipat lake Bishnupur, Manipur. It was noticed during present investigation that flourishing growth and frequency of distribution of macrophytes was correlated with an increase in phosphate and nitrogen contents of the water bodies as these nutrients stimulate rapid organic production by aquatic macrophytes. Sarkar et al., (2002), similarly the increased dissolved oxygen (DO) and free Co, in water bodies gradually favoured the growth and distribu-

tion of macrophytes. In present investigation, a unique observation indicates the eutrophic nature of the lake. The lake has got amorphous growth of vegetation with rich biodiversity. The highest growth of submerged species indicates eutrophic nature of lake. A clear cut zone of floating and submerged species can not be observed and hence all such communities were found in intermixed mats.
However, the Eichhornia sp. showed its dominance heights may be due to increased load of sewage added by Mucchi nallah and decomposition activities. This has resulted serious threat to the ecosystem stabilization and the very existence of lake.

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Alteration of resting period of pollen of five cultivars of Apocynaceae by mineral (sodium tetraborate): Further Evidence of a Criticism of Brewbaker and Kwack (1963), Sudhakaran (1967-Ph.D.Thesis) and Saoji and Chitaley (1972) – A Critical Review*

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Abstract

Sodium tetraborate altered the resting period of pollen of 7 series and failed in 2 series of the Apocynaceae.

Keywords:- *Palynology, Minerals, Growth regulators*

Introduction

Palynology, in recent years has attracted the attention of workers of different disciplines on account of its numerous applications to problems of plant taxonomy, genetics, geology, medical and agricultural sciences. Pollen physiology furnishes the information required for effecting hybridization of plants growing in different geographical and climatic regions with blooms in different seasons.

Materials and Method

Pollen of successive flowers (*viz*. F, F-24, F-48, F-72 series *i.e*. open flowers and the flower buds which require 24, 48, 72 hours to open respectively) of 5 cultivars of Apocynaceae *e.g*. red-, pink- and white-flowered cultivars of *Nerium odorum* Soland. and pink- and white-flowered cultivars of *Catharanthus roseus* (L.) G. Don. were collected at the stage of the dehiscence of anthers in the open flowers. Germination of pollen grains of successive flowers was studied by standing-drop technique in the optimum concentrations of sucrose as well as in the optimum concentrations of sucrose supplemented with the optimum concentrations of sodium tetraborate (Table-1). The rate of pollen germination of successive flowers was determined by fixing the cultures at one hour intervals. Such preparations were continued for 10 hours. Observations on the germination of pollen were recorded 24 hours after incubation.

Results and Discussion

Potentiality of pollen germinability was recorded in F series of all the 5 cultivars of the Apocynaceae studied. It was the pollen of F-24 series of red-flowered cultivar of *Nerium odorum* and both the cultivars of *Catharanthus roseus* found germinated in the optimum concentrations of sucrose. It should be pointed out that the pollen of F-48 and F-72 series of pink-flowered cultivar of *C. roseus* showed their germination in the optimum concentrations of sucrose. Thus the potentiality of pollen germinability in Apocynaceae was observed in 10 out of 20 series investigated (Table-1). Germination of pollen of F-72 series of pink-flowered cultivar of *Catharanthus roseus in vitro* culture of sucrose was noted in the present investigation.

However, Trisa Palathingal (1990-M.Phil.Thesis) failed to germinate the pollen of F-72 series of pink-flowered cultivar of *C. roseus* in Brewbaker and Kwack's (1963) culture medium. This proves that the culture medium is also having the bearing on the germination of pollen. This also confirms that Brewbaker and Kwack's(1963) culture medium is not ideal for pollen cultures. This was also pointed out earlier by the author (2006h, m, o, 07d).

The delay in pollen germination was interpreted by Saoji and Chitaley (1972) as being due to the grains not being mature enough to effect pollination, immediately after being shed from the anther. Further they stated that 4-5 hours are required for the complete maturation of pollen grains. It was Salgare(1983) who pointed out of the first time that the pollen require resting period before germination and it was the failure of Saoji and Chitaley (1972) who misinterpreted the resting period for pollen maturity. Further he(1983) stated that this resting period differs species to species which is also noted in the present investigation (Table-1). This resting period is altered by different chemicals. Present work as well as the extensive work of Salgare(1983, 84, 85, 86b, 2001, 04, 05a-b, 06b-f, i, k, n-o, 07a-b, d-e), Salgare and Theresa Sebastian (1986), Salgare and Shashi Yadav (2002, 05), Salgare and Sanchita Pathak (2002, 05) and Salgare and Sanju Singh (2006) made it very clear that Saoji and Chitaley's (1972) arguments are superficial and misleading. Sodium tetraborate altered the resting period of pollen of 7 series and failed in 2 series of the Apocynaceae (Table-1). The mineral extended the resting period of pollen of 6 series. Sodium tetraborate caused maximum extension in the resting period of the pollen of F series of pink-flowered cultivar of *Nerium odorum*. Alteration of resting period of pollen of successive flowers by the minerals was noted by Salgare and Shashi Yadav (2002, 05). Alteration of the resting period of pollen by the herbicides was noted by the author (1983, 84, 85, 86b, 2001, 04, 05a-b, 06b-f, i, k, n-o, 07a-b, d-e) and Salgare and Theresa Sebastian (1986). Recently Salgare and Sanchita Pathak (2002, 05) and Salgare and Sanju Singh (2006) noted the alteration of resting period of pollen by the heavy metal. Variation of the resting period of pollen of successive flowers of 5 cultivars of *Petunia axillaris* in various sugars was recorded by the author (2007b, f).

Table-1: Effect of sodium tetraborate on the rate of pollen germination of successive flowers of five cultivars of Apocynaceae

Cultivars			Conc.		trfpg	
	Series	% PV	SC	ST	C	T
Nerium odorum						
Pink-flowered	F	91±0.42	50	10	1	7
White-flowered	F	61±2.87	50	10	3	5
Red-flowered	F	61±3.17	20	05	1	3
Red-flowered	F-24	61±3.17	20	10	1	3
Catharanthus roseus						
White-flowered	F	89±0.97	20	01	1	1
White-flowered	F-24	89±0.97	50	10	2	1
Pink-flowered	F	93±0.98	20	10	1	4
Pink-flowered	F-24	93±0.98	50	01	1	1
Pink-flowered	F-48	93±0.98	50	01	8	5
Pink-flowered	F-72	93±0.98	80	Ng_2	Ng_2	Ng_2

C, in control sets time required for germination of pollen in optimum concentrations of sucrose; ST, optimum concentrations of sodium tetraborate in mg/ml; Conc, ptimum concentrations of sucrose and sodium tetraborate; SC, optimum concentrations of sucrose in %; Ng_1 and Ng_2, no germination of pollen even after 10 and 24 hours of sowing respectively; PV, pollen viability; T, time required for germination of pollen in optimum concentrations of sucrose + sodium tetraborate (in treated sets); trfpg, time required for the germination of pollen in control sets and treated sets in hours.

Sudhakaran (1967) stated that in *Vinca rosea* L. [*Catharanthus roseus* (L.) G. Don.] besides pollen grains which produced single pollen tube, it has also been noticed that tetraploid grains frequently produce more than one pollen tube. Pollen tubes are branched quite frequently. Aberrations of this type in the pollen tube development are not observed in diploid pollen tubes, but quite frequently met with the pollen grains of irradiated plants. Salgare (1983, 86a, 2006a-c, e, g-h, j, l-m, 07b-d) made it very clear that Sudhakaran (1967) had failed to trace out the branched pollen tubes and polysiphonous condition which is fairly common even in diploid pollen grains. Apart from this Sudhakaran (1967) was not able to report the various types of pollen tube deformities either with diploid or tetraploid grains. Present findings as well as the previous work of Salgare (1983, 86a, 2006a-c, e, g-h, j, l-m, 07b-d) also proved that Sudhakaran's (1967) observations are superficial and misleading.

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Toxic effect of malathion on acetylcholinesterase activity of liver, brain and gills of freshwater catfish *Heteropneustes fossilis*

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Abstract

The toxic effects of malathion were evident in the inhibition of acetylcholinesterase activity of liver, brain and gills of freshwater catfish *Heteropneustes fossilis*. Maximum inhibition of 77.12% and 72.83% were recorded in brain and gills respectively after 72 hour of exposure to 4.80 mg/l pesticide. However, in liver highest inhibition of 67.81% in enzyme level was noticed at 6.50 mg/l pesticide concentration after 24 hours of exposure, beyond which fish could not survive. Pesticide repressed the enzyme activity so intensely that it showed no sign of return to normalcy. The fish also elicited dissociated behaviour with increasing concentrations of pesticide toxicity.

Keywords:- *AchE, Malathion, Toxicity, Concentration, Inhibition*

Introduction

Fish inhabiting a diverse environment are sensitive to toxic environment, being exposed via extensive delicate respiratory surface. Wide variety of pesticides and due to their persistance and nonbiodegradable nature, they got accumulated in different tissues of the fish and affect their growth and survival (Kaur and Toor, 1977; Kulshrestha and Arora, 1985). Acetylcholinesterase is the enzyme responsible for terminating the action of acetylcholine at cholinergic synopsis (Ronald *et al.,* 1999). It acts as a key transducer at cell membrane level, an alteration in the level of its functional activity may result in microdeformation and configurational change. Acetylcholinesterase is the target enzyme for organophosphate pesticides which is inhibited by these pesticides and its inhibition leads to blockage of neurotransmission (O'Brien, 1976) leading to physiological alterations in non targeted organisms of the aquatic system.

Present observation deals with the effect of organophosphate pesticide malathion on the Acetylcholinesterase (AchE) activities of liver, brain and gill tissues of freshwater stinging catfish *Heteropneustes fossilis,* highly popular and expensive table fish, due to its higher nutritional quality and medicinal value.

Materials and Method

Freshwater stinging catfish *Heteropneustes fossilis* (length 20.5 – 24.0 cm, weight 160 – 200 grams) were collected from local resources, transported to laboratory and treated with $KMnO_4$ (2 mg/l). Apparently healthy looking fishes were acclimatized for seven days in glass aquaria under standard laboratory conditions and fed them with small pieces of goat liver, but starved for a period of 24 hours prior to the experiment. Static bioassay tests were followed as given by Doudoroff *et al.,* 1951; APHA, 1992. The pesticide was commercially formulated product (Cynamid India Ltd.), extensively used in India. Pesticide concentrations were selected on the basis of 80 – 100% survival of fishes for that period. Control fish in

experiment were also maintained in identical conditions.
The controled and exposed fishes were taken out from each preparation after every 24 hours interval and washed with distilled water. Liver, brain and gill tissues were taken out and 2.5% homogenate was prepared in 0.7% saline solution, at nearly freezing temperature. Biochemical analysis was performed following the method of Hestrin (1949), using Bausch and Lomb spectronic - 20 spectrophotometer at 540 µm against blank. The physico-chemical properties of the tap water used in the experiment were as follow: temperature (22±1.4 ^{0}C), pH (7.4±0.02), Dissolved oxygen (6.6±0.8 mg/l), alkalinity (106±10.0 mg/l) and hardness (118±12.4 mg/l).

Results

Acetylcholinesterase activity was significantly inhibited by malathion toxicity in *H. fossilis*. The results obtained on enzymal activity of liver, brain and gill tissue of fishes, exposed to different concentrations of

Table-1: Effect of Malathion toxicity on Acetylcholinesterase levels of *H. fossilis*

Pesticide conc. (mg/l)	**Acetylcholinesterase (µ moles Ach hydrolysed/ 100 mg f. wt./ hr.) Mean ± Standard Deviation**			
	Time of exposure in hours			
	24	**48**	**72**	**96**
LIVER – Control – 69.60±8.15				
3.55	28.80±7.05	32.60±6.40	38.40±3.82	41.36±5.05
4.80	36.00±7.75	29.60±2.82	23.20±3.72	
5.80	30.00±3.72	26.40±5.05		
6.20	22.40±5.40			
BRAIN – Control – 75.20±9.21				
3.55	31.20±6.56	32.80±6.10	29.60±5.05	30.00±6.32
4.80	36.80±7.83	33.40±4.25	17.20±4.07	
5.80	44.00±8.84	15.20±5.05		
6.20	18.80±6.09			
GILLS – Control – 64.80±6.64				
3.55	24.40±5.04	27.20±2.70	32.80±1.91	37.60±3.20
4.80	43.20±7.21	32.80±3.72	17.60±4.36	
5.80	30.60±3.82	25.60±4.10		
6.20	28.00±4.60			

No. of observations – 8 in each experiment

pesticide have been summarized in Table-1. At 3.55 mg/l pesticide concentration AchE levels were inhibited 58.62%, 53.16%, 44.82% and 39.08% in liver, 58.51%, 56.38%, 60.63% and 60.10% in brain and 62.34%, 58.02%, 49.38% and 41.97% in gills, after exposure for 24, 48, 72 and 96 hours respectively, from control levels. The maximal inhibition was found in liver after 24 hours, in brain after 72 hours and in gills after 24 hours. At 4.80 mg/l concentration the enzyme level continuously fell by 48.27%, 57.47% and 66.66% in liver, 51.06%, 55.58% and 77.12% in brain and 33.33%, 49.38% and 72.83% in gills after exposure to 24, 48,

72 hours respectively, versus control levels. At 5.80 mg/l concentration AchE activity decreased significantly by 56.89% and 62.06% in liver, 41.48% and 79.78% in brain and 52.77% and 60.49% in gills after exposure for 24 and 48 hours respectively, as compared to control. At the highest concentration of 6.50 mg/l, all the fishes died after 24 hours of exposure, when decline of 67.81% in liver, 75.00% in brain and 56.79% in gills had occurred from initial control levels.

Pesticide repressed the enzymal activity so intensely that it showed no sign of return to normalcy and finally proved fatal to fish after 96 hours, even at the lowest concentration of pesticide used. Exposure at higher concentration of pesticide, fish appeared restless, hyperactive showing erratic movements, rapid opercular movements, gulping air at the surface, followed by loss of balance, became calm and finally died.

Discussion

Esterases and transaminases are the target enzyme involving every tissue. Interaction of these enzymes with toxicant is a complex phenomenon involving interplay between several metabolic pathways. Repressed enzyme levels caused by toxicant and other associated compounds have been attributed to decreased neurosecretory and hepatosecretory activities (Praveen *et al.*, 2004). The toxicant on entering into the fish body affect their metabolism, leading to physiological, pathological and biochemical disorders (Bais and Arasta, 1995; Arasta *et al.*, 1999; Karuppasamy, 2000; David *et al.*, 2003). Organophosphate pesticide are known to metabolise into their corresponding oxygen analogue which are potent inhibitors of acetylcholinesterase in invertebrates and vertebrates (Natarajan, 1984). Varied Lc_{50} have been reported with different organophosphate pesticides in different fishes under varying situations (Kumar *et al.*, 1995; Thannipon *et al.*, 1995; Rawat and Bhargava, 1997; Nath *et al*., 2000; Jeyarthi Shanti and Jebanesan, 2001; Sharma *et al*., 2001 and Singh, 2003) noticed marked decline in acetylcholinesterase activity. Present investigation clearly indicated significant inhibition in AchE enzyme levels in liver, brain and gill tissues of *H. fossilis*, due to the toxicity of malathion, even at lowest concentration. Sudheer Kumar *et al*., (2006) reported maximal inhibition in AchE in brain followed by muscle, gill and liver in *Tilapia mossambicus*, exposed to chlorophyriphos. Progressive decrease in AchE activity in Nile *Tilapia* by Thannipon *et al.*, (1995) exposed to monocrotophos. Fish *H. fossilis* exposed to different concentrations of malathion for different periods revealed comparatively higher abatement in brain showing a maximal inhibition of 77.12%, followed by gills (72.83%) and liver (67.81%). Gills and body surface being the primary sites of absorption (Murphy, 1971; Kumar *et al*., 2000) were the first to be affected by toxicant. In order to get rid off the toxic environment fish exhibited, increased opercular movements copious mucus secretion followed by restlessness, hyperactivity and erratic movements showing fish in acute stress. Intensity in such evident behavioral changes are dose dependent (Matsmura, 1980) and their median survival time seems to be directly related to body size, weight and age. Profuse secretion of mucus by gills with oedema and fusion of hyperplastic secondary gill lamellae were observed by Mishra *et al*., (2005). It appears that fish *H. fossilis* exposed to lowest concentration of pesticide did not reach up to the exhaustion, rather they were able to accommodate and acclimatize with the developed stress.

Biochemical changes due to the utilization of organic resources of fish owing to the shift in respiratory metabolism in toxic environment, possibly yielded excess energy to compensate the stress. A shift in cellular respiratory metabolism towards anaerobiosis as a prelude towards adaptability to cope with the enhanced energy demand (Obula Reddy and Neerja, 2001). Chandra (1988) opined that malathion may

lead to inhibition of cholinesterase at neuro effector sites in adrenal medulla, leading to hypersecretion of adrenalin which resulted in hypermetabolic conditions to meet stress condition. Tandon and Dubey (1983) reported increased aldolase activity, an important gluconeogenic enzyme to withstand the stress condition caused by pesticide malathion and dimicron in *Clarias batrachus*. Marked inhibition in AchE in different tissues of fish following exposure to higher concentration of sumithion has been reported by Koundiya and Ramamurthy (1978), Dubey (1980), Natrajan (1984), Thannipon *et al*. (1995) and Sudheer Kumar *et al*. (2006). It has been observed that the cause of death in organophosphate pesticide poisoning is always asphyxiation. The pesticide penetrates brain which results in the failure of respiratory centre of brain after that of respiratory organs (O'Brien, 1976). In these observations AchE levels were prominently hindered in brain and gills at lower but maximal inhibition occurred in liver at highest malathion concentration. Since the fishes have ability to detoxify xenobiotics in their liver like mammals, probably that is why liver might have the last target of toxicant in accumulating more acetylcholine. The dissociated behaviour of fish *H. fossilis* may be related due to the accumulation of acetylcholine which resulted in neuromuscular paralysis of the bronchial pump and oxygen diffusion across the gill and lead to excitatory effects like tremors and convulsions.

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Rotifer diversity in Ramala lake, Dist. Chandrapur (Maharashtra)

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Abstract

An extensive study of the ecology and systematics of Rotifers in the Ramala Lake of Chandrapur was made from May-2006 to April-2007. The Rotifers constituted 34.6% of total zooplankton and their density ranged from 300 to 2000 ind/ltr. The higher density of Rotifers was recorded during winter season whereas, minimum observed in summer. Dominance of Family Brachionidae was observed during the whole period of investigation indicates the eutrophication in the ecosystem.

Keywords:- *Rotifers, Ecology, Diversity, Eutrophication, Ramala lake*

Introduction

Globally, around 2000 species of rotifers are known. Present study of rotifers in India have 325 species belonging to 25 families and 63 genera. Thus rotifer species from this country comprise about 13% of the global Rotifera (Sharma, 1998). Rotifers play the role as link between the nanoplankton and carnivorous zooplankton. Rotifer exhibits ability to colonise diversified freshwater biotopes and they are apparently the most sensitive indicators of water properties.

Rotifers can populate vacant niches with extreme rapidity and convert primary production into a form, usable for secondary consumer, producing upto 50% of the total plankton biomass . Rotifers are amongst some of the most abundant and important members of the freshwater fauna. According to Sladeck (1983) rotifer population are very useful in indicating water quality, particularly in pollution studies.

The Ramala Lake is oldest of its kind and is situated in the central part of the City, the lake is influenced by anthropogenic activities like washing, bathing, boating, idol immersion and commercial fishery.

Materials and method

The study was concluded from May-06 to April-07, the zooplankton samples were collected monthly by towing 41 mm mesh net, brought to laboratory and preserved in 4% formalin for identification and counting. The rotifers were observed with the help of binocular microscope and counted with Sedgwick Raffter Cell and identified by Edmondson (1959), Tonapi (1980) and Dhanapathi (2000).

Results and Discussion

Detailed microscopic examination of rotifera under binocular microscope has carried out and revealed that, there were total 18 species observed throughout the study period. In rotifers, Brachionus genera showed their dominance during winter season and least occurrence during monsoon and moderate during summer. Rotifers are aquatic microscopic (100-1000 mm) organisms with the anterior end modified into a ciliary organ, the corona. The coronal disc with synchronous beating of its cilia look like a rotating wheel hence

rotifers are commonly called wheel animalcules.

Sharma (2001) in a review article focus the role of fresh water rotifera as a biological indicators and bio-monitor in water quality assessment. A rational approach to maintain desirable quality of our fresh water resources is to recognize the bio-indicator species dwelling in them, this offers option and opportunity. For environmental engineers and biologist to designate and recruit appropriate rotifer species and operate the bioreactors at peak efficiency in water treatment and recycling.

In the present investigation, 18 species of rotifer population were observed belonging to 10 genera. The rotifera population in Ramala Lake has higher magnitude during winter season and lower magnitude during monsoon. Their diversity and density is mainly controlled by availability of food as a favourable water quality.

The similar study was reported by Abdus Saboor and Altaff (1995) in a tropical pond during summer and rainy season. Seshagiri Rao et al., (1984) observed in Manjira reservoir, Sangareddy (A.P.).

The higher density as well as biomass of brachionoids in the zooplankton community clearly indicate that most of the ponds are polluted by the organic pollution. Most of which is contributed by the domestic sewage, Sladecke (1983).

Table-1: Monthly variation in different species of rotifers

Sr. No.	Rotifers	May	June	Jully	Aug	Sep	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1.	Filina longiseta	03	01	-	-	06	06	09	06	11	05	04	02
2.	Filina opoliensis	06	02	-	-	02	02	-	-	-	03	-	03
3.	Keratella tropica	25	39	05	02	17	19	19	25	32	12	13	19
4.	Asplanchna sp.	13	12	02	-	-	07	07	11	11	03	-	09
5.	Trichocerea longiseta	12	04	03	01	02	11	11	17	21	07	05	07
6.	Trichocerea cylendrica	04	02	-	-	-	02	03	06	06	05	02	04
7.	Trichocera porcellus	05	04	-	02	02	02	-	-	04	04	04	04
8.	Brachionus calyciflorus	04	-	-	-	03	02	02	06	06	-	-	07
9.	Brachionus quadricornis	10	02	02	-	-	03	05	05	03	03	16	09
10.	Brachionus forficula	27	17	07	07	13	18	18	25	27	14	12	14
11.	Brachionus Bidenta	09	03	-	-	12	12	12	02	-	-	12	06
12.	Brachionus plicatilis	05	02	-	-	-	02	02	08	07	-	-	05
13.	Lepadella sp.	02	02	-	-	-	02	02	04	06	06	-	-
14.	Lecane bidentata	08	-	-	02	02	06	06	06	-	-	05	08
15.	Lecane monostyla	06	05	-	-	-	-	02	07	07	-	-	02
16.	Monostyla bulla	04	02	-	01	-	-	02	04	06	-	-	02
17.	Synchaeta sp.	07	-	02	01	06	08	-	-	08	08	06	06
18.	Epiphanes sp.	02	01	-	-	01	-	01	01	02	01	02	03

In the present investigation, brachionoids showed high density in the rotifers. Brachionus forficula showed their dominance as far as B. calyciflorous observed minimum. The B. calyciflorous species considered as fresh water Indicator.

Seasonal changes in Rotifera density depends particularly on physical condition i.e. water quality, partially on available food supply and partially on predatory pressure exerted by the carnivorous zooplank-

ton. In present investigation, the less number of genera observed during monsoon may be due to high water level and less nutrients in the pond. The reduction in the number of genera may also be due to predation.

In the monsoon, fall of rotifers density can be attributed in the distributed effects (Bhati and Rana, 1987). Brachionus species are the characteristic feature of eutrophic status, as far as Ramala Lake shows brachionus species dominance, indicating higher eutrophic nature of lake.

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Population dynamics of mycoflora in BLSB susceptible maize varieties

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Abstract

Seed mycoflora of three varieties susceptible to Banded leaf and Sheath blight disease of maize was isolated from fresh harvest of 2007 following agar plate method. The results indicated the presence of fifteen species belonging to eleven genera. Highest percentage of *Aspergillus niger* was recorded in all tested varieties. The effect of dominant fungi on seed germination, seedling growth, and their fresh and dry weight and vigour index was recorded. It showed that highest (94%) percent of seed germination was observed in control.

Keywords:- *Maize, Seed mycoflora, Banded leaf and sheath blight, Susceptible, Rhizoctonia solani*

Introduction

Maize (*Zea mays* L.) is an important cereal crop of the world. In India maize occupies fifth place in area and fourth in production among the major cereals grown poor seed germination, seedling growth and no. of diseases are responsible for the low productivity seed borne mycoflora is a term indicating the association of fungi with seeds or parasitic,easily penetrating into the seed causes instant death or delayed systemic infestation of the emerging seedling. In India maize suffers from a number of diseases viz., Rust and Smut of maize,Charcoal rot, Sclerotial blight (Banded leaf and sheath blight), Bacterial stalk rot, Turcicum leaf blight etc. Among these Banded leaf and sheath blight and bacterial stalk rot are economically important. Banded leaf and sheath blight disease is caused by the most versatile and dreaded pathogen *Rhizoctonia solani (*Kuhn). Banded leaf and sheath blight causes 15-20% yield losses annually (Saxena, 2002).
The yield and emergence of seeds are to known to be affected by a number of factors among which seed borne microbes are prominent. The longevity of seed is determined largely by fungi. Extensive work has been done on seed mycoflora of different crops in India (Singh *et al.*, 1973; Borah *et al.*, 2003; Das *et al.*, 2003; Wattal and Puttoo, 2003).
Present study was carried out to check the seed mycoflora of some varieties popularly grown by maize farmers in district Bahraich, the percentage occurrence of isolated mycoflora and their effect on germination, seedling growth and vigour.

Materials and Method

Seeds of three popular Cv. of maize viz., Amar, Sweety and Suguna were collected from different seed lots in different agroecological regions of Bahraich district following ISTA (1993). These Cv. are susceptible to Banded leaf and sheath blight disease. The freshly harvested seeds of maize varieties 2007 was used as seed samples. For isolation of all possible mycoflora associated with 100 surface sterilized seeds by 2% Sodium hypochlorite (NaOCl) and 100 unsterilized seeds were plated by following standard technique, agar plate method (APM). Observations were done after seven days of incubation at

temperature25^{0}C.Number of colonies of each fungus were counted and percentage occurrence of each fungus was calculated.

For testing the pathogenic behaviour of dominant fungal forms towel paper method was followed (ISTA, 1993). 1*10^6 cfu of *Aspergillus niger, Aspergillus flavus* and *Aspergillus fumigatus* were inoculated with surface sterilized seeds. Observations were recorded after seven or eight days of incubation. Control was also maintained for comparison. Germination percentage, fresh and dry weight of root and shoot along with their length was observed. Vigour index was also calculated following Abdul-Baki and Anderson (1973).

Results and Discussion

The result reveals fifteen species were found associated to all tested varieties at varying level of incidence. Ten species were detected from Cv., Amar; nine from Sweety; ten from Suguna.

Cv.Amar: *Aspergillus niger, Aspergillus fumigatus, Aspergillus flavus, Aspergillus ochraceous, Alternaria tenuis, Curvularia lunata* were associated internally. *Rhizopus nigricans, Penicillium citrinum, Fusarium roseum* and *Phoma* sp. was associated externally.

Cv.Sweety: *A.niger,A.fumigatus,A.tenuis,C.lunata,R.nigricans* were associated externally while *A,flavus,F.roseum,Phoma* sp. was found associated internally.

Cv.Suguna:*A.niger.A.fumigatus,A.alternata,Dreschelra* sp.,*C.lunata,Mucor variens* were externally associated and *A,flavus,P.citrinum,F.roseum,Monilia* sp. were internally associated with seeds.Neither a single colony of *Rhizoctonia solani* was observed in all tested varieties.

The effect of seed borne fungi on germination showed the maximum (94%) in control and minimum (74%) in *A.flavus* inoculated seeds. Highest root length (10.0cm) was observed in *A.flavus* and lowest (6.8cm) in *A.niger* inoculants. Highest shoot length (7.0cm) was recorded in *A.fumigatus* and lowest (3.2cm) in control.

Fresh and dry weight was maximum (0.269, 0.036) in *A.flavus* and minimum (0.128, 0.008) in control respectively. Fresh weight of root was recorded maximum (1.004) in *A.fumigatus* inoculants and minimum (0.070) in *A.niger* by causing seed rotting and seedling mortality. *Aspergillus niger* showed minimum effect on seed germination and seedling growth.*A.flavus* was pathogenic causing seed rotting and seedling mortality.

Loss in germinability have been reported by several workers (Kumhar *et al.*, 1987; Mehrotra *et al.*, 1992; Mondal *et al.*, 1981). By the association of different fungi both pathogenic and bioagent inoculated vigour index has been calculated Nayak *et al.*, (2001).

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A study on organic pollution based on algal distribution in some rural and Temple ponds of Balrampur, U.P. India

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Abstract

The present paper deals with the algal distribution and organic pollution in fifteen rural and temple ponds in Balrampur. Algae belonging to Chlorophyceae, Cyanophyceae, Euglenophyceae and Bacillariophyceae were studied. Occurrence of *Microcystis aeruginosa* was observed in many ponds. Among the ponds studied one pond showed confirm high organic pollution, five ponds moderate organic pollution, five probable high organic pollution and four ponds no organic pollution.

Keywords:- *Organic pollution, Algal distribution, Temple pond*

Introduction

Fresh water resources of Balrampur are facing destruction due to urbanization and development. Land filling and no reliance on traditional water sources have led to the destruction or impairment of traditional ponds. Due to this, quality of water in many ponds have drastically deteriorated. The rural and temple ponds of Balrampur have traditionally served as source of water for drinking and recreational purposes. No reports are available on the quality of water in these ponds. Algae often serve as good indicator of the quality of the water, hence a study was undertaken to understand the floristic structure and to evaluate the water quality by employing the water quality index of Palmer (1969).

Materials and Method

The present study was carried out in fifteen ponds located in and around Balrampur, These ponds are - (1) Tulsidas pokhara (2) Mewalal talab (3) Pajawa tal (4) Jharkhandi talab (5) Motisagar tal (6) Purainiya tal (7) Jalwania pond (8) Burhwa tal (9) Suraj kund (10) Radha kund (11) Jhali tal (12) Seta dwar pond (13) Bihar pond (14) Chikani pond and (15) Mouri pond.
Collections were made during October to December 2006. The samples were preserved in 4% formaldehyde and the phytoplankton were identified using relevant monographs. Palmer's pollution index[1] was employed to find out the level of organic pollution in these ponds. For quantitative estimation, haemocytometer method was used and percentage composition of all the groups was calculated.

Results and Discussion

In the present study the algal flora was dominated by diffrent groups viz. cyanophyceae, chlorophyceae, euglenophyceae and bacillariophyceae. The distribution pattern of phytoplankton in different ponds is summarized in Table-1.
About thirty two algal genera dominated the flora. Among them six belonged to *Cyanophyceae* sixteen to

Table-1 : Distribution of phytoplankton in fifteen pond

Algal genera	Pond Name														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Chlorococcus	+	+		+	+	+	+	+					+		+
Merismopedia	+				+	+		+						+	+
Microcystis		+	+	+		+	+				+			+	
Oscillatoria				+	+	+		+			+				+
Anthrospira	+														
Alabaenopsis															
Chlamytomonas														+	
Chlorella													+		
Ankistrodesmes	+	+	+		+	+		+	+	+	+		+	+	
Coelastrum		+			+	+		+						+	+
Crucigenia			+					+						+	
Dictyosphaerium	+	+	+		+			+						+	+
Scelenastrum		+													
Kirchneriella	+							+						+	
Micractinium											+				
Pediastrum	+	+	+		+	+		+	+		+			+	
Schoroederia	+						+								
Tetraedron		+							+	+	+			+	
Tetrastrum	+					+									
Scenedesmus	+		+	+	+	+	+	+	+	+	+			+	+
Cosmarium	+														
Staurastrum					+										
Euglena	+			+	+				+				+		+
Phacus					+						+		+		
Lepocinclis													+		
Trachelomons	+	+	+						+	+	+		+		+
Cyclotella															
Melosira				+		+				+	+	+	+		
Synedra															
Cymbella	+	+													
Navicula					+										
Nitzschia				+		+	+	+			+	+	+	+	+

chlorophyceae, four to *euglenophyceae*, and six to *bacillariophyceae*. The Jhali tal showed dominance of *bacillariophyceae*. The *chlorococcales* were widely distributed a most of the ponds studied. Among them

Scenedesmus represented in thirteen and *Ankistrodesmus* in twelve ponds. The ponds offer a suitable habitat for these algal forms. The percentage composition also showed variation. The algal percentage composition of various algal groups in the 15 ponds is given in Table-2.

The Palmer's algal pollution index is employed in all the ponds and the results are summarized in Table-3. The maximum index was observed in Motisagar Tal with an index value of 22. Five ponds showed moderate organic pollution, five showed probable high organic pollution and four ponds showed no organic pollution. Aquatic habitat assessment with relation to the resident algal community helps in assessing the quality of the water resource. Algal community dominated by *Chlorococcus, Microcystis, Ankistrodesmus, Dictyosphaerium, Pediastrum, Scenedesmus, Trachelomons, Melosira and Nitzschia* were found in many ponds. Their presence is an indication of the organic pollution of the water as established by [1, 2, 3] and Hosmani and Bharati (1980). The genus *Scenedesmus* is represented in thirteen ponds, its occurrence in polluted water especially in eutrophicated water is established by[4]. Palmer (1969) also gave a high ranking for this genus. The absence of desmids is often considered as an indication of pollution in pond. Absence of desmids was observed in thirteen ponds. All these ponds except one showed moderate levels of organic pollution. Singh (1973) used *Microcystis (Anacystis)* as the best single indicator of pollution[6]. About fifty percent of the ponds studied showed the presence of *Microcystis* suggesting the deteriorated quality of the water.

Table-2: Percentage composition of algae in fifteen ponds

Algal Class	Pond														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Cyanophyceae	12	49	40	59	14	47	75	18	0	0	55	7	7	32	67
Chlorophyceae	84	13	40	24	30	33	15	72	38	25	19	26	26	59	20
Euglenophyceae	0	33	20	7	0	0	0	0	62	13	12	62	62	0	3
Bacillariophyceae	4	5	0	10	56	20	10	10	0	62	14	5	5	9	10

Table-3: Palmer's algal generic pollution index values in fifteen ponds

Algal genera	**Index values**	**Pond**														
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Anacystis	1		1	1	1		1	1				1			1	
Oscillatoria	4				4	4	4		4			4				4
Phormidium	1															
Chlamydomonas	4														4	
Pandorina	1															
Scenedesmus	4	4	4	4	4	4	4	4	4	4	4	4			4	4
Micratimium	1											1				
Ankistrodesmus	2	2	2	2			2		2	2	2	2		2	2	
Chlorella	3													3		
Closterium	1															
Stigeoclonium	2															
Cyclotella	1															
Melosira	1		1		1	1	1				1	1	1	1		
Gomphonema	1															
Navicula	3	3														
Nitzschia	3				3		3	3	3			3	3	3	3	3
Synedra	2					2										
Euglena	5	5		5	5	5				5				5		5
Phacus	2			2								2		2		
Nepocinelis	1													1		
Total		**14**	**8**	**14**	**18**	**22**	**15**	**8**	**13**	**11**	**7**	**18**	**4**	**17**	**14**	**16**

Biological indices offer a cheap, fast and effective means of finding the pollution status of the water. By employing Palmer's algal pollution index it was found at about seven percent of the ponds showed confirmed organic pollution, thirty three percent showed probable high organic pollution, thirty three percent showed moderate organic pollution and twenty seven percent showed no organic pollution. It is found that quality of water in majority of the ponds are in a poor state.

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Zooplankton diversity of Tadoba lake, Tadoba Andhari tiger reserve (TATR) Dist. Chandrapur, (M.S.)

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Abstract

Tadoba Andhari Tiger Reserve exhibits rich floral and faunal diversity. However, no consolidated account is available on its rich biodiversity. In considering the view of great Tadoba Lake, the present density was investigated; the study reveals that the biodiversity of zooplanktonic organisms has been fairly good which is evident from the identification of four groups with 33 species. The rich faunal density indicates highly productive nature of pond.

Keywords:- *Tiger reserve, Biodiversity, Zooplanktonic*

Introduction

Tadoba Andhari Tiger Reserve (TATR) in the Chandrapur District in Eastern Maharashtra represents a unique habitat for wildlife in central India and oldest National Park of the state. Tadoba has been named after the local Gond Chieftan "Taru", locals offer prayer to *Tadoba Deo* located on the edge of the Tadoba Lake. There is a belief that sprinkling water of Tadoba Lake on their farmland deeps pests and disease under control. Tadoba Lake is a big lake about 120 ha. and it is a very prominent tourist spot of Maharashtra State.

Zooplankton are the most fascinating group of micro- organism found in aquatic body. The zooplankton in water belongs to four main taxonomic groups such as Rotifera, Copepoda, Cladocerans and Ostracoda. They are abundant in the shallow area of the lake; they play a vital role as primary consumers. The occurrence and abundance of zooplankton in a lake depends on its productivity. Zooplankton occupies an intermediate position of food webs.Zooplankton has been used as an indicator for monitoring the water quality. The zooplankton that plays a role of converting phytoplankton into food, it is suitable for fish and aquatic animals. Zooplankton has been a subject of study in India and several worked by some workers, Dhanpati (2000), Tonapi (1980), Pennak (1955), and Kodarkar (1992). The paper deals with studies on zooplankton diversity in Tadoba Lake. Seasonal qualitative and quantitative analysis of zooplankton diversity were carried out.

Materials and method

During the period of investigation, samples were collected by plankton net made by silk bolting cloth no. 25 (mesh size 56), water sample was filtered through the net from littoral and open water zone, carefully transferred to 50 ml. bottle and preserved in 4% formaline. Preserved samples were examined under a binocular microscope by using Sedgwick Raffter Cell. Qualitative analysis was done by Tonapi (1980), Pennak (1989), Dhanpati (2000) and Kodarkar (1992).

Results and discussion

The seasonal abundance of zooplankton average were noted in table – (1 and 2). Seasonal zooplankton study shows that qualitatively 33 species were identified, these belonging to different taxonomic groups, 15 were Rotifera, 9 Cladocerans, 8 Copepoda and one from Ostracoda. In present investigation, Rotifera shows dominance and Ostracoda shows their least appearance, Cladocerans and Copepoda were moderate.

In seasonal variation, the maximum average density of total zooplankton (238 ± 34.59) ind/lit. was noted during the winter season of 2005-06 and minimum seasonal average density (100 ± 12.44) ind/lit. was noted during summer season of 2005-06.

Table-1: Average seasonal values of zooplankton in Tadoba lake during 2005-06

Sr. No.	Zooplankton	MONSOON	WINTER	SUMMER
	Rotifers			
1	T. cylendrica	1.25 ± 1.118	2.50 ± 1.12	1.50 ± 1.12
2	T. longiseta	5.25 ± 1.920	6.75 ± 3.269	1.50 ± 1.12
3	B. calyciflorus	2.75 ± 1.479	7.50 ± 2.693	2.50 ± 1.500
4	B. fulcatus	4.75 ± 3.112	10.2 ± 6.300	3.75 ± 2.487
5	B. quadricornis	5.00 ± 2.345	10.5 ± 2.291	2.25 ± 1.479
6	B. forficula	2.25 ± 2.487	5.50 ± 3.041	3.25 ± 1.920
7	B. rubens	2.25 ± 2.487	7.75 ± 2.278	1.50 ± 1.12
8	B. plicatus	2.50 ± 2.598	7.75 ± 2.947	5.25 ± 3.112
9	B. diversicornis	3.50 ± 1.803	4.25 ± 2.681	2.75 ± 2.165
10	F. longiseta	0.75 ± 0.829	1.75 ± 1.785	0.00 ± 0.00
11	Monostyla	5.25 ± 1.920	9.00 ± 7.450	3.75 ± 2.487
12	Keratella	3.00 ± 2.236	12.2 ± 5.974	1.50 ± 1.658
13	Asplanchna	2.00 ± 0.707	1.80 ± 1.12	2.00 ± 1.871
14	Lecane	3.00 ± 1.871	7.00 ± 1.358	3.50 ± 1.118
15	Epiphanes	0.00 ± 0.00	0.25 ± 0.50	0.00 ± 0.00
	Ostracoda			
1	Cypris	9.50 ± 7.500	0.00 ± 0.00	10.5 ± 10.595
	Cladocera			
1	Moinodaphnia	7.50 ± 7.826	13.0 ± 4.301	4.25 ± 1.090
2	M.branchiata	2.75 ± 1.479	8.50 ± 3.571	4.25 ± 3.832
3	B.longirostris	2.25 ± 2.487	0.00 ± 0.00	0.00 ± 0.00
4	Simocephalus	4.25 ± 2.278	4.50 ± 2.50	5.50 ± 1.803
5	Alona	4.00 ± 2.915	7.50 ± 3.20	3.50 ± 1.80
6	Chydorus	4.75 ± 1.92	6.00 ± 1.41	1.75 ± 1.48
7	P. denticulatus	4.75 ± 2.385	7.25 ± 2.947	3.75 ± 1.299
8	C. reticulata	3.25 ± 4.548	7.75 ± 5.309	4.25 ± 3.031
9	Macrothrix rosea	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
	Copepoda			
1	Cyclops male	3.25 ± 2.947	1.75 ± 1.785	0.00 ± 0.00
2	Cyclops female	6.75 ± 1.479	9.00 ± 4.64	3.25 ± 1.785
3	Mesocyclops	1.00 ± 1.25	0.00 ± 0.00	0.00 ± 0.00
4	Microcyclops	1.50 ± 0.866	9.25 ± 2.17	2.25 ± 2.278
5	Eucyclops	4.00 ± 3.317	11.0 ± 4.12	3.00 ± 1.225
6	Diaptomus male	3.25 ± 2.861	2.50 ± 1.50	1.75 ± 1.920
7	Diaptomus female	6.75 ± 4.815	10.2 ± 3.63	2.25 ± 1.920
8	Nauplius	1.00 ± 1.225	1.50 ± 1.12	0.00 ± 0.00

Table-1: Average seasonal values of zooplankton in Tadoba lake during 2005-06

Season	MONSOON	WINTER	SUMMER	AVERAGE
Rotifers	43.50 ± 11.41	129.00 ± 27.74	35.00 ± 11.81	69.17 ± 42.45
Ostracoda	9.50 ± 7.50	0.00 ± 0.00	10.50 ± 50.59	6.67 ± 4.73
Cladocera	33.50 ± 11.19	54.50 ± 8.08	27.25 ± 4.38	38.42 ± 11.65
Copepoda	33.50 ± 11.19	45.25 ± 7.79	12.50 ± 4.56	30.42 ± 13.54
Total Zoo	120.0 ± 18.17	238.00 ± 34.59	100.0 ± 12.44	152.6 ± 60.88

Discussion

The Study of zooplankton fauna especially zooplankton, even of a particular area is an extensive and complicated phenomenon due to environment, physical, geographical, and chemical variations involving ecological, extrinsic and intrinsic factors. The members of zooplankton community are important for their role in trophic dynamics and in energy transfer in the aquatic ecosystem. The seasonal fluctuations of the zooplankton population are a well-known phenomenon. Welch (1952) mention that, the fluctuation in zooplankton population is greatly influenced by the variation in temperature along with many other factors. Among the several factors, temperature seems to exhibit the greatest influence on the periodicity of zooplankton (Battish and Kumari, 1996). In the present investigation, seasonal zooplankton study shows that qualitatively 33 species were identified, these belonging to different taxonomic groups, 15 were Rotifera, 9 Cladocerans, 8 Copepoda and one from Ostracoda. In present investigation, Rotifera shows dominance and Ostracoda shows their least appearance, Cladocerans and Copepoda were moderate. Similar findings were observed in Jagtunga samudra reservoir, Kandhar, Dist. Nanded (Ugale, 2002). The zooplankton population in Tadoba Lake was higher magnitude during winter season and the lower magnitude during summer. Their diversity and density is mainly controlled by availability of food as favourable water quality (Chandrashekher, 1997).

In the present study, the results indicate that the maximum number of species occurred during winter season than summer and monsoon, which was also reported by Abdus Saboor and Altaff (1995), Kumar (2001). The less number of genera might be attributed to the less nutrient in the pond which consequently result in less productivity or might be due to the depletion important factors such as dissolved oxygen and pH. According to Welch (1952) in most of the tropical fresh water bodies, pH is always correlated with photosynthetic activity and phytoplanktonic biomass.

Rotifera group shows their dominance, maximum population densities were observed during winter season and minimum population density was during summer season. Dhanapathi (1997) had suggested that, temperature plays a conspicuous role in the occurrence of variations in rotifers in tropical region.

Cladocerans species were shows maximum population density during winter season and minimum population density during monsoon. The success of Cladocerans mainly depends on ability to feed efficiently on a wide range of particular organic matter. Number of Copepods Species recorded in present study were eight. Maximum population density of copepods occurs in winter season. Among the copepods Cyclops sp. and Diaptomus sp. were dominant. Ostracoda species presence was least in number; only Cypris species was recorded during investigetion. Maximum population density of Ostracoda was observed during monsoon and total absence during winter season. Environmental factors like temperature, salinity, DO, and sediment composition seem to influence cumulatively the distribution of Ostracods. The higher population of Ostracoda during monsoon could be due to abundance of fine detritus to which omnivorous

organism switch over during this period from their natural benthic habitat and bacteria, mould and algae as food (Tonapi,1980).

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In vitro: Antibacterial activity of *Salsola kali* Linn.

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Abstract

Plant based medicine were commonly used in India and all over world. Medicinal plants produce a variety of compounds of known therapeutic properties. The substances can either inhibit the growth of pathogens or kill them and have least toxicity to host cell are considered for developing new antimicrobial drugs. Plants are known to contain innumerable biologically active compounds, which possess antibacterial properties. Medicinal components from plants play an important role in conventional plant derived medicine. They have been a part of the evolution of human healthcare for thousands of years. Now a day, nearly eighty percent of the global population turns to plant derive medicines as their first line of defense for maintaining health and combating diseases. Antibacterial activity of petroleum ether, ethanol and water extract of different parts of *Salsola kali* Linn. was studied against *E. coli, K. pneumoniae, S. aureus, B. subtilis* and *S. mutans*.

Keywords:- *Antibacterial activity, Medicinal components, Medicinal plant, Salsola kali*

Introduction

The ancient Ayurvedic literature describes *Salsola kali* Linn. ash as "Sarjjikakshara", used for the preparation of a large number of Ayurvedic compounds formulations (Gupta and Nath, 1984), which seems to correct the dysfunctions of liver (Kumar and Upadhyay, 1994). It has the properties of the fire. It is pungent, warm and acrid. It is efficacious in gulma, flatulence of stomach, diseases of belly, bile, worms, asthma, intestinal obstruction, enlargement of spleen and liver. The juice of the plant was said to be rich in soda and it shows excellent diuretic properties (Grieve, 1992). According to Hartwell the plant is used in folk remedies for the cancerous condition. Aerial parts of plant *Salsola kali* contained stigmasterol, campesterol, sitosterol and their glycosides (Prabhat *et al.*, 2005; Prabhat and Navneet, 2007). Medicinal herbs and their extract are widely used in the treatment of liver diseases like hepatitis, chlorosis and loss of appetite (Cupp, 1999). These exert physiological and therapeutic effect (Prabhat *et al.*, 2008). The compounds that are responsible for the medicinal properties of the drug are usually secondary metabolites. Antibacterial activity of petroleum ether, ethanol and water extract of aerial parts, stems, roots and seeds of *Salsola kali* Linn. was studied against *E. coli, K. pneumoniae, S. aureus, B. subtilis* and *S. mutans*.

Materials and Method

The plant material was collected from the Vijay Nager near Ganganager in Rajasthan district. It was identified from Botanical Survey of India, Dehradun (Uttarakhand). The aerial parts, stems, roots and seeds of the plant were collected and dried at room temperature for one week, grounded and kept as dried powdered.

Powdered plant materials were extracted with three different solvents i.e. petroleum ether, ethanol and

water by using soxhlet extractor for 24 hours. The polarity of the solvent would leach out compounds soluble in the particular solvent. The solvent was removed at a low temperature under reduced pressure to yield a thick syrup or semi solid mass. The fractions were further used to test for the antimicrobial activities.

Muller Hinton agar (Himedia No. 173) media was used to test the antimicrobial activity against *Escherichia coli* (MTCC-739), *Klebsiella pneumoniae* (MTCC-109), *Bacillus subtilis* (MTCC-441), *Staphylococcus aureus* (MTCC-96) and *streptococcus mutans* (MTCC-890) by well diffusion method (Ahmad *et al.*, 1998; Ahmad *et al.*, 1999). 8 mm diameter wells were punched in the agar and filled with extracts and respective solvents for negative control and antibiotic (100 mg/ml) was used as positive control. The slants were incubated at 37 ^{0}C for 18-24 hours. The antimicrobial activity was evaluated by measuring the diameter of inhibition zone in mm and their percentage[10].

$$\text{Percentage of Inhibition} = 100 - \frac{T \times 100}{C}$$

Where, C = Growth in standard
T = Growth in test

Results and Discussion

The plant parts showed broad spectrum antibacterial activity (table 1-4) i.e. the petroleum ether, ethanol and water extracts were active against both gram positive and gram negative bacteria. The *Salsola kali* extracts were found to be less effective as compared to ampicillin. Investigation into the folklore antimicrobial activity of *Salsola kali* against *Salmonella paratyphi* and *Serratia marcescens* were conducted[11]. Here we report on the preliminary result from the antibacterial test of twelve crude extracts from plant species. The antibacterial activity of plant parts i.e. aerial parts, roots, stems, seeds and antibiotic ampicillin in all the three solvents against *Escherichia coli, Streptococcus mutans, Staphylococcus aureus, Bacillus subtilis* and *Klebsiella pneumoniae* at concentrations of 100 mg/ml is given in tables 1-4.

Table-1:The percentage of inhibition of stems extract and antibiotics (Ampicillin) against pathogens

Pathogens	Zone of inhibition (in mm) (extract 100 mg/ml)			Zone of inhibition (in mm) (antibiotic 100mg/ml)			Percentage of inhibition		
	Petroleum ether	Ethanol	Water	Petroleum ether	Ethanol	Water	Petroleum ether	Ethanol	water
E. coli	NI***	12	10	14	18	20	0.00	33.33	50.00
K.pneumoniae	10	20	20	22	27	30	54.54	25.92	33.33
S. aureus	20	25	20	25	29	30	20.00	13.79	33.33
B. subtilis	20	24	26	26	28	30	23.07	14.28	13.33
S. mutans	10	20	20	18	26	30	44.44	23.07	33.33

*** Represents no inhibition

Table-2: The percentage of inhibition of roots extract and antibiotics (ampicillin) against pathogens

Pathogens	Zone of inhibition (in mm) (extract 100 mg/ml)			Zone of inhibition (in mm) (antibiotic 100mg/ml)			Percentage of inhibition		
	Petroleum ether	Ethanol	Water	Petroleum ether	Ethanol	Water	Petroleum ether	Ethanol	water
E. coli	NI***	14	10	14	18	20	0.00	22.22	50.00
K.pneumoniae	10	19	20	22	27	30	54.54	29.62	33.33
S. aureus	18	20	18	25	29	30	28.00	31.03	40.00
B. subtilis	20	18	20	26	28	30	23.07	35.71	33.33
S. mutans	12	20	20	18	26	30	33.33	23.07	33.33

*** Represents no inhibition

Table-3: The percentage of inhibition of seeds extract and antibiotics (ampicillin) against pathogens

Pathogens	Zone of inhibition (in mm) (extract 100 mg/ml)			Zone of inhibition (in mm) (antibiotic 100mg/ml)			Percentage of inhibition		
	Petroleum ether	Ethanol	Water	Petroleum ether	Ethanol	Water	Petroleum ether	Ethanol	water
E. coli	NI***	15	10	14	18	20	0.00	16.16	50.00
K.pneumoniae	10	20	19	22	27	30	54.54	25.92	36.66
S. aureus	12	22	18	25	29	30	52.00	24.13	40.00
B. subtilis	10	25	20	26	28	30	61.53	10.71	33.33
S. mutans	NI***	20	21	18	26	30	0.00	23.07	30.00

*** Represents no inhibition

Table-4: The percentage of inhibition of aerial parts extract and antibiotics (ampicillin) against pathogens

Pathogens	Zone of inhibition (in mm) (extract 100 mg/ml)			Zone of inhibition (in mm) (antibiotic 100mg/ml)			Percentage of inhibition		
	Petroleum ether	Ethanol	Water	Petroleum ether	Ethanol	Water	Petroleum ether	Ethanol	water
E. coli	NI***	12	10	14	18	20	0.00	33.33	50.00
K.pneumoniae	10	20	18	22	27	30	54.54	25.92	40.00
S. aureus	10	15	16	25	29	30	60.00	48.27	46.66
B. subtilis	12	14	15	26	28	30	53.84	50.00	50.00
S. mutans	10	18	18	18	26	30	44.44	30.76	40.00

*** Represents no inhibition

The zone of inhibitions obtained in crude extracts of different parts of plants varied against pathogens while it was same in case of ampicillin. The results revealed that antibiotic is more effective as compared to crude extracts. The ethanolic extracts of seeds showed the highest activity against *Bacillus subtilis* followed by *Staphylococcus aureus, Klebsiella pneumoniae, Streptococcus mutans* and *Escherichia coli* as compared to other extracts.

The extracts of stems showed maximum activity followed by seeds, roots and aerial parts. The antibacterial therapy is going through crises due the rapidly increasing development of resistance to existing agents. Antibiotic resistance has increased substantially in the recent years and is posing an increasing therapeutic problem. The use of plants as primary health remedies is quite common due to their pharmacological properties. The plant produced a variety of phytoconstituents that have antibacterial

activity. These compounds include stigmasterol, campesterol, b- sitosterol and their glycosides etc. The natural antimicrobial compounds in plants can inhibit the growth of bacteria by means of unknown mechanisms other than that of known antibiotics and for this reason the search for new antibiotics must continue. The present study has shown that the plant and its parts are potentially a rich source of antibacterial agents. The plant extracts inhibited the growth of tested pathogens. The crude extracts (100mg/ml) of each part was used for determination of their potency against pathogens and compared with antibiotic (100mg/ml). The extent of antimicrobial activity of the extracts based on inhibition zone diameter has been described as low (10-14), moderate (15-20) and strong (21-26) by Ahmad *et al*. (1999). In our study, seeds and stems extracts showed strong activity against all pathogens and followed by roots and aerial part. The ethanolic and water extracts of each part is highly effective against all pathogens because more phytoconstituents were leached in these solvents. Our findings have validated the use of this medicinal plant for the treatment of microbial infections such as diarrhoea and fever. It seems important to recommend that further studies using isolated constituents instead of whole extracts must be done in this field. Health foundations have to increase their funding of these studies and research to help saving the lives of many peoples. This will also offer a great help in facing the emergence and spread of antimicrobial resistance.

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Air quality monitoring of main urban center of Haridwar

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Abstract

Present study was carried to measure air quality status of main urban center of Haridwar. Parameters such as suspended particulate matter, respiratory suspended particulate matter, oxide of sulphur (SO_x) and nitrogen dioxide (NO_2) were recorded during the study period. Suspended particulate matter and respiratory suspended particulate matter were reported higher than the permissible limit whereas oxide of sulphur and nitrogen dioxide was recorded under the permissible limit prescribed by Central Pollution Control Board (CPCB).

Keywords:- *Air quality, Particulate matter, SO_x, NO_x*

Introduction

Air pollution in urban areas due to mobile or vehicular pollution is predominant and significantly contributes to air pollution problems. Automobiles responsible for 60 % of the total air pollution problem. Road traffic produce volatile organic compounds, suspended particulate matter (SMP), respiratory suspended particulate matter (RSPM), oxide of sulphur (SO_X), oxide of nitrogen (NO_X) and carbon monoxide (CO) can cause health problems including burning eyes and nose, itchy irritated throat, and breathing problems (Ingle *et al.,* 2005). Some chemicals found in polluted air can cause cancer, birth defects, brain and nerve damage, and long-term injury to the lungs and breathing passages in certain circumstances. Above certain concentrations and durations, certain air pollutants are extremely dangerous and can cause severe injury or death. Present study has been carried out to assess air quality status of Haridwar city which will help in the prediction of various health problems among local mass caused by air pollution.

Materials and Method

Study area

Present study has been carried out at main urban center of Haridwar city that is Ranipur intersection. This area contains most of the shopping complex, institutes and other important offices which bear extremely high traffic load throughout the year.

Air quality monitoring

The ambient air quality was undertaken as per the norms prescribed by the Central Pollution Control Board (CBCB). The sampling was carried out for four days in a week and four weeks in a month, from January to December 2005. Air samples were collected in Respiratory Dust Sampler (RDS) APM-460. During the sampling day sampler was kept at height of 2 m from the ground level and the initial and final rotameter readings were recorded every eight hour and average from 24 hours. Air quality monitoring of gaseous pollutants viz., SO_x and NO_2 was carried out using the method of West and Gaeke (1956) and Jacob and Hochheiser (1958) respectively.

Results and Discussion

Monitoring of ambient air quality of main urban center of Haridwar has been carried out during January to December 2005. Table-1 showing the monthly average variation in suspended particulate matter (SPM), respiratory suspended particulate matter (RSPM), oxide of sulphur (SO_x) and nitrogen dioxide (NO_2). Lowest value of suspended particulate matter was recorded 315.00 μgm^{-3} (July) whereas highest value was recorded 466.00 μgm^{-3} (May). Highest concentration of respiratory suspended particular matter was recorded 112.50 μgm^{-3} (May) and lowest value was found 95.00 μgm^{-3} (August). In case of gaseous pollutants, highest concentration of oxide of sulphur recorded 10.50 μgm^{-3} (Nov) and its lowest value recorded 7.00 μgm^{-3} (March). Concentration of nitrogen dioxide during the study period was recorded between 12.00 μgm^{-3} (September) to 17.15 μgm^{-3} (February).

Varma *et al.* (1993) have reported a higher concentration of S.P.M. in winter and summer seasons in comparison of Monsoon and pre- monsoon seasons at Sindri and Dhanbad. Gupta and Vidya (1994) observed that the atmosphere gets cleaned due to precipitation effect of rain during monsoon season, thereby affecting the S.P.M. Present study reveals that highest valued of SPM and RSPM were also found highest during the pre-mansoon period. Das *et al.,* (2003) monitored the ambient air quality of Tantra-Raikela-Bandhal (TRB) iron ore mines with respect to suspended particulate matter (SPM), SO_2 and oxides of nitrogen and their level of concentration in different seasons of the year and observed that the concentration of SO_2 and NO_X remained below the prescribed limits except for few places of study area where it exceeded the limit. Jain *et al.* (2006) studied vehicular concentration with regard to RSPM, SPM, NO_2, SO_2, and found SO_2 and NO_2 within the permissible daily standards, RSPM and SPM were also exceeding the prescribed limits.

Present study shows that concentration of gaseous pollutants remained under the limit prescribed by Central Pollution Control Board, however, particulate matter (SPM and RSPM) were higher than the prescribed limits of CPCB.

Table-1: Average concentration of primary air pollutants recorded at Ranipur Mod during the study period (2005)

Months	SPM (μgm^{-3})	RSPM (μgm^{-3})	SO_x (μgm^{-3})	NO_2 (μgm^{-3})
January	430.12	111.00	8.00	16.00
February	350.33	109.00	9.50	17.15
March	400.45	100.50	7.00	14.20
April	410.00	105.55	9.00	15.20
May	466.00	112.50	8.50	14.80
June	430.10	118.40	9.00	14.00
July	315.00	110.50	9.00	13.50
August	330.00	95.00	8.00	15.35
September	335.00	98.32	8.00	12.00
October	360.70	105.11	7.30	13.00
November	380.00	109.50	10.50	14.70
December	400.00	109.00	8.50	15.10

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Dispersion of heavy metals in textile effluent and pond environment in Panipat industrial area

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Abstract

The Panipat region is well known textile industrial zone of Northern India and have a large number of dye houses and textile processes units. The dyeing house industries uses a large volume of water for wet dip coloring process and draine most of the waste water as effluent. The effluent containing composite mixture of different pollutant in terms of heavy metals. Metal accumulation in sediments provides a record of the spatial and temporal history of pollution from surface water to ground water. The dispersion of heavy metals from textile effluents to adjoining pond system ultimately affect quality of water. The present study revealed that pond sediment found highly polluted regarding heavy metals load. Transfer factor for Fe, Mn, Ni and Pb was found very high in pond through open effluent drainage system.

Keywords :– *Textile effluent, Heavy metals, Pond sediment, Aquatic environment*

Introduction

Textile industries consume large volume of water of high purity and discharge large quantities of effluent that normally exhibit polluting characteristics. Approximately, 40,000 different dyes and pigments are used in the industry and over $7x10^5$ tons of these dyes are produced annually worldwide (Zollinger, 1987). 10-15% of the dyes used in textile processing were lost in the effluent during the dying processes (Vaidge and Datye, 1982). The effluents from dye industries contain high amount of cation, anion, organic pollutants in the form of colour and heavy metals. Both natural processes and anthropogenic activities are responsible for introducing metals in to the aquatic system. Many contaminants discharged into surface water rapidly become associated with the particulate matter and incorporated in sediments. Metal contaminated sediments may release heavy metals back to the overlying water column and, thus, pose risk to aquatic life and ecosystems (Forstner and Wittman, 1981).

Composite effluents from textile industries and dyeing houses of Panipat industrial area normally discharged openly into a common effluent drain without any adequate treatment and commences in a large pond near Binjhole village near to industrial area, which may change the quality of bottom sediments of drain and pond sediment and the physico-chemical characteristics. Sediments reflect the current quality of the water system and can be used in detecting the presence of contaminants that do not remain soluble after discharge into surface water (Forstner, 1985). As a result of complex physical, chemical and biological processes a major fraction of heavy metals are found to be associated with bottom sediments (Baruah *et al.,* 1996). Metal accumulation in sediments provides a record of the spatial and temporal history of pollution. Hence, sediment monitoring can provide important information on various pollution events.

Materials and Method

Geographically, Panipat city is situated between 29° 09' 50'' and 29° 50' North latitude and 76° 31' 15'' and

77° 12' 45'' East longitude with altitude of 255 msl. Panipat town is located on the National Highway no.1 about 90 km toward north of Delhi has a population of about 0.27 million. Study point (Textile Dye houses) in Panipat city is situated on Jatal road in industrial area near GT Road. The effluent samples were collected from common effluent drain and surface water samples were collected from a pond of village Binjhole situated near industrial area, where the effluent drain ends up and delay for a long time. Sediment samples were collected from the bottom of pond. All the samples were collected and preserved for further analytical work. All samples were analyzed by the standard methods (APHA, 1995) and Trivedi and Goel (1984). Transfer factor between textile effluents and surface water was calculated for each metal according to Lokeshwari and Chandrappa (2006).

Results and Discussion

The concentrations of heavy metals in water samples from effluent drain, pond water and pond sediment are presented in Tables-1, 2 and 3 respectively.

Table-1: Seasonal variations of heavy metals in textile effluents (in ppm)

Heavy metals	Pre-monsoon		Monsoon		Post-monsoon	
	Mean	SD	Mean	SD	Mean	SD
Cd	0.052	0.042	0.025	0.037	0.012	0.008
Cu	0.440	0.085	0.343	0.058	0.165	0.066
Fe	0.527	0.093	0.253	0.130	0.266	0.079
Mn	0.153	0.050	0.127	0.047	0.224	0.072
Ni	0.037	0.016	0.016	0.015	0.031	0.013
Pb	0.500	0.207	0.250	0.085	0.422	0.133
Zn	0.173	0.059	0.110	0.012	0.238	0.132

Table-2: Seasonal variations of heavy metals in pond water (in ppm)

Heavy metals	Pre-monsoon		Monsoon		Post-monsoon	
	Mean	SD	Mean	SD	Mean	SD
Cd	0.009	0.001	0.001	0.002	0.004	0.002
Cu	0.427	0.045	0.397	0.136	0.252	0.084
Fe	9.700	3.035	4.233	1.450	4.820	2.961
Mn	0.530	0.061	0.463	0.070	0.172	0.062
Ni	0.127	0.025	0.073	0.033	0.054	0.045
Pb	1.800	0.557	0.610	0.412	0.504	0.364
Zn	0.156	0.031	0.110	0.020	0.158	0.066

Transfer factor values of all metals are depicted in Table-4. Cadmium concentrations in textile effluent (0.005-0.052 ppm) and pond water (0.001-0.012 ppm) turn down in rainy season due to the dilution factor. Cadmium slightly fluctuated and remains mostly constant in pond sediment (4.0-5.7 ppm). Cadmium transfer is due to some other non-point sources of cadmium pollution. During the last decade, the industrial use of Cd has increased and can create both acute and chronic cases of clinically identifiable

Table-3: Seasonal variations of heavy metals in pond sediments (in ppm)

Heavy metals	Pre-monsoon		Monsoon		Post-monsoon	
	Mean	SD	Mean	SD	Mean	SD
Cd	5.717	0.451	4.780	0.455	4.054	0.595
Cu	51.520	5.098	43.880	6.877	43.834	7.332
Fe	5640.333	2179.050	4312.667	463.092	6013.400	856.579
Mn	942.000	48.135	724.000	56.471	836.400	38.708
Ni	63.667	8.083	52.333	9.074	52.800	3.768
Pb	69.000	6.245	55.333	9.292	44.000	5.385
Zn	240.000	92.601	142.333	59.341	123.200	42.032

Table-4: Transfer factor for heavy metals from textile effluent to pond water

Heavy metals	Pre-monsoon	Monsoon	Post-monsoon
Cadmium (Cd)	0.17	0.05	0.32
Copper (Cu)	0.97	1.16	1.53
Iron (Fe)	18.42	16.71	18.12
Manganese (Mn)	3.46	3.66	0.77
Nickel (Ni)	3.39	4.52	1.74
Lead (Pb)	3.60	2.44	1.19
Zinc (Zn)	0.90	1.00	0.66

toxicity in humans (Mani *et al.*, 2005). When the animal kept on contaminated feed along with the industrial polluted environment for long time, they suffer from its toxicity symptoms which may be sub clinical or clinical. The retention time of Cd is quite high (half life being 40 years). Bordas and Bourg (1998), Vazquez *et al.,* (2007) and Korfali and Davies (2004) observed the similar Cd concentrations in sediments.

Concentrations of copper in textile effluent are due to the residues of some dyes especially used for blue or green colours. Copper concentrations in textile effluent (0.16-0.44 ppm) were found parallel or sometimes higher than iron. Most of the part of copper content reaches in pond water (0.25-0.43 ppm) and rest settle down in drain sediment. Copper in pond sediment (38.6-52.4 ppm) also settled down after some time. Copper may accumulate in living organisms and their various body parts (Kudesia, 1992). High amount of heavy metals like Cu and Zn may harm the living organism of existing ecosystem (Aslam *et al.,* 2004). The Cu concentration level in study area has been compared with those observed by Korfali and Davies (2004) in sediments. Iron is one of the most abundant heavy metal in rocks and soil, ranking fourth by weight. However, iron was not found in high concentration in textile effluents (0.24-0.54 ppm), but the high concentrations of iron was observed in effluent drain sediment (5656.00-8467.70 ppm) due to the continuous settlement. Iron was present in high quantity in pond sediment (3803.5-6013.4 ppm). Iron's transfer factors were found very high from textile effluent to pond water up to 25.00. Manganese was found as a second abundant element in the effluent drain and pond sediment after iron. However, manganese

was comparatively low in textile industrial effluent (0.11-0.31 ppm). Transfer factor of Mn from textile effluent to pond water was noticed from 1to 4 almost in all seasons, while below 1 in winter season. Nickel is one of the second trace elements of the present study after cadmium. As it is very toxic to plants and animals, even in low concentrations and has a tendency to get accumulated in different body parts. However Ni was presented in very low concentration in textile effluent (0.007-0.067 ppm) but in pond water (0.047-0.13 ppm), it was found comparatively high due to the regular input. Ni concentration in pond water was noticed higher during the summer season due to the loss of water by vaporization from pond system. Ni was found very high like other metals due to the settling of metals on bottom in pond sediment (49.0-63.7 ppm). Highest transfer factor of Ni from textile effluent to pond water was found in monsoon seasons.

The observations of the study reveals that Ni never reflected the pollution load in drain or pond sediment through the geo-accumulation index because it was found always below than 1. Nickel may accumulate in aquatic life but its presence is not magnified along food chains. This trend of Ni concentration in present study has been supported on the basis of recommendation of Nasr *et al.,* (2006) in sediment. It may be pointed out that the builds up of heavy metal like Cr, Pb, Ni warrant toward continuous monitoring and suitable measures are needed before these become toxic.

Lead was found highest in textile effluent. Lead mostly remained in effluent (0.25-0.50 ppm) and fluctuated in pond (0.5-1.8 ppm). Rest quantity of lead settled down on bed sediment of pond. Lead was the second most abundant metal species after iron. Pb was found slightly higher in pond water (0.50-1.8 ppm). It should not be more than 0.01 mg/l for health views, while it should be less than 0.1 mg/l generally in drinking water (WHO, 2006).

Zinc was not found so high in textile effluent (0.11-0.34 ppm) in comparison to lead. Similarly, it was found in less quantity in pond water (0.11-0.2 ppm) and accumulated in very high quantity in bed sediment (116.2-240.0 ppm) of pond. Zinc concentration was fluctuated in pond sediment (116.2-240.0 ppm) season to season. High amount of Zn may harm to living organism of that ecosystem (Aslam *et al.,* 2004).

The presence of heavy metals in the aquatic environment has been of great concern to scientists and biologist because of their toxic nature (Bharti, 2007). Heavy metals travel from one level to another in the ecological system by being accumulation in abiotic and biotic components. In the studied area, basically anthropogenic source of heavy metals are the dye houses in textile industrial area. Heavy metals reach in effluent drain and also its bottom sediment and further into pond and bed sediment of pond near village Binjhole adjoining to textile industrial area of Panipat. Heavy metals percolate slowly from the bed sediment of Binjhole pond towards the ground water table and there may be a threat to deep aquifers also by leaching process of metals. Heavy metals have a tendency to accumulate and store in different trophic levels. The storage of heavy metals has created harmful effects for biotic components. Heavy metals in pond water were observed slightly lower than textile industrial effluents, whereas the heavy metal concentrations in effluent drain were higher than pond sediment.

The present study reveals that there was heavy metals pollution in pond water and sediment. Due to the regular discharging of metals residues in the textile industrial area, a threat have been appear on plant vegetation, livestock and human beings of the region (Malik *et al.,* 2006). It is therefore obvious that scientific treatment is necessary to minimize the pollution effects before textile industrial effluent is discharge on the land. There is a need to take effective steps for improving wastewater use efficiency through renovation and modernization of recycling treatments of wastewater.

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Forest types of Katarniaghat Wildlife Sanctuary- A biogeographic classification

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Abstract

The rich soils of tarai coupled with an annual precipitation over 1300 mm result in great diversity of vegetation in the WLS. The vegetation varies from dense moist tarai sal forest to large open grassland. The vegetation close to Girwa river and its tributaries is characterized by the presence of dense canebrakes. Some artificial regeneration of exotic and indigenous species has also been done in past. The Katarniaghat WLS represents the tarai-bhabhar, bio-geographic sub-division of upper Gangetic plains. As per Champion and Seth's (1962) classification the following forest types are recognized. (1) The Sal forests: which constitute 3C/C2b Moist Bhabhar Sal; 3C/C2b Moist Bhabhar Sal; 5B/C1b Dry Plains Sal. (2) The miscellaneous forests: which constitute 3/E1 *Terminalia alata forests*;1/E1 Cane brake; 4D/SS1 Eastern Seasonal Swamp forest; 4D/SS2 *Barringtonia* Swamp Forest; 3/ISI Low Alluvial Savannah Woodland, *Bombax-Albizzia*; 5B/C2 Northern Mixed Deciduous Forest; 5/E6 *Aegle* Forest; 5/IS2 Khair-sissoo Forest. (3) Grasslands: which constitute 3/ISI Low Alluvial Savannah Woodland, *Bombax-Albizzia.*

Kewards:- *Biogeographic classification, Forest types, Katarniaghat Wildlife Sanctuary, Bahraich*

Introduction

TheKtarniaghat WLS is located in the Nanpara Tehsil of distric Bahraich. The Indo-Nepal border constitutes the nothern boundary of the WLS. The entire area, totaling 40009.35 ha, is situated between $28^0$06' N and $28^0$24' N latitudes and $81^0$02' E and $81^0$19' E longitude. Consequent upon Govt. of U.P. notification no. 3 388/14-3-32/1976 dated May 31, 1976, these forests came to be constituted as a Wildlife Sanctuary. The Sanctuary, together with the adjoining 15002.75 ha of reserve forests, which serve as buffer, constitutes one ecological unit. It is one of the few remnants of the rich and diverse tarai ecosystems, having connectivity with the Royal Bardia National Park in Nepal which lies to the noth, and Dudwa National Park, which lies to the west of the Sanctuary. Katarniaghat Wildlife Sanctuary is one of the most significant representativ of highly rich, diverse and fragile tarai ecosystems, presently under threat if not zealously guarded against anthropogenic pressures. The rich soils of tarai coupled with heavy monsoon downpour result in immense floral diversity, which gives rise to a mosaic of diverse habitats. The forests of the WLS range from dense moist tarai sal forests to large open grasslands and dense canebrakes in the riverine tracts. These forests boast of some of the finest stands of sal in this bio-geographic zone. Many of the species of vegetation are of conservation importance. The whole of the area is subject to the climatic variations typical of the plains of northern India with their extremes of heat and cold. The winter nights are very cold and foggy and heavy dews fall regular, with the rresult that the vegetation remains damp for most of the day. The days at this time of the year are cool and bright. Frosts occur generaly in January. The nights remain cool and dew falls until late in the spring, the hot weather commencing in April and lasting until the rains break towards the end of

June. Heavy monsoon rains fall from then onwards unti October and give, with the winter rains, an average annual fall of about 1300 mm. The prevailing winds are from the east, but during the hot weather there are often strong west winds, and mild hurricanes from the noth and west accompanied by showers. Since no study was conducted earlier to catalogue the range of biodiversity available in the same sanctuary and to conserve the known range of biodiversity with emphasis on endangered threatened and rare elementary floras the preent work was under taken to study the flora as classify the sanctuary.

Materials and Method

Regular survey was made of the forest area under study and samples were collected in separates polythine bags so as to identify the same at rest home of head quarters with the help of available floras. The herbarium was prepared as recommended by Jain and Rao,1976 and Rao,1989.

Results and Discussion

The rich soils of tarai coupled with an annual precipitation of over 1300 mm result in great diversity of vegetation in the WLS. The vegetation varies from dense moist tarai sal forest to large open grassland. The vegetation close to Girwa river and its tributaries is characterized by the presence of dense canebrakes. Some artificial regeneration of exotic and indigenous species has also been done in past. The Katarniaghat WLS represents the tarai-bhabhar bio-geographic sub-division of upper Gangetic plains. As per Champion and Seth's (1962) classification the following forest types are recognized (4) the Sal forests: which constitute 3C.C2b Moist Bhabhar Sal; 3C/C2b Moist Bhabhar Sal/5B/C1b Dry Plains Sal; 5B/C1b Dry Plains Sal. (5) The Miscellaneous forests: which constitute 3/E1 *Terminalia alata* forests; 1E1 Cane brake; 3/ISI Low Alluvial Savannah Woodland, *Bombax- Albizzia*; 5B/C2 Northern Mixed Deciduous Forest; 5/E6 *Aegle* Forest; 5/IS2 Khair-sissoo Forest. (6) Grassland: which constitute 3/ISI Low Alluvial Savannah Woodland, *Bombax-Albizzia*.

3C/C2b Moist Bhabhar Sal: Forming a fairly extensive block of forests adjoining the Nepal border in the north-east of the WLS, this type includes the best sal forests which occurs on the well drained dammar where the soil is rich and slightly sandy loam of good quality. The stocking is generally good but the crop is irregular with a smaller proportion of younger age classes except in scattered groups. mature and over mature trees are also scattered all over the area and are more common near grassy depressions. The density varies between 03 to 08 regeneration of sal is generally inadequate. On the clayey soil, asna (*Terminalia alata*) predominates and in some places it occurs in almost pure and extensive groups. Regeneration of asna is almost absent. Mixed in the overwood is a small proportion of haldu (*Adina cordifolia*). Padal (*Stereospermum suaveolens*), kusum (*Scheichera oleosa*) and *Ficus* species. The under wood is moderate to dense and consists of Rohini (*Mallotus philippinensis*), Jamun (*Syzygium cumini*), Asidh (*Logerstroemia parviflora*), Kari (*Milnisa velutina*) and Tendu (*Diospyros chloroxylon*) Rohini appears to be competing with sal, thus retarding natural regeneration of sal. The undergrowth consists of light grasses with bhant (*Clerodendron viscosum*), Kasraut (*Moghania brevipes*), Puchere (*Colebrookia oppositifolia*), Guturu (*Glycosmic pentaphylla*), Bhakmal (*Ardisia solanacea*) and Ban-tulsi (*Pogostemon plecentranthoides*). The common climbers are Karwanth (*Tiliacora acuminate*), Maurain (*Bauhinia vahlu*) and Gauj (*Milletia auriculata*). This type occurs in Rampurwa 1, Rampurwa 2, Nishangara 4 to 12 and Murtiha 2 to 4.

3C/C2b Moist Bhabhar Sal 5B/C1b Dry plains Sal: The forests of this type represent and transitory stage between the high level and the dry alluvial sal. These are hardly distinguishable from the surrounding moist forests except for the presence of dying trees. These forests occur in areas contiguous to the type mentionned above. Sal predominates over most of the areas with an admixtures of asna in varying proportions being greatest near nalas and low lying aeras. Other common species in the over wood are Haldu (*Adina cordifolia*), Padal (*Stereospermum suaveolens*), Kusum (*Schleichera oleosa*) and various species of figs. The density is extremely variable, the younger age classes are generally deficient and regeneration of sal is very poor on the whole. The underwood mostly consists of Asidh (*Lagerstroemia parviflora*), Jamun (*Syzygium cumini*), Kura (*Holarrhena antidysentrica*), Kari (*Miliusa velutina*), Amaltas (*Cassia fistula*), Bhilawa (*Semicarpus anacardium*), Sandan (*Ougenia ougeninensis*) and Rohini (*Mallotus phihppinensis*). The undergrowth generally consists of Bhant (*Clerodndron viscostum*), Kasraut (*Moghania brevipes*), Mororphal (*Helicteres isora*), Guturu (Glycosmis pentaphylla) and grasses. The common climbers are Gauj (*Milletia auriculata*) and Karwanth (*Tiliacora acuminate*). This type occur in Rampurwa 2 to 45, Nishangara 13 and 14, Murtiha 24 and 25, Murtiha 5,6, 10, 15 and 16.

5B/C1b Dry Plain Sal: This type occurs over much of the centre and south of the WLS, where the soil is a hard, dry and somewhat impermeable stiff loam overlying almost pure sand. The crop consists chiefly of middle aged and mature trees, while the younger age classes are generally in deficit, Sal is the main species and asna is comparatively scarce where soil and moisture conditions are still moderately favourable usually in slight depression, the stocking is good but elsewhere in open crop occurs much of growing stock having died of drought. In the driest areas the crop is xerophytic and sal is either disappearing or has disappeared and is being replaced by miscellaneous species usually Bel (*Aegle marmalos*), Tendu (*Diospyros chloroxylon*) and Haldu (*Adina cordifolia*) so that the sal areas gradually merge into purely miscellaneous forests. The over Wood consists of Bahera (*Terminalia belerica*), Haldu (*Adina cordifolia*), Padal (*Streospermum suaveolens*), Kusum (*Schleichera oleosa*), Mahau (*Madhuca indica*) andFicus species. In the under wood are found Asidh (*Lagerstroemia parviflora*), Jamun (Syzigium cumini), Kari (*Miliusa velutina*), Amaltas (*Cassia fistula*), Bhilawa (*Ougenia ougeinensis*) and Dhak (*Butea monosperma*). In more open areas there is dense undergrowth of Meethi-neem (*Murraya koenigii*), Bhant (Clerodendron viscosum), Kasraut (*Moghania brevipes*), Marophal (*Helicteres isora*) and Guturu (*Glycosmis pentaphylla*). The common climbers are Gauj (*Milletia auriculata*), Karwanth (*Tiliacora acumminata*), Maurain (*Bauhini vahlu*) and Alia (*Acacia pinnata*). This type occurs in Murtiha 8, 22, 21,19 and 16.

3/E1 *Terminalia alata* forest: Asna occurs thoughout the sal region on heavy and wet soil, that is to say, on clayey alluvial patches, usually in small goups sometimes extending over faily large areas. This is commonly found in Dharmapur and Nishangara ranges. Middle aged trees predominate and both the younger age classes and mature trees are generally deficient. The trees are of good height and bole form with occasional sal in the to canopy. The understorey has smaller Asna and Jamun with shrubby undergrowth of Rohinii, Bhant and sometimes coarse grasses.

I/E1 Cane brake: This type occurs in wet hollows on soils which are more or less permanentaly wet and which usually consists of fine clay very rich in humus. This type thus locally occcurs in Motipur 1 to 4, 6, 8-10 along the numerous creeks and lakes and in swamps which occupy former river beds. Bent (*Calamus tenuis*) is the most common and important species. *Jamunm injur* (*Baringtonia acutangula*) and *Salix* species are also met with in this region.

4D/SSI Eastern seasonal Swamp forest/4D/SS2: *Barringtonia* Swamp forest: The vegetation in depressions and along nalas, which remains under water continuously for a fairly long period during the rains

comes under this category. The most common species found in such areas are Jamun, Injur, Gutel, Semal and *Salix* species. Bent and narkul also occur gregariously locally.

3/ISI Low Alluvial Savannah Woodland (*Bombax-Albizzia*): This type occurs in the higher and more stable alluvial terraces which have been in existence long enough for the development of a true soil with more or less humus, floods occasionally submerge them for relatively brief periods and enrich them by a deposit of fertile slit. The soil may be porous or clayey and badly drained. The common species occurring in this type are Khair, Semal, Asidh, Haldu, Jigna, Bahera, Gutel, Jamun, Patju, aonla, Kaim, Bhilawa, Kumbhi, Kusum, Shisham, Bauhinia, Grewia and *Albizzia* species. This type occurs in parts of Katarniaghat 1 to 6, Nishangara 1, Dharmapur 1 and 2, Murtiha 26, 20 and 17 and Murtiha 7, 9 and 14.

5B/C2 Northern mixed deciduous forest: In this forest type the upper canopy is formed by a mixture of trees practically all of which are deciduous during the dry season usually for several months, though some for a short period only. The upper canopy is light, the trees having relatively short boles and poor form. Most of the species also occur in the moist, deciduous forest with for better developement. There is usually a thin shrubby under growth including some evergreen xerophytic species.

5/E6 Aegle forest: The type occurs as islands of varying size on stiff dry clayey soils in dry sal or inferior moist sal forests wshich it is said to be displacing. As the whole tract is typically higher than the surrounding areas and the river beds, the thin upper layer of loamy soil is rapidly eroded away from the edges of the dammars and stiffy dry clayey sub-soil often containing calcareous matter of manganese nodules are exposed. The bel colonizes such areas. Over considerable areas, bel is found pure of almost puer but elsewhere it is mixed with numerous exrophtic species such as Tendu, Chittaina, Khair, Haldu, Jigna and Kanju. The crop is usually rather open and tree growth as a rule is tunted, although species like Haldu and Khair sometimes appears to be thriving fairly well. There is usually a light growth of grass, which in some places, notably northwest of Nishangara consists of baib. In places where continued erosion has cut through the beds of clay and exposed the lower sand, the resulting micture has been washed down to for moist and fertile pockets of well aerated soil below the dammar which support well grown pole crops of sal often extending for some distance along sides of the ravines. Where erosion has been more recent and is still actively continuing patches of sal reproduction are becoming or have become established along the ravines owing to the exposure of a more fertile sandy alluvium underlying the beds of clay.

5/Khair-sissoo forest: This type is met within the north and east of the WLS and Dhamapur on the new sandy deposits of the rivers Girwa and Kauriala. The species occurs are Khair, largely young Jhau and Madar. Shisham and Semal are colonizing the older areas. In moister areas, however, babool replaces shisham and there is less Khair.

3/ISI Low Alluvial Savannah Woodland (*Bombax-Albizzia*): This type is met with all the more stable riverine flats which are subject to occasional floods and tend to be water logged during the rainy season but which dry out during the rest of the year. The crop consists of scattered trees of the early seres of normal succession on new riverian soils, almost entirely restricted to fire hardy species such as Semal, Haldu, Asidh, Jigna, Khair and Kanju standing over dense grass. Patches of shrub growth also of fire hardy species such as Ber and Karaunda are also met with the areas where this type occurs are Katarniaghat 1 to 6, Nishangara1, Dharmapur 1 and 2, Murthia 7,9,11,15,17, 20 and 26.

The floral diversity in the WLS is immense. The present documentation indicates the presence of 95 tree species, 57 shrubs/small trees, 28 climbers and 23 species of grasses. The main tree species are Sal (*Shorea robusta*), Asna (*Terminalia alata*), Shisham (*Dalbergia sissoo*), Bel (*Aegle marmelos*), Kusum (*Scheichera oleosa*), *ficus* spp. and Semal (*Bambax cieba*) etc. The main grass species occurring in the area are Kaans

(*Saccharum spontaneum*) and Moonja (Saccharum munja) *Calamus tenuis* is the cane found in the area.

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Assesment of bio-medical waste generated in Government hospitals, Agara city (India)

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Abstract

Bio-medical wastes include anatomical, pathological and clinical infectious/ hazardous organic and inorganic wastes. These wastes are disposed off in unscientifically manner. The study has been conducted in the government healthcare establishment only to reveal the per day waste generation on each patient, present mode of waste management within the units bed our suggestions which has helped the units to improve their waste management practices, in the city of Agra.

Keywords:- *Waste management, Healthcare waste, Management, Government hospital, Bio-medical waste*

Introduction

Bio-medical waste can be defined as the total waste stream that is generated from healthcare establishments, health related research facilities, laboratories and emergency relief donations. Hospitals, clinics, laboratories, medical research centers, pharmaceutical manufacturing plants, pharmacies, blood banks, veterinary healthcare centers and home healthcare activities are some of the generators of healthcare waste.

Bio-medical waste generated from diagnosis activities can be broadly categorized as general waste and hazardous waste. This, however, remains true only when proper segregation and separation of waste is practiced according to type at the source. There are different estimates regarding the share of hazardous and non-hazardous constituents of healthcare waste. Tietjen *et al.* (2003) also held that 85% of the waste produced in hospitals and clinics is non-contaminated and poses no risk of infection. On the other hand, WHO (2000) reported that from the total waste generated by healthcare activities, 80% is general waste and the balance is considered as hazardous, as it tends to be infectious, toxic or radioactive.

The total 10,000 approximately beds of healthcare units are located in Agra. Out of which 35% is from government sector and rest 65% is from private sector. Approximately 25,000 kgs of hospital waste is produced every day out of which 70-75% is non-infectious wastes, 20-25% infectious wastes and 05-10% is hazardous wastes. Out of which most of the hospitals, nursing homes and pathological laboratories are disposing off the waste in their neighborhoods due to lack of awareness, inadequate services, limited utilization of existing facilities, lack of adequate institutional arrangements, operation inefficiencies & nodal authorities inefficiency in performing their task effectively etc. but few take proper care of their wastes. The present study aim to the total waste generated in government hospital and their effective management of proper disposal of these waste.

Materials and Method

The study was carried out in three government hospitals i.e. District Hospital, Sarojini Naidu Medical

College, & Hospital and Lady Loyal Hospital, Agra. The Total waste was calculated by taking sample of everyday during study period (i.e. April, 2006). Sample was collected 24 hrs from each sampling unit in different colour coded polythene bags i.e. Yellow, Red and Blue. Yellow bag contain Human tissue, Organs, Body parts, Animal tissues, Carcasses, Bleeding parts, Fluid, Blood and Experimental animals used in research, veterinary hospital waste, animal houses, waste from laboratory, cultures and stocks etc. Red bag contain human and animal cell culture, waste from production of biological toxins, items contaminated with blood and blood fluid including cotton, dressing, soiled plaster casts, linen, bedding and wastes generated from disposal item other than sharps etc. Blue bag contain needles, syringes, scalpels, blades, glass, tubing, catheters, intra-venous sets etc. Total waste per day and per bed per day at each study site was calculated by division of total waste per month per day and waste per day division of total no. of bed of each site.

Results and Discussion

Results showing the hospital waste generation in three government hospitals in Agra city. In these hospitals, the total medical waste composite such as radioactive waste 2%, bottle broken glass 16%, needles sharpeners 6%, body parts 5%, miscellaneous 1%, plastic 10%, cardboard 2%, bandage swabs, cotton, cloths 9%, paper 3% and other wastes 46% (Fig. 1). The waste generation per month was observed to 14489.3 kg, 758.4 kg and 15016.37 kg at S.N. Medical College & Hospital (S.N.M.C.&H.), M.G. Road, Lady Loyal Hospital (L.L.H.), Raja ki Madi and District Hospital (D.H.), Sayee Ki Takia of Agra city (Table 1 & Fig. 2) and the average waste generation per day at source was found to be 25.28 kg, 482.9 kg and 500.54 kg at L.L.H., S.N.M.C.&H. and D.H. as shown in Fig. 3. An average waste generated per bed per day was found 4.49 kg/bed/day at S.N.M.C.& H., 0.12 kg/bed/day at L.L.H. and 4.20 kg/bed/day at D.H. respectively (Table 1 & Fig. 4). The healthcare waste produced in different healthcare unit are found within limit (0.5-2 kg/bed/day) describe in CPCB guideline Kishore and Ingle (2004), Acharya and Singh (2000) and Patil and Shekdar (2001). Rampal *et al.* (2002) also observed the generation of solid waste per capita per day and average solid waste generation per day along with qualitative composition of solid waste; moreover Sharma (2002) also reported that between 75% and 90% of the waste produced by healthcare facilities is general waste, comparable to domestic waste.

Table-1: Healthcare waste generated by government healthcare units in Agra City

Name of Healthcare unit	Total no. of beds	Total waste generated per month (kg)	Average waste generation per day (kg)	Average waste generation per bed per day (kg)
S.N.M.C. Hospital	976.00	14489.30	482.90	4.49
Lady Loyal Hospital	200.00	758.40	25.28	0.12
District Hospital	119.00	15016.30	500.54	4.20

The average generation of waste/month by the government three healthcare units in Agra was observed in yellow bag, red bag and blue bag. The yellow colour bag waste generated/month was observed 514.12 kg at L.L.H., 5811.77 kg at DH and 7751.3 kg at SNMC&H and the total waste generated/day in between 17.13 kg at L.L.H., 193.7 kg at DH and 258.3 kg at SNMC&H respectively (Table-2 & Fig. 5 & 6).

Table-2: Healthcare waste generated per month and per day by government healthcare units in Agra City

Colour code	Waste	S. N. M. C. Hospital	Lady Loyal Hospital	District Hospital
Yellow	Total waste generated/month (kg)	7751.3	514.12	5811.77
	Total waste generated/day (kg)	258.3	17.13	193.7
Red	Total waste generated/month (kg)	4352	156.5	5011.35
	Total waste generated/day (kg)	145.06	5.21	167.04
Blue	Total waste generated/month (kg)	2386	87.8	4160.6
	Total waste generated/day (kg)	79.53	2.92	138.68

The red colour bag also containing total waste generated/month was observed 156.5 kg at L.L.H., 4352 kg at SNMC&H and 5011.33 kg at DH and the total waste generated/day 5.21 kg at L.L.H., 145.06 kg at SNMC&H and 167.04 kg at DH respectively. The blue bag observed total waste generated/month was observed 87.8 kg at L.L.H., 2386 kg at SNMC&H and 4160.6 kg at DH and the total waste generated/day 2.92 kg at L.L.H., 79.53 kg at SNMC&H and 138.68 kg at DH respectively (Table-2 & Fig.5 & 6). This waste dumped without proper disposal or incinerated. Fikru (2004) also observed that the open burning of waste in holes or similar enclosures (45%) and incineration (43%) were the most common types of waste disposal methods for sharps waste and in 33% of the health facilities, the dumping of waste in unsupervised areas and/or open burning as well as the inappropriate use of incinerators are the commonest malpractices that often meet the eyes. Yemane & Millogo (2000) also reported that 38% of the waste management consisted of burning, 32% done using holes or similar enclosures; sharps and other wastes were dumped using open ground or otherwise unsupervised containers in 30% of the healthcare facilities. Furthermore, the report revealed that among the health centers using incinerator, 50% of them dumped sharps openly and rather nonchalantly, resulting in the conspicuous presence of sharps laying here and there around the health centers in 49% of the places visited. Disposing used syringes in open places and the belief that used syringes are not harmful are widespread among the communities studied and awareness on where to dispose of used needles and syringes are found to be very low was described by Solomon (2005). Consequently, sharps are observed relegated in open containers, exposing personnel and the rest of the public to needle stick injuries in 61% of the facilities.

Recommendations

1) What method use for waste segregation. To appoint a well knowledge staff for separate collection, transport, treatment and proper disposal of infectious healthcare waste.
2) To store waste at site, including the specification of the bins (colour, size, type etc. according The Biomedical Waste (Management & Handling) Rules 1998/2000).
3) To develop a time table for proper waste collection and transportation at dumping site.
4) Proper procedures to consider for waste storage and treatment

5) Given protective clothing to worn and safety measures to be practiced by waste collectors.
6) Recycle non-hazardous waste by separating the waste into organic and inorganic factors, selling the inorganic waste and making compost from organic waste.
7) Regular monitor the waste management practices in the hospital and evaluate the performance of the system time to time.
8) Contact the municipality for separate collection of hazardous and non-hazardous waste. If municipal service is not available, make arrangement for treatment and disposal of hazardous waste.

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Diversity in phyllosphere mycoflora infected with Black Mildew

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Abstract

Correct identity of a fungus absolutely free from ambiguities is vital for its employment in applied discipline. The weeds and forest plants serve as reservoirs of leaf spot pathogens which on getting opportunity may spread to agricultural and horticulture plants. Keeping this view in mind the authors during January 9-12, 2088 while in Mahabaleshwar, surveyed the lush green vegetation for folicolous fungi on Jan 10, 2008. The authors collected eleven host plants being parasitized with none fungi. out of these two hosts *Syzygium* sp. Linn. (Myrtacear; HClo- 48269) and *Flacourtia indica* Merrill (Flacourtiaceae; HClO- 48270) were found infected with novel species of *Meliola syzygineа*Singh and Mall sp. no. and *M. flacourticola* Sing and Mall sp. nov. respectively. The fungal diversity of Phyllosphere mycoflora of the above said two hosts were worked out following standard methods. On *Syzygium* sp. Linn., *Meliola syzginea* Singh and Mall sp. no. only was representing frequency class D where as *Aspergillus niger* Van Tiegh, *A. flavus* L., *Curvularia* sp. (Waker) Boedifin was representing class C; *A. Terreus* Thom, *Scoratia* sp., *Mucor* sp. class B; *Fusarium* sp. Sheldon and *Penicillum* sp. class A. No fungus was found representing frequency class E. On *Flacourtia indica* Merrill, *Aspergillus niger* Van Tiegh only was found representing frequency class E where as *Meliola flacourticola* Singh and Mall sp. nov. and *A. ustus* Thom and Church represented class D; *Trichoderma verdi* Pers. ex Fr., *Fusarium* sp. Sheldon. class C; *Rhizopus* sp. Ehrenb ex Corda, *Scoratia* sp. class B and *Trichoderma* sp., *Penicillium globarcum* class A.

Keywords:- *Mycobial diversity, Phyllosphere, Black mildew, Species novum*

Introduction

Correct identity of a fungus absolutely free from ambiguities is vital for its employment in applied discipline. The weeds and forest plants serve as reservoirs of leaf spot pathogens which on getting opportunity may spread to agricultural and horticulture plants. Keeping this view in mind the authors during january 09-12, 2008 while in Mahabaleshwar so as to attend the 60th Annual meeting and National Symposium of Indian Phytopathological Society, New Delhi at Regional Wheat Rust Research Station, Mahabaleshwar Distt. Satara, the authors surveyed the lush green vegetation for foliicolous fungi on January 10, 2008. The present study have been under taken to explore the diversity in Phyllosphare mycoflora Infected with Black Mildew.

Materials and Method

The fungal diversity of Phyllosphere mycoflora of the two hosts *Syzygium* sp. and *Flacourtia indica* were worked out following standard methods as described by Mishra and Kanaujia, 1972a,b, 1981, 1982; Kanaujia and Singh, 1977, 1978; Singh and Mall, 2007, 2008. The mycoflora of phyllosphere was developed on PDA medium supplemented with antibiotic and incubated at 25±2 ^{0}C after serial dilution of 1 ml washing of leaves surface as described by Ruinen (1961) and Kanaujia (1977). The samples were taken in 10 petriplates and observation were taken after the seven days. Morphotaxnomic determinations of taxa were done with the help of current literature and resident expertise available. New Holotypes have been deposited in HClO, IARL, New Delhi and all the siotypes retained in the departments herbarium for further reference.

Results and Discussion

The authors collected eleven host plants being parasitized with nine fungi. Out of these two hosts *Syzygium* sp. Linn. (Myrtaceae; HCIO- 48269) and *Flacourtia indica* Merrill (Flacourtiaceae; HCIO- 48270) were found infected with novel species of *Meliola syzyginea* Singh and Mall sp. nov. and *M. flacourticola* Singh and Mall sp. nov. respectively. The fundal diversity of phyllosphere mycoflora of the above said two hosts were worked out following standard methods. On *Syzygium* sp. Linn., *Meliola syzginea* Singh amd Mall sp. nov. only was representing frequency class D wehre as *Aspergillus niger* Van Tiegh, *A. flavus* L., *Curvularia* sp. (Waker) Boedifin was representing class C; *A. Terreus* Thom, *Scoratia* sp. *Mucor* sp. class B; *Fusarium* sp. Sheldon and *Penicillium* sp. class A. No fungus was found representing frequency class E. On *Flacourtia indica* Merrill, *Aspergillus niger* Van Tiegh only was found representing frequency class E where as *Meliola flacourticola* Singh and Mall sp. nov. and *A. ustus* Thom and Chruch represented class D; *Trichoderma verdi* Pers. ex Fr., *Fusarium* sp. Sheldon class C; *Rhizopus* sp. Ehrenb ex Corda, *Scoratia* sp. class B and *Trichoderma* sp., *Penicillium globarcum* class A. The moisture requirement, desiccation or waterlogging are important in determination of fungal population. Waid (1960) found that there is a great reduction in active growth of fungi whenever the moisture content is sufficiently high so as to reduce aeration.The different edaphic factors and cover vegetation influence mycoflora to an appreciable degree. At the same moment no single component may be spotted out as major microbial determinant. Environmental conditions and microbial composition interact in a very specific manner maintaining an equilibrium.

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In-vitro antimicrobial activity of *Psidium guajava* (L.) against some isolated oral pathogens

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Abstract

Methanolic extract of *Psidium guajava* stem was investigated for its antimicrobial activities against five isolated oral pathogen. Among the 50 sample collected from patients 26.25% were identified as *Staphylococcus* spp., 25% as *Micrococcus* spp., 23.75% *Streptococcus* spp, 15% *Corynebacterium* spp and 10% Proteus spp.The strongest antimicrobial activity was observed against *Micrococcus spp.*

Keywords:- *Psidium guajava, Antimicrobial*

Introduction

In recent year antibiotic resistance to common antibiotic has been increasing day by day. The mechanism of resistance is either emergence of bacteria or mutation of one or more genes. This situation, the undesirable side effect of certain antibiotic and the emergence of previously uncommon infections has forced scientist to look for new antimicrobial substance from medicinal plant and other sources (Marchese and Shito, 2001). The screening of plant extracts and plant products for antimicrobial activity has shown that plants represent a potential source of new antimicrobial agents (Amani et al., 1998). Recent interest in chewing sticks and their extract has focused on their effects on organisms that are involved in oral infection. Dental caries and periodontal disease i.e. gingivitis and periodontitis are the most common chronic oral diseases worldwide. Although these diseases have affected human beings since prehistorical times, the prevalence of these diseases has greatly increased in modern times. The prevalence of dental diseases in India is approximately 60-65% (Shouri, 1941) while the prevalence of periodontal disease is approximately 65-100% (Kanal et *al.* 1971). Dental caries is an infectious microbial disease that results in localized dissolution and destruction of the calcified tissues of teeth (Ross *et al.,* 1994). Most of the investigators believe that development of caries of enamel is preceded by the formation of microbial plaque in the tooth (Gibbons *et al.* 1963). The human oral cavity is habitat for about 500 cultivable and non cultivable bacterial species (Paster *et al.*2001) up to 100 species can be present in a particular oral cavity (Consensus, 1996) while the majority of these species are commensals, a subset is opportunistic pathogens. They have also been implicated in the etiology of a number of systemic diseases like infective endocarditis, (Barrau *et al.* 2004) respiratory infections, (Mojon *et al.* 2003) cardiovascular diseases, (Okuda et *al.,* 2004) and brain abscess (Corson *et al.* 2001).Oral bacterial isolates resistant to penicillin, metronidazole, tetracycline and macrolides have been reported by researchers from different countries (Sweeney *et al.,*

2004). Such resistant bacteria have also been isolated from infections at extra oral sites (Doern *et al.* 1996). To cope with this problem of antibiotic resistance, a number of strategies such as reduced antibiotic use and antibiotic alternatives have been proposed (Hamilton *et al.,* 2004). Among antibiotic alternatives are therapies derived from complementary and alternative medicine. In fact, there are an overwhelming number of studies on the antibacterial activities of plant and natural products derivatives. Recently some plant extracts have been shown to have activity against resistant bacterial strains (Gibbons *et al.* 2003).

Psidium guajava (L.) (Guava) belong to the family Myrtaceae, grows nearly throughout the country up to 1500 m. it is cultivated commercially in almost all states. The total estimated area being about 50,000 hectares. The important guava growing states are: U.P. Bihar, Uttaranchal. Maharastra, Assam, West Bengal, Andhra Pradesh & Chennai. About half of the total area is reported in Uttar Pradesh. The plant of guava is found almost every garden of Indians. Guava is rich in tannins, phenols, triterpenes, flavonoids, essential oils, saponins, carotenoids, lectins, vitamins, fiber and fatty acids. Guava fruit is higher in vitamin C than citrus (80 mg of vitamin C in 100g of fruit) and contains appreciable amounts of vitamin A as well. Guava fruits are also a good source of pectin – a dietary fiber. The leaves of guava are rich in flavonoids, in particular, quercetin. Much of guava's therapeutic activity is attributed to these flavonoids. The flavonoids have demonstrated antibacterial activity. Quercetin is thought to contribute to the anti-diarrhea effect of guava; it is able to relax intestinal smooth muscle and inhibit bowel contractions. In addition, other flavonoids and triterpenes in guava leaves show antispasmodic activity. Guava also has antioxidant properties which are attributed to the polyphenols found in the leaves (Arima *et al.,* 2002). Bark and leaf extracts have shown to have in vitro toxic action against numerous bacteria. In several studies guava showed significant antibacterial activity against such common diarrhea causing bacteria as *Staphylococcus, Shigella, Salmonella, Bacillus, E. coli, Clostridium, and Pseudomonas* (Abdelrahim *et al.* 2002). The present study was undertaken to investigate the in vitro antibacterial activity of methanolic extract of twigs of *P. guajava* against oral pathogens.

Materials and Method

Collection of sample for isolation of oral pathogen

Total 50 samples were collected from Shree "Mahant Indresh hospital" Patel Nagar, Dehradun. The samples from dentine of teeth were taken into a sterile cotton swab. The cotton swab was placed in each approximal site and then passed along the gingival margin into the next approximal site of both the upper and lower teeth.

Enrichment of the sample

The cotton swabs were enriched in lactose broth (HiMedia) and Trypticase soy broth (HiMedia) for 12 hours at 37^0 C in the incubator. Then the enriched sample was streaked on both general Nutrient Agar and Selective media Brain Heart Infusion Blood Agar (HiMedia), Mac Conkey Agar (HiMedia), Mannitol Salt Agar (HiMedia), and Vogel Johnson Agar (HiMedia).

Isolation and identification of pathogens

The pathogens associated with dental caries, gum and periodontal diseases were isolated from infected tissues and identified by standard morphological and biochemical tests on the surface of the growth of the isolates (Holt. *et al.,* 1994).

Collection of Plant Material

The Plant used were the air dried stem of *P. guajava* (Guava) collected from Forest Research Institute (FRI) Dehradun and Identified by Botanical survey of India, Dehradun.

Extraction of Plant Materials

The air dried and powdered material was extracted, with methanol by soxhlet apparatus by removing the solvent with rotary evaporator (Butchi Type) crude extracts were obtained.

Antibacterial Assay

Preparation of Inoculum

The ideal inoculum after overnight incubation gives the even semi confluent growth. Too heavy inoculum may reduce the size of inhibition zone by many antimicrobial agents from plant source. Using a straight wire touch 5-10 well isolated colonies of particular microorganism against which antimicrobial activity to be tested. Inoculate on the Nutrient Broth Medium. Incubate at 35-37°C for 4 – 6 hour. The density of the inoculums is adjusted to 10^8 cfu/ml by comparing with that of 0.5 Mc Farland Standard.

Agar Well Diffusion

0.1 ml of the original cultures (about10^6-10^7 cells) were added into sterile duplicate sets of Petri dishes and 25 ml of the molten (45° C) Mueller Hinton Agar (HiMedia, Ltd) were poured into Petri dishes. The methanol extract (0.1ml) were placed in wells (8mm diameter) cut in the agar media and plates were incubated at 37° C in the case of bacteria and at 30°C in the case of yeasts (Kývanç et al., 1986). The resulting inhibition zones obtained with bacteria were recorded after 24 hour.

Results and Discussion

The present study was conducted to investigate the antimicrobial activity methanolic extract of *P. guajava* against some isolated oral microorganism. Among the 50 sample collected from patients 26.25% were identified as Staphylococcus spp., 25% as Micrococcus spp., 23.75% *Streptococcus* spp, 15% *Corynebacterium* spp and 10% proteus spp. (Fig.1). Among the 40 microbial samples collected from adult patients, 10.63% were identified as *Staph. aureus*, 4.32% as *Strep. mutans*, 6.38% *Strep. faecalis*, 2.12% *Strep. pyogenis*, 5.25% *Lactobacillus acidophilus*, 2.1% *Ps. aeruginosa* and 4.3% as Candida albicans (Al-Bayati and Sulaiman, 2008).

On the other hand, the methanolic extract of *P. guajava* showed activity against the entire isolated microorganism. Zone of inhibition ranged from 12.82±1.15 - 16.93±1.28 mm. Maximum activity was shown against Micrococcus sp. i.e. 16.93±1.28mm and less active as compared to tested microorganism is against Proteus sp i.e. 12.82±1.15mm. Standard drug Amoxicillin and Doxycycline was active against the entire test microorganism. The extracts of *P. guajava* compared with the standard antibiotics (Doxycycline and Amoxicillin). The plant extracts and antibiotics show almost equal antibacterial activity against oral pathogens. Previous studies reported that the methanolic extract of *Psidium guajava* was also shown to possess antibacterial effect on *Bacillus subtilis, Staphylococcus aureus, Escherichia coli* and *Pseudomonas aeruginosa* (Abdelrahim *et al.,* 2002). Gnan and demello (1999) reported a complete inhibition of growth of *S. aureus*, *S. epidermidis* and *Salmonella typhimurium* caused by aqueous guava leaf extract at a concentration of 8 mg/ml. Veeira et al (2001) reported the microbicidal affect of guava sprout

extract (ethanol, acetone and water) upon toxigenic S.aureus and E. coli, performed using radial diffusion. Earlier pharmacological investigation indicated that its fruit and leaves posses antibacterial, hypoglycemic, anti-inflammatory , analgesic, antipyretic, spasmolytic and CNS depressant activities (Begum et al., 2002). Jairaj et al., (1999) also reported the water, alcohol and chloroform extracts of leaves were effective against *Aeromonas hydrophila*, *Shigella* spp., *Vibrio* spp., *Staphylococcus* spp., *Sarcina lutea* and *Mycobacterium phlei*. It can be concluded that the methanolic extract are excellent oral hygiene agents and their use should be promoted based on scientific knowledge of their benefit and proper use. Because it is widely available in India and is inexpensive. *P. guajava* chewing sticks can be great help in developing countries with financial constrains and poor or limited oral health care facilities.

Table-1: Effect of methanolic extract against isolated microorganism

		Zone of inhibition (In mm)		
Microorganism	**No. of isolates**	**MeOH***	**Amoxicillin**	**Doxycycline**
Micrococcus sp.	20	16.93±1.28	17.97±1.25	18.07±1.21
Cornebacterium sp.	12	15.81±1.22	16.67±1.54	16.05±1.62
Staphylococcus sp.	21	15.23±1.14	16.21±1.58	15.72±1.61
Streptococcus sp.	20	16.48±0.97	17.32±1.58	16.47±1.55
Proteus sp.	8	12.82±1.15	14.0±1.38	14.15±1.71

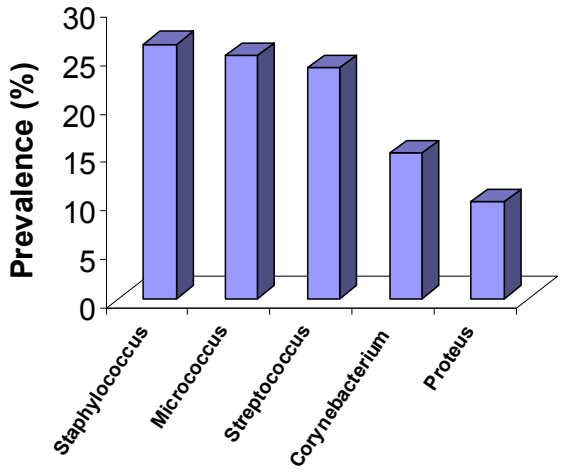

Fig.1: Prevalence of isolated microorganism.

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Natural disaster: Earthquake

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Abstract

A disaster is the impact of a natural or man-made hazard that unconstructively affects society or environment.Earthquakes are most destructing among all the known disasters as their prediction is not yet possible. Depending on earthquake severity, a quake can pose hazards to people's lives, property and lifeline infrastructure such as highways, water supply and electricity generating facilities.

Keywords:- *Disaster, Earthquake, Epicentre, Richter scale, Magnitude, Earthquake risk*

Although the earth belongs to humans but this truth cannot be ignored that in every place the humans live, there is possibility of existence of natural disasters.There are wildfires in hot dry regions and avalanches in cold. On land, earthquakes rattle buildings and bring down trees; underwater, they can generate monster waves capable of erasing entire coastlines. Volcanoes burble up from Earth's molten core, while hurricanes, tornadoes, and lightning come from the sky.

Disaster is unlike anything else in human experience. It strikes quickly – it changes the lives of all that it touches and its effects are felt long even after the event. Definition of earthquake given by the Oxford English Dictionary "Anything that befalls of ruinous or distressing nature; a sudden or great misfortune, mishap, a calamity". An occurrence arising with little or no warning, which causes or threatens serious disruption of life and perhaps death or injury to large number of people, is the disaster.

The word *disaster* has been derived from *astrology* which means that a bad event happens when the stars are in unfavorable position. A natural disaster is the consequence of a natural hazard which affects human activities. Natural disasters strike the Earth at any time and at any place. The lack of planning or lack of appropriate emergency management has led to the financial, environmental or human losses. The resulting loss depends on the capacity of the population to support or resist the disaster, their resilience. This understanding is concentrated in the formulation: "disasters occur when hazards meet vulnerability". A natural hazard will hence never result in a natural disaster in areas without vulnerability, e.g. strong earthquakes in uninhabited areas. The losses due to disasters have been reported much larger in developing countries. As a percentage of GDP, in developing countries the losses due to natural disasters is found to be 20 times more than in industrialized countries.

Some examples of natural disaster are volcanic eruption, earthquake, landslides, floods, draught etc. Earthquakes are among the deadliest and most destructive of natural disasters.

Why earthquakes occurs?

Human activity has increased the occurrence of earthquakes in three main ways. First, the Earth's crust has been loaded with increasing numbers of large water reservoirs and this has created local minor

earthquakes. Second, the disposal of liquid wastes in deep wells has caused an increase in fluid pressures in rocks in certain regions, facilitating movements along fractures. Third, the underground testing of nuclear devices creates pressure which could affect the stability of earth's crust. Earthquake is a series of vibrations on the earth's surface caused by the generation of elastic (seismic) waves due to sudden rupture within the earth during release of accumulated strain energy. Faulting may be considered as an immediate cause of an earthquake. Due to constant movement of plates, deformation is caused which results to generations of strain energy.

Earthquakes will occur anywhere within the earth where there is sufficient stored elastic strain energy to drive fracture propagation along a fault plane. An earthquake is caused by a sudden slip on a fault. Stresses in the earth's outer layer push the sides of the fault together. Stress builds up and the rocks slip suddenly, releasing energy in waves that travel through the rock to cause the shaking that we feel during an earthquake **[Spence *et. al*., 1989]**. A fault is a thin zone of crushed rock between two blocks of rock, and can be any length, from centimeters to thousands of kilometers. It is a fracture in the crust of the earth along which rocks on one side have moved relative to those on the other side. Most faults are the result of repeated displacements over a long period of time.

There are 3 different kinds of faults: (1) Normal, dip-slip fault. The fault plane of a normal fault dips away from the uplifted crustal block. Faulting occurs in response to extension.

(2) Reverse, dip-slip fault. The fault plane of a reverse fault dips beneath the uplifted crustal block. Faulting occurs in response to compression.

(3) Strike-slip fault. Crustal blocks slide past each other. The slip may be left lateral or right lateral. This example shows a left-lateral, strike-slip fault **[*www2.nature.nps.gov*]**.

Earthquakes occur on faults. When an earthquake occurs on one of these faults, the rock on one side of the fault slips with respect to the other. The fault surface can be vertical, horizontal, or at some angle to the surface of the earth. The slip direction can also be at any angle. Because of this, there are two different types of earthquake that can occur. The strike-slip earthquake occurs on an approximately vertical fault plane as the rock on one side of the fault slide horizontally past the other. The dip-slip earthquake happens when the fault is at an angle to the surface of the earth and the movement of the rock is up or down. Surface rupture occurs when movement on a fault deep within the earth breaks through to the surface. Not all earthquakes result in surface rupture. Fault rupture almost always follows preexisting faults which are zones of weakness. Rupture may occur suddenly during an earthquake or slowly in the form of fault creep, which is the slow movement of faults in the earth's crust. Sudden displacements are more damaging to structures because they are accompanied by shaking.

Earthquake terminalogy

The earth's crust is divided into several major plates, some 50 miles thick, which moves slowly and continuously over the earth's interior. Most earthquakes occur as the result of slowly accumulating pressure that causes the ground to slip abruptly along a geological fault plane on or near a plate boundary. The resulting waves of vibration within the earth create ground motion at the surface that vibrates in a very complex manner. The point where the fault first slips is the focus or hypocenter of the earthquake. A theoretical point on the earth's surface directly above the focus is the epicentre of the earthquake. **Epicentre** – It is the point on the surface of the earth vertically above the origin place (hypocentre) of an earthquake. This point is expressed by geographical latitude and longitude.

Magnitude - It is a quantity to measure the size of an earthquake in terms of its energy and is independent of the place of observation.
Richter scale – Magnitude is measured on the basis of ground motion recorded by an instrument and applying standard correction for the epicentre distance from recording station. It is related with the logarithm of amount of energy released by an earthquake and expressed in Richter scale.
Intensity – It is the rating of the effect of an earthquake at a particular place, based on the observations of the damaged areas, using a descriptive scale like Modified Mercalli Scale.

How are earthquakes measured?

Earthquakes are measured with a seismographic network. Each seismic station in the network measures the movement of the ground at the site. The slip of one block of rock over another in an earthquake releases energy that makes the ground vibrates. That vibration pushes the adjoining piece of ground and causes it to vibrate as well, and thus the energy travels out from the earthquake in a wave. Most earthquakes are measured by magnitude. Magnitude measures the energy produced by the earthquake, rather than what people feel during the event. The instruments used to record the motion of the ground during earthquakes are called *seismographs*. First developed during the 1890's, these instruments are installed in the ground throughout the world and operate as seismographic network. Seismograph consists of seismometer, which is a pendulum or a mass mounted on a spring, and which moves during earthquakes. Seismographs produce seismograms, which is the paper copy with squiggly lines. **[*www.crew.org*]**.

CLASSIFICATION OF EARTHQUAKES–

Slight	-	Magnitude up to 4.9 on the Richter scale
Moderate	-	Magnitude 5.0 to 6.9
Great	-	Magnitude 7.0 to 7.9
Very Great	-	Magnitude 8.0 and more

CERTAIN EARTHQUAKES OF INSTANT DECADE

The primary effects of earthquake are violent ground motion accompanied by fracturing which may shear or collapse large buildings, bridges, dams, tunnels and other rigid structures. Secondary effects include short range events such as fires, landslides, tsunami and floods and long-range effects, such as regional subsidence, uplift of land masses and regional changes in ground water hydrology. Table-1 displays the earthquakes occurred during 2000 to 2008. Although a large number of earthquakes occurred during this period, those which were more harmful and fatal are discussed- On January 2001, an earthquake of 7.9 magnitudes on Richter scale rocked the city of Bhuj of Gujarat state in western India at 03:16 GMT (8:46 AM local time) and reduced most of its sand stone modern buildings to heaps of rubble. This earthquake was caused by movement of Indian plates as it moves northward into Eurasian plate. Estimate of lives lost is 30,000 and injured 55000. Some aftershocks as strong as 5.9 magnitudes were also being recorded. This quake was the most powerful to strike India since August 15, 1950, when an 8.5 magnitude earthquake killed 1538 people in Assam (India). The largest earthquake in the world since Alaskan earthquake (1964) [USGC, 2008] was of 9.3 magnitude that struck on DEC 26, 2004 at 00:58 GMT (6:58 AM local time) in Indian subcontinents. The death toll has been estimated at over 283,000, especially from the Tsunami [Noson *et al.*, 1988] generated by the earthquake. The Tsunami fanned out over the Indian Ocean causing

severe and sudden flooding in SriLanka, India, Thailand Indonesia and other areas. Most of the people were caught by surprise because of lack in warning system. The Indian Ocean has no way to warn of an impending Tsunami, unlike Pacific Ocean which has a well developed warning system. There have been many powerful aftershocks along the whole 745 miles fault that was affected, notably in the Andaman Nicobar Island.

Table-1: Harmful and fatalearthquakes during 2000-2008

DATE	TIME	PLACE	FATALITIES	MAGNITUDE
January 13, 2001	17:33	El Salvador	844	7.7
January 26, 2001	03:16	Gujarat, India	20,085	7.7
June 23, 2001	20:33	Coastal Peru	75	8.4
March 25, 2002	14:56	Hindu Kush Region, Afghanistan	1,000	6.1
May 21, 2003	18:44	Boumerdes, Algeria	2,226	6.8
December 26, 2003	01:56	South Eastern Iran	31,000	6.6
October 23, 2004	17:56	Ojiya, Japan	46	6.9
December 26, 2004	00:58	Off West Coast, Northern Sumatra	300,000	9.3
February 22, 2005	02:25	Zarand, Iran	790	6.4
March 28, 2005	16:09	Northern Sumatra, Indonesia	1,313	8.7
June 13, 2005	22:44	Tarapaca, Chile	11	7.8
October 8, 2005	03:50	Muzaffarabad, Pakistan	>75,000	7.6
November 26, 2005	00:49	Jiujiang, Jiangxi Province, China	13	5.7
May 27, 2006	22:54	Java, Indonesia	6234	6.3
July 17, 2006	08:19	South of Java, Indonesia	>400	7.7
March 6, 2007	05:49	Sumatra, Indonesia	>60	6.4
April 1, 2007	20:39	Soloman Islands	>28	8.1
August 15, 2007	23:40	Northwest of Chinch Alta, Peru	519	8.0
September 12, 2007	11:10	Sumatra, Indonesia	23	8.4
February 3, 2008	07:34	Lac Kio Region, Democratic Republic of Congo	>39	6.0
May 11, 2008	07:10	Wanchuan, China	>80000	7.8

The 2008 Sichuan earthquake or Great Sichuan Earthquake, of intensity 8.0, occurred at 14:28:01.42 (China Standard Time) on May 12, 2008 in Sichuan province of China. It was also known as the Wenchuan earthquake after the earthquake's epicenter in Wenchuan County, Sichuan province. The earthquake was felt as far away as Beijing (1,500 kilometers away) and Shanghai (1,700 kilometers away), where office buildings swayed with the tremor. Official figures state that 69,197 are confirmed dead, including 68,636 in Sichuan province and 374,176 injured, with 18,222 listed as missing. The earthquake left about 4.8 million people homeless, though the number could be as high 11 million. It is the deadliest and strongest earthquake to hit China since 1976 Tangshan earthquake which killed at least 240,000 people. Strong aftershocks, some exceeding magnitude 6, continue to hit the area even months after the main quake, causing new casualty and damage.

Earthquake risk

The earthquake risk to a structure or system can be considered to be made up of four components as follows:

Seismic Risk = Hazard X Exposure X Vulnerability X Location

Hazard means the occurrence of a terrifying earthquake of sufficient magnitude (hence peak intensity at the point of occurrence) capable of causing damage to the weakest manmade structures. Exposure indicates the objects and structures made by man which are exposed to the effects of the Hazard and will include buildings, bridges, dams, power plant, life-line structures etc. Vulnerability indicates the damageability of the exposure under the action of the Hazard, weaker constructions being more vulnerable and risky than the stronger ones. Finally location means how far exposure is situated from the location of the hazard; the nearer ones being in greater danger than those far away. The various Hazardous effects of earthquakes are shown in Fig.1.The determination of seismic risk level involves considerable uncertainty and requires special study and understanding of the phenomena involved. The policy planning regarding mitigation of earthquake risk is not only concerned with the existing risk level but also with what would be the acceptable risk taking into account the tradeoffs involving cost to the individual, cost to the society, amount of safety increased per unit of additional cost etc.

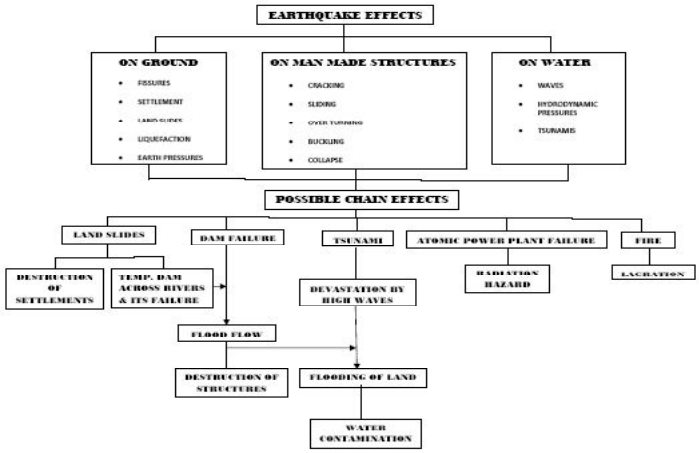

Fig.1 : Hazardous effects of earthquake

Approach to handle the problems

It appears that three approaches exist which seem to have been used advertently or otherwise for handling the earthquake or other natural disaster **[Arya, 1981]**. The first seems to be fatalistic, that is, everything

left to the mercy of supernatural powers or fate. This is where the destiny of most of the rural population in developing countries seems to lie. Those who die are relieved of the burdens of life but those who survive, struggle to continue to exist and rebuild whatever they could. The second approach appears to be indifferent to the preventive pre-disaster measures but take whatever possible action could be taken after the tragedy by way of relief and rehabilitation. Where the natural disaster take place frequently, this becomes a heavy burden on the resources of the state without a long term solution. The population remains under the fear of the tragedy and the development of the region remains restricted. The third and most scientific approach is that of determination to meet the challenge by using appropriate preventive measures before hand so that the disastrous effects are either completely prevented or minimised, the aftershock relief works are reduced to a minimum, life becomes normal within the least possible time, and people continue their economic pursuits with the least amount of break **[Arya, 1981]**.

Studies by UNDRO conclusively reveal that: (a) the natural disasters constitute a major development problem in most countries particularly in their disaster prone regions, (b) most of these disasters can be prevented or mitigated and, (c) the most basic preventive measures are the least expensive too.

Earthquake prediction studies help in defining the hazard and its location and in stimulating preparedness actions including preventive measures before the occurrence of the hazard and emergency relief measures after the event. Prediction as a means of disaster reduction by saving human lives is extremely unreliable at present and for saving economic losses it will be utterly useless.

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