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Ph.D. Thesis, Dissertation and Reports

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Contents

Environment Conservation Journal 7 (3) 1-7, 2006
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Monitoring of herbicide (fernoxone) toxicity by using pollen as indicators – pollen of five cultivars of *Petunia axillaris* : Further Evidence of a Criticism of Banerji and Gangulee (1937), Brewbaker and Kwack (1963), Dharurkar (1971 - Ph.D. Thesis), Berg (1973), Brandt (1974), Vick and Bevan (1976), Rasmussan (1977), Navara, Horvath and Kaleta (1978), Mhatre (1980 - Ph.D. Thesis), Mhatre, Chaphekar, Ramani Rao, Patil, Haldar (1980), Shetye (1982 - Ph.D. Thesis) and Giridhar (1984 - Ph.D. Thesis) : A Critical Review

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Abstract

All the concentrations (10^{-17}-10^{-2} -10^{-3}, 1, 5, 10, 20-20-100 mg/ml) of fernoxone tried suppressed the germination of pollen of F series of violet-flowered cultivar, F-24 series of all the five cultivars and F-48 series of white-flowered cultivar of *Petunia axillaris*.

Key Words : *Palynology, Toxicology, Environmental Science, Herbicides.*

Running Title : Monitoring of herbicide toxicity by using pollen as indicators – Pollen of *Petunia axillaris*

Introduction

The use of vegetation as biological indicator of environmental quality has a long history dating back to the miners canary, to the recognition about 100 years ago. Recent studies have shown the feasibility of using natural vegetation for monitoring pollution (Berg, 1973; Brandt, 1974; Rasmussan, 1977; Navara *et al.*, 1978).

Materials and Methods

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 *Petunia axillaris* BSP. *e.g*. light-violet-, pink-, violet-, white- and white-violet-flowered cultivars were collected at the stage of the dehiscence of anthers in the open flowers. Germination of pollen grains of successive flowers were studied by standing-drop technique in the optimum concentrations of sucrose (acts as control) as well as in the optimum concentrations of sucrose supplemented by the different concentrations (10^{-17}-10^{-2}-10^{-3}, 1, 5, 10, 20-20-100 mg/ml) of fernoxone (Table 1). The cultures were then transferred to a moist filter chamber, stored at room temperature (21.9-32.2°C) having RH 58% and in diffuse laboratory light. Observations 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. Percentage inhibition was also determined.

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.

Potentiality of the germinability of pollen is noted only in F series of pink- and white-flowered cultivars of *Nerium odorum*. Both of them are single-flowered cultivars (Salgare, 1983). Potentiality of the germinability of pollen was recorded in F and F-24 series of *Physalis minima* and *Solanum xanthocarpum* (Ram Indar, 1981-), in red-flowered (double-flowered) cultivar of *Nerium odorum* and in white-flowered cultivar of *Catharanthus roseus* (Salgare, 1983), in all the 5 cultivars of *Petunia grandiflora* (Sharma, 1984), in all the 5 cultivars of *Solanum melongena* (Singh, 1985) and in all the 5 cultivars (light-violet-, pink-, violet- and white-violet-flowered cultivars) of *Petunia axillaris* except for white-flowered cultivar (Salgare, 1986a-). Pollen germination *in vitro* culture of sucrose was noted in F, F-24 and F-48 series of *Brunfelsia americana* and in violet-flowered form of *Datura fastuosa* (Ram Indar, 1981), in all the 3 cascades (Sharma, 1984) and in white-flowered cultivar of *P. axillaris* (Salgare, 1986a). However, it was the pollen of white-flowered form of *D. fastuosa* (Ram Indar, 1981) and pink-flowered cultivar of *C. roseus* (Salgare, 1983) showed their germination *in vitro* culture of sucrose in all the 4 series (F, F-24, F-48, F-72 series) investigated. Potentiality of the germinability of pollen in all the 4 series investigated was also noted by Salgare (1986f) in 3 Leguminous crops *viz. Cyamopsis tetragonoloba* Var. Pusa Navbahar – gawar, *Phaseolus aureus* Var. J-781- mung and *Phaseolus mungo* Var. T-9- urid. Theresa Sebastian (1987) observed the germination of pollen of one of the Leguminous crops *i.e. Vigna mungo* Type 9, of Uttar Pradesh in all the 4 series investigated *in vitro* culture of sucrose. Suwarna Gawde (1988) noted the germinability of pollen of 2 Leguminous crops *viz. Vigna unguiculata* Var. Pusa Barsati – cowpea and *Vigna radiata* . Var. Pusa Baisakhi of Delhi in all the 4 series investigated. Johri and Chhaya Roy Chowdhury (1957) stated that in *Citrullus colocynthis,* where pollen grains 'mostly remained attached in tetrads', satisfactory germination is observed.

Salgare (1983) observed the germination of pollen of F-72 series of pink-flowered cultivar of *Catharanthus roseus in vitro* culture of sucrose. However, Trisa Palathingal (1990) 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 points out that Brewbaker and Kwack's (1963) culture medium is not ideal for pollen culture.

As a rule the percentage of pollen germination is always less than the pollen viability. However, Banerji and Gangulee (1937) and Dharurkar (1971) 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, 2000b, 06b) who stated that the observations of Banerji and Gangulee (1937) and Dharurkar (1971) are exaggerating.

All the concentrations (10^{-17}-10^{-2}-10^{-3}, 1, 5, 10, 20-20-100 mg/ml) of fernoxone tried suppressed the germination of pollen of F series of violet-flowered cultivar, F-24 series of all the five cultivars and F-48 series of white-flowered cultivar of *Petunia axillaris* (Table 1). Even the lowest concentration (10^{-17} mg/ml) of fernoxone tried prevented the germination of pollen of F-24 series of red-flowered cultivar of *Nerium odorum* and F-48 and F-72 series of pink-flowered cultivar of *Catharanthus roseus* (Salgare, 1983). Pollen of F series of duet and sonata, F-24 series of white cascade, duet and sonata and F-48 series of all the 3 cascades did not germinate when treated with 10^{-17} mg/ml of fernoxone. All of them are the cultivars of *Petunia grandiflora* (Sharma, 1984). This proves that the pollen of the said series are highly sensitive and acts as an ideal indicators of pollution. Thus it is confirmed that the pollen development and activity are more sensitive indicators of adverse factors in the botanical environment and the use of an entire vascular plant (Berg, 1973; Brandt, 1974; Vick and Bevan, 1976; Rasmussan, 1977; Navara, Horvath and Kaleta, 1978; Mhatre, 1980; Mhatre *et al*. 1980; Shetye, 1982 and Giridhar, 1984) as an indicator of pollution is a very crude method and rather a wrong choice. There is no evidence of any entire vascular plant exhibiting this much degree of sensitivity. This is confirmed in the present critical review (Table 1). This was already proved earlier by Salgare (1983, 84, 85a-c, 86a, c-f, 2000a, 01a-b, 05a-c, 06a, c), Salgare and Theresa Sebastian (1986), Salgare and Phunguskar (2002), Salgare and Sanju Singh (2002) and Salgare and Sanchita Pathak (2005) and his Research Group (Ram Indar, 1981-; Sharma, 1984; Singh, 1985; Theresa Sebastian, 1987; Suwarna Gawde, 1988 and Trisa Palathingal, 1990) in their extensive work.

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Table 1. Inhibitory effect of fernoxone on pollen germination and tube growth of successive flowers of five cultivars of *Petunia axillaries* BSP.

		iocs		rchi					pgtgstch				TC
Cultivars	Series	PV	SC	PG	TG	V/O	RCPG	RCTG	HC	PG	TG	V/O	TC
Light-violet-	F	76	50	32	030	0.09	10^{-17}-20	10^{-17}-20	20	94.29	66.67	0.03	40
Pink-	F	93	50	28	035	0.11	10^{-17}-10^{-5}	10^{-17}-10^{-7}	10^{-7}	96.67	75.00	0.03	10^{-5}
Violet-	F	80	50	25	038	0.11	Ng	Ng	Ng	Ng	Ng	Ng	Ng
White-	F	95	30	34	080	0.24	10^{-17}-10^{-13}	10^{-17}-10^{-15}	10^{-15}	97.22	88.10	0.03	10^{-13}
White-violet-	F	90	30	30	325	0.88	10^{-17}-10^{-9}	10^{-17}-10^{-11}	10^{-11}	90.63	97.14	0.03	10^{-9}
Light-violet-	F-24	76	30	25	045	0.14	Ng	Ng	Ng	Ng	Ng	Ng	Ng
Pink-	F-24	93	10	16	030	0.09	Ng	Ng	Ng	Ng	Ng	Ng	Ng
Violet-	F-24	80	60	25	030	0.09	Ng	Ng	Ng	Ng	Ng	Ng	Ng
White-	F-24	95	10	26	030	0.09	Ng	Ng	Ng	Ng	Ng	Ng	Ng
White-violet-	F-24	90	30	30	210	0.57	Ng	Ng	Ng	Ng	Ng	Ng	Ng
White-	F-48	95	10	13	40	0.12	Ng	Ng	Ng	Ng	Ng	Ng	Ng

HC, concentrations of herbicide in mg/ml; iocs, in optimum concentrations of sucrose germination of pollen and tube growth; Ng, no germination; PG, % inhibition caused by the herbicide in the germination of pollen; pgtgstch, pollen germination and tube growth in sub-toxic concentrations of herbicide; PV, pollen viability in %; rchi, range of concentrations of herbicide for inhibition of pollen germination and tube growth; rcpg, range of concentrations of herbicide for inhibition of pollen germination; rctg, range of concentrations of herbicide for inhibition of pollen tube growth; SC, optimum concentrations of sucrose in %; TG, % inhibition caused by the herbicide in tube growth; V/O, *in vitro* tube length in compare to *in vivo* in %.

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Study of effect of Malathion and Magnesium sulphate induced changes in Erythrocytes count of *Channa striatus*

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Abstract

The present paper described the short term effect of organophosphorus pesticide malathion and magnesium sulphate individually and in combination on the erythrocytes of ***Channa striatus*.** The result obtained showed that 96 hours exposure of Malathion decreases erythrocytes count up to 75%, while Magnesium sulphate showed no significant change in erythrocytes count .However, Magnesium Sulphate in combination with malathion decreases the malathion toxicity to erythrocytes up to 55.76%. Thus , present findings clearly indicates that magnesium sulphate help in reducing the toxicity of Malathion up to certain limit.

Keywords : *Erythrocytes, Channa striatus, Malathion, Magnesium sulphate*

Introduction

Malathion , an organophosphorous pesticide/insecticide is used to kill insects on agricultural crops, on stored products, on golf course, in home and in garden. It is also used to kill mosquito, med flies, fleas on pets and to treat head lice of human (Hazarica *et al*., 2003 and ATSDR, 2003) , while Magnesium plays an important role in various metabolic processes such as oxidative phosphorylation and cellular enzymatic reactions. It also appears to be important in maintenance of normal blood pressure (McCarren, 1983).Very scanty work has been done on the blood of fishes, because fishes has very little amount of blood . Looking to the importance of blood in fish physiology and pesticides-malathion in agriculture field, the present study was aimed to find out the short term effect of malathion and magnesium sulphate on erythrocytes of *Channa striatus* individually and in combination.

Material and Methods

1 **The animal :***Channa striatus* were collected from the local fish market and acclimatized to the laboratory condition for one week during which they were regularly fed with Prawn power and Soya meals.

2 **Test chemicals :** Following two chemical were used in present study-

a. Malathion (Boss Agro chemical Pithumpur, Indore) M.P. 2.9^{o} C

b. Magnesium Sulphate (V chem., 274 Sec E Sanwer Road, Indore) M.P. 1125^{o}C

2 **Experimental Design** - Total 80 Fishes were used in the present experiments. They were divided into following four groups ;

Ist Group- In this group 20 Fishes were kept in the untreated water for (Control group).

IInd Group- 20 Fishes were kept in 1 ppm malathion solution in a separate aquarium(experimental group).

IIIrd Group- In this group 20 Fishes were kept in 10 ppm $MgSO_4$ solution in separate aquarium (experimental group) .

IVth Group- This Group also includes 20 fishes but in combined solution of 1 ppm malathion and 10 ppm magnesium sulphate (experimental group)

4. **Autopsy-** 5 Fishes of control and treated groups were sacrificed at 24, 48, 72 and 96 hours. The blood was taken from caudal peduncle and stored in EDTA coated vial for further analysis.

5. **Method-** Erythrocytes (RBC) were counted by Hemocytometer following the method described by Sharma *et al*.(2002).

Result

Effect of malathion on RBC of *Channa striatus*

Effect of 1 ppm malathion on RBC was studied for 96 hours. The results obtained showed that malathion alter the values of RBCs after various exposure duration.The RBC count of control fish was $2.60x10^6$ / cu.mm, which after exposure of test chemical for 24, 48, 72 and 96 hours reduced into 2.14, 1.22, 1.05 and $0.65x10^6$ / cu. mm respectively. The decrease in RBCs count after 24, 48, 72 and 96 hours were 17.6, 53.0, 59.6 and 75 percent respectively. These results showed that effect of Malathoin on RBC was duration dependent (Table 1 and Figure 1).

Recovery in malathion treated RBCs of *Channa striatus*

Fishes treated for 96 hrs in malathoin (1ppm) were kept in fresh water for further 96 hrs to see the recovery in RBC. After 24,48,72 and 96 hours RBCs count increased very slightly and reached up to 0.066, 0.065, 0.069 and $0.73x10^6$ / cu. mm. respectively. The increase in RBC count in 24, 48, 72 and 96 hrs were 1.53, 00, 6.15 and 12.30 percent respectively (Table 2 and Figure 2).

Effect of magnesium sulphate on RBC of *Channa striatus*

Effect of 10 ppm magnesium sulphate on RBC was studied for 96 hours. Result obtained showed that magnesium sulphate alter the value of RBC count after various exposure duration (Table 3 and Figure 3) The trend in change were not constant. In 24 , 48 and 72 hrs the RBC counts increases 1.15. 0.38 and 0.76 per cent respectively, while in 96 hrs treatments RBC values decreases 0.38 per cent.

Combined effect of magnesium sulphate and malathion on RBC of *Channa stri*atus

Effect of 1 ppm malathion and 10 ppm of magnesium sulphate on RBC of *Channa striatus* was studied for 96 hours. Result obtained showed alteration in the values of RBCs, after various exposure durations .The RBC count of control fish was $2.60x10^6$ /cu. mm., which after combine exposure of malathion and magnesium sulphate for 24, 48, 72, and 96 hours reduces RBC count to 2.43, 1.96, 1.12, and $1.15x10^6$/cu. mm. respectively. The decrease in 24, 48, 72 and 96 hours were 6.53, 24.61, 56.92 and 55.76 per cent respectively , which was very less in comparison to test chemical malathion's effect(Table 4 and Figure 4).

Discussion

Hematological studies have been carried out in different fishes in normal and experimental conditions. Raizada and Singh(1982) observed average total number of RBC in male ($1.85x10^6$ /cu. mm) and female($1.08x10^6$ /cu. mm) *Cirrhinus mrigala*. In *Trichogaster fasciatus* the mean value of RBC was $1.83x10^6$ /cu. mm (Raizada and Gupta,1982). Sharma and Shandilya (1982) had observed average number of RBC in *Labeo rohita*($2.65 x10^6$ /cu. mm), in *Clarias batrachus*($4.5 x10^6$ /cu. mm) and in *Channa punctatus*($1.30 x10^6$ /cu. mm) in *Oreochromis mossambicus*. While Sharma and Singh (2004) reported RBC count 0f *Channa puctatus* as $2.60x10^6$/cu.mm.Patro *et al*.(2004) recorded RBC values ($2.60x10^6$ /cu.mm) In the present investigation too the RBC count was noted as $2.60x10^6$ /cu.mm in *Channa straitus* .

Pesticides induced changes in various blood parameters of fishes have been reported by a few workers (Shammi *et al*.,1978; Qayyum *et al*.,1982; Qayyum and Shammi,1983 and Thakur and Sahai,1986).In *Channa punctatus* Pandey *et al*. (1979) have shown that DDT, metacid and unizeb causes aneamia, whereas treatment of endrin,urea and phenol bring about polycythemia. Qayyum *et al*. (1982) reported that in *Clarias batrachus* diptarex intoxication bring about changes in erythrocyte count. In *Saccobranchus fossilis* (Verma *et al*.,1979) reported that RBC increased with increasing the treatment period. While Thakur and Sahai (1987) described significant decrease in total RBC count of *Garra gotyla gotyla* when it was induced to carbaryl. In the present experimental study RBC count of 96 hrs treated malathion induced *Channa straitus* was 75 per cent less than control value. Similar reduction in RBC count in malathion treated *Channa punctatus* (Pandey *et al*. 1976) and *Clarias batrachus* (Mukhopadhyay *et al*. 1980) were observed.

When the fishes of treated group were placed in separate aquarium without treatment in fresh water to see the recovery status the results obtained showed that the initial value of RBC count ($0.65x10^6$ /cu. mm) increased and reached up to $0.73x10^6$ /cu. mm in 96 hrs. This states that in malathion treated fishes, the recovery in RBC count were very slow. To speed up the recovery it requires some stimulating agent, which can neutralize the effect of malathion.

To see this fact in the present study a separate experiment was setup in which, fishes were treated with combination of malathion and $MgSO_4$ for 96 hours. When fishes were exposed to malathion for 96 hours the reduction in count was $0.65x10^6$ /cu. mm in comparison to $2.60x10^6$ /cu. mm. While fishes were exposed to $MgSO_4$ alone the RBC count were $2.59x10^6$ /cu. mm and were very nearer to the control. However, when fishes were treated in combination with malathion and $MgSO_4$,the RBC count after 96 hour was $1.15x10^6$ /cu.mm. This showed that $MgSO_4$ reduced the toxicity of malathion up to 43.47 percent Thus it can be concluded that magnesium sulphate has a role in preventing the malathion toxicity in RBC count up to certain limits.

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Table 1: Effect of Malathion on RBC of *Channa striatus*

Time in hours	Control value (in 10^6 / cu mm)	Experiment value (in 10^6 / cu mm)	Difference	Per cent alter
24	**2.60**	**2.14**	**0.46**	**17.6**
48	**2.60**	**1.22**	**1.38**	**53.0**
72	**2.60**	**1.05**	**1.55**	**59.6**
96	**2.60**	**0.65**	**1.95**	**75**

Table 2: Recovery in RBC after 96 hours in Malathion treated fish *Channa striatus*

Time in hours	Control value (in 10^6 / cu mm)	Experiment value (in 10^6 / cu mm))	Difference	Per cent alter
24	**0.65**	**0.66**	**0.01**	**1.53**
48	**0.65**	**0.66**	**0.00**	**00**
72	**0.65**	**0.69**	**0.04**	**6.15**
96	**0.65**	**0.73**	**0.08**	**12.30**

Table 3: Effect of Magnesium sulphate on RBC of *Channa striatus*

Time in hours	Control value (in 10^6 / cu mm)	Experiment value (in 10^6 / cu mm))	Difference	Per cent alter
24	**2.60**	**2.63**	**0.03**	**1.15**
48	**2.60**	**2.61**	**0.01**	**0.38**
72	**2.60**	**2.62**	**0.02**	**0.76**
96	**2.60**	**2.59**	**0.01**	**0.38**

Table 4: Combined effect of Malathion and Magnesium sulphate on RBC of *Channa striatus*

Time in hours	Control value (in 10^6 / cu mm)	Experiment value (in 10^6 / cu mm))	Difference	Per cent alter
24	**2.60**	**2.43**	**0.17**	**6.51**
48	**2.60**	**1.96**	**0.64**	**24.61**
72	**2.60**	**1.12**	**1.48**	**56.92**
96	**2.60**	**1.15**	**1.45**	**55.67**

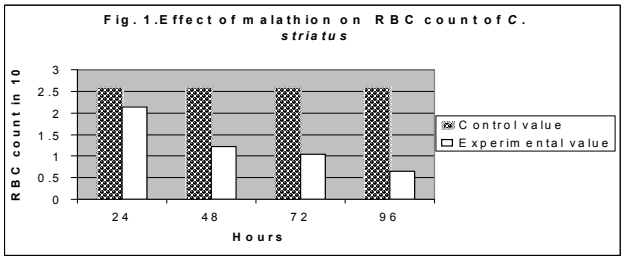

Fig. 1. Effect of malathion on RBC count of *C. striatus*

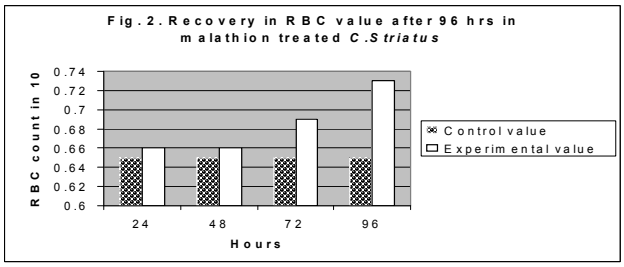

Fig. 2. Recovery in RBC value after 96 hrs in malathion treated *C. Striatus*

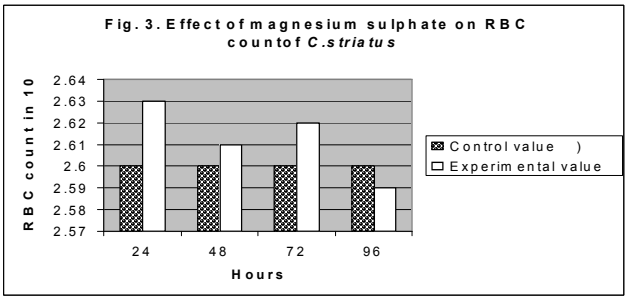

Fig. 3. Effect of magnesium sulphate on RBC count of *C. striatus*

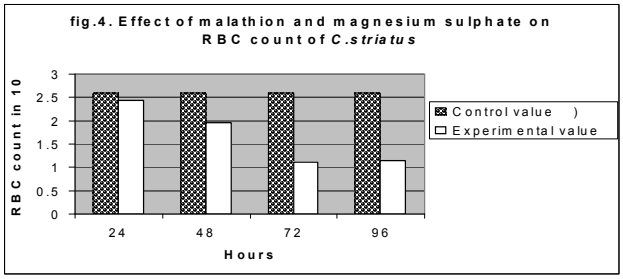

fig. 4. Effect of malathion and magnesium sulphate on RBC count of *C. striatus*

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Social cost benefit analysis of Sultanpur National park, Haryana

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Abstract

This paper deals with the estimation of the social benefits accuring from the Sultanpur National Park, Haryana. Sultanpur National Park is an important wetland located about 50 km away from Delhi. Both foreign and domestic visitors arrive at the Park for bird watching and recreational purpose. Economic valuation of the Park was done by ascertaining the Willingness to Pay of the visitors by asking questions to them. The results obtained indicated that the social benefits accuring from the Park are far in excess of the maintenance cost of the Park even though the direct benefits to the Park are quite less. It can be said that the society values the Park highly as a place for recreation and as environmental resource.

Key words: *Sultanpur National Park, Cost benefit analysis, Willingness to Pay.*

Introduction

There is a broad and growing consensus that wetlands are critically important ecosystems that provide globally significant social, economic and environmental benefits. Important wetland functions and services include groundwater recharge, flood mitigation, erosion control, and retention of carbon, nutrients and pollutants (Dugan, 1990; NRC, 1995). Wetlands support important levels of global biological diversity, including over 10,000 species of fish, over 4,000 of amphibians, and numerous species of waterfowl (McAllister *et al*.,1997; WCMC, 1992). Wetland ecosystems also provide opportunities for recreation, aesthetic experience and reflection. Recreational uses including fishing, sport hunting, bird watching, photography, and water sports. Improper management of wetland resource results into habitat degradation, loss in breeding grounds and wintering areas of migratory avifauna and loss of aesthetic and other values. Increased demand for land associated with population growth continues to be a significant cause of wetland loss. Economic valuations had proved to be a powerful tool for measuring and comparing the various benefits of wetlands and this exercise could act as a catalyst for wetland conservation (Edward *et al*., 1997; Ramachandra, *et al.*, 2005). Cost-benefit analysis plays an important role in valuation of wetlands. In cost benefit analysis, both the paid price and unpaid price is taken in account. One of the most straight forward methods employed by various economists for the valuation of non-market benefits is the method of contingent valuation (Mitchell and Carson, 1989). This method involves asking the people their Willingness to Pay (WTP) by conducting a survey. More accurately, Willingness to Pay is the amount the society would be willing to pay to use a good beyond that which it actually does pay (Scodarai, 1990). An individual's WTP is the maximum of money he is willing to give for the resource he enjoyed. The economic value of environmental resources is measured by the summation of many individuals' Willingness to Pay for it. Therefore, economic valuation in the environment context is about 'measuring the preferences' of people for an environmental benefit or against environmental degradation. The present study is the simple attempt to estimate the social benefits accruing from the Sultanpur National Park in Haryana.

Methodology

The current study was based on the survey conducted through a Questionnaire. A common Questionnaire was used for both the India and Foreign visitors in the National Park. It was aimed to obtain information

regarding the education, occupation, income, expenditure at the site, group size, number of males and females, vehicle used and travel cost. Sampling was started in the first week of February 2005 and concluded at the last week of the May 2005. In total, 500 questionnaires were distributed to both the Indian and Foreign visitors. Information regarding the expenditure in day to day maintenance and monthly pay was obtained from the office of the National Park. The seasonal variation of different species of birds and their monthly counted data was also obtained from the office. In addition, the information about the tourist flow in each month was also accquired. After the field work, elementary calculation works were done to convert foreign currency to equivalent Indian currency. The sum of the per head expenditure during the travel, boarding, lodging and recreation were calculated. This gives the individual's Willingness to Pay for enjoying the National Park. Multiplying the average WTP with the total number of tourist in the year we get the annual WTP for foreign and Indian visitors. Adding the foreign and Indian annual Willingness to Pay, the total Willingness to Pay for the year is estimated. Subsequently, comparison between the annual investments of the year to the total WTP gives an idea of the benefits or loss to the National Park.

Description of the Study site

The Sultnapur National Park is located in Gurgaon district of Haryana, about 50 km from Delhi and 15 km from Gurgaon on the Gurgaon Farukh Nagar Road. In the old map this area was shown as marshy land having a salt pan, where water accumulates during rains and dries out during summer. A number of organisms like crustaceans, fish and insects thrive during floods which attract a number of birds. The sanctuary potential was first of all identified by the world famous Ornithologist Peter Jakson keeping in views its importance and potential. An area covering 859 acres was declared a Bird Sanctuary in 1972 and was upgraded to the status of National Park in 1991. In Sultanpur National Park 255 bird species are residents and around 90 migratory bird species arrive in search of feeding grounds. In winter the sanctuary provides a picturesque panorama of migratory birds. The important tree species found in the Park are *Acaccia nelotica, Dalbizzia sissues, Albizzia lebbek* and *Zizyphus sps*. The aquatic vegetation consists mainly of *Eichornia crassipus, Typha angustata, Trapa, Azolla, etc*. Apart from the birds the periphery of the lake provides a good habitat to many other animals such as Blue Nilgai, wild cat, rabbit and reptiles. For the benefits of bird lover certain facilities have been developed in the Park like an education and interpretation centre, a library as well as films, slides and Binoculars. There are four watch towers located at different points. In addition there is parking facilities and drinking waters.

Results and Discussion

The result of the study indicates that, on an average around thirty thousand visitors, both Indian and foreigners visit the National Park per year. It can be seen from Table 1, that, the number of foreign visitors per year was significantly less (comprising less than 7 % of the total) than the number of Indian visitors. The estimated average individual's Willingness to Pay for and an Indian visitor and foreign visitor to access the Park were Rs. 93.92 and Rs. 161.50, respectively. The variation in the Willingness to Pay between the Indian and foreign visitors was attributed to the variation in the mode of travel and the other expenditures on the site. Almost all the foreign visitors arrived at the Park mentioned either Gurgaon or Delhi as the last place visited before arrival. Majority of the foreign visitors used car and taxi to visit the Park. In contrast, most of the Indian visitors belong to nearby places within a distance of 50 km from the Park and used buses and three wheelers as their mode of travel. A small section of the Indian visitors used car/taxi. However, as the number of Indian tourists far exceeded the foreign tourists, the total

Willingness to Pay for the Indian visitors were more compared to the total Willingness to Pay by the foreign visitors. For instance, in the year 1991, a total of 886 foreigners (~3 % of the total visitors) visited the Park and the calculated total Willingness to Pay by them was Rs. 1, 43, 089.00. Corresponding, estimated total Willingness to Pay for the 31, 368 (~97 % of the total visitors) Indian visitors during the year was Rs. 29, 46, 083.00. It can be further observed from the Table 1, that even though the direct benefits for all the five years were less than the maintenance cost of the Park, the estimated total Willingness to Pay for all the years are much greater than the maintenance cost. The estimated total Willingness to Pay of the visitors was 10.13, 3.17, 7.67 and 4.10 times greater than the maintenance cost respectively, for the years 1991, 1995, 2001 and 2005. The direct benefits to the Park include the income earned through the entry fee of the visitors, vehicle parking fee, video and still camera fee, *etc*. In the above five years under study the income from the direct benefits ranged between 11 and 33 % of the expenditure in the different years. Since, Willingness to Pay is a measure of social benefits, it can be inferred that the benefits accruing from the Park are far in excess of the costs. It can also be noted that the number of Indian visitors are decreasing for the past few years. Thus the benefits arising from them have been decreasing steadily over the last few years. This decrease can be attributed to the decrease in the number of birds arriving at the Park in the recent few years. In the last few years there was a fall in the number of birds in the National Park. The reason for the less number of birds arriving at the Park might have been, perhaps the deterioration in environmental quality of the Park over the past few years. The monthly variation of visitors to the National Park and the number of birds in the Park illustrated in Figure 1. The correlation between the number of visitors and the number of birds in the Park is quite evident from the graph. The correlation coefficient of the two is positive (0.861) and significant. From the information contained in the questionnaire various other interesting results have been obtained. Fig. 2 shows the variation in the average Willingness to Pay of Indian and Foreign tourists according to their income status. In case of the foreigners the average Willingness to Pay of the third income level (Rs. 228.20) and fourth income level (Rs. 250.54) are nearly equal and the Willingness to Pay are more for the individuals falling under these two levels. In the case of Indian tourists, the individual falling in the third level of income class (Rs. 126.86) have the highest average Willingness to Pay. Thereafter, the average Willingness to Pay of Indian visitors decreases with income. The average Willingness to Pay of Indian visitors falling in the fourth and fifth income level was Rs. 97.14 and Rs. 58.00, respectively. No explanation at present can be given to this behaviour and the reason behind it needs to be investigated. The variation in the WTP of the Indian and foreign tourists to their occupational and the educational status are depicted in Fig. 3. From the figure [(i) Occupational classes] it could be inferred that the average WTP is nearly the same for all the occupational categories. Even though the average WTP for the house-wife was higher than other categories, we can ignore this while deriving the above inference since there was only one housewife in our samples. In case of the foreign tourist the WTP is highest among the individuals who come under the category of Academics. Comparing the figures, it can be further noted that for each occupational level except for the housewives the average WTP for the Indian tourists is lower than that of the foreign tourists. With regard to the educational classes [(ii) Educational classes] the average WTP was found to be highest for individuals at the school in case of foreign tourist. In case of Indian visitors the WTP is found to be nearly equal for the last two levels of education. However, in the case of the foreign tourist the last two are widely different. It can be inferred on the basis of the trends from the figures that generally the people who are highly educated attach more value to the benefits of environment resources.

Conclusion

From the results of our study it can be inferred that the social benefits arising from the Park are much higher in comparison to the maintenance costs involved. However, the current study falls short to represent a complete analysis of the costs and benefits of the National Park because of certain limitations. Some of the limitations are: (i) the travel cost analysis method could not be applied because of lack of data on population of different zones. Hence, the values of total WTP obtained from our study may be the underestimates of the actual WTP. (ii) Exact travel cost for the foreign visitors could not be calculated because of the problem faced in estimating their exact travel distance and therefore, the travel cost was estimated only from the place they last visited before arriving at Sultanpur National Park. Despite these limitations, the results obtained convincingly indicated that the society values the Park highly as a place for recreation and as environmental resource. Given that tourism is one of the growing income generating industries globally, the economic value of the Park may be enhanced considerable in future. Maintaining wetlands and capitalizing on these values can be a valuable alternative to more disruptive uses and degradation of these ecosystems.

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Table 1. Estimated Costs and benefits in different years for Sultanpur National Park

Years	No. of Visitors		Annual Budget** for the NP (in Rs.)	Direct benefit to the NP* (in Rs.)	WTP (in Rs.)		Total WTP (in Rs.)
	Foreign	Indian			Foreign	Indian	
1991	886	31, 368	3, 05, 000	1, 02, 000	1, 43, 089	29, 46, 083	30, 89, 172
1995	1, 257	25, 490	8, 20, 000	89, 000	2, 03, 006	23, 94, 021	25, 97, 026
2001	2, 217	29, 931	4, 13, 000	99, 000	3, 58, 046	28, 11, 120	31, 69, 165
2005	2, 118	28, 286	7, 31, 000	1, 22, 000	3, 42, 057	26, 56, 621	29, 98, 678

*WTP – Willingness to Pay; NP – National Park; *The earning from the entry, vehicle Parking, camera fees, etc.; **The expenditure allocated for salary of the staffs, maintenance of the Park, etc.*

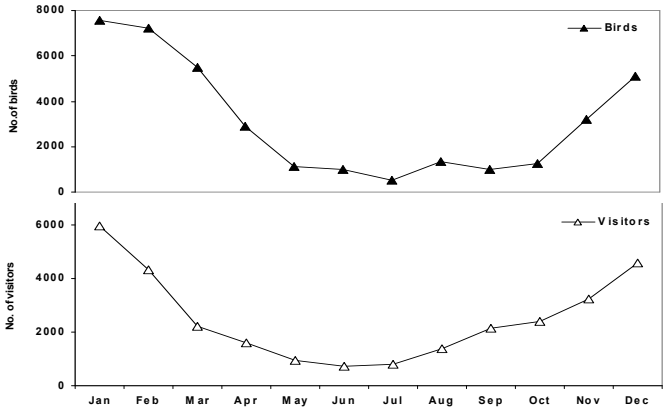

Fig. 1 Average monthly variation in number of birds and isitors at the Park

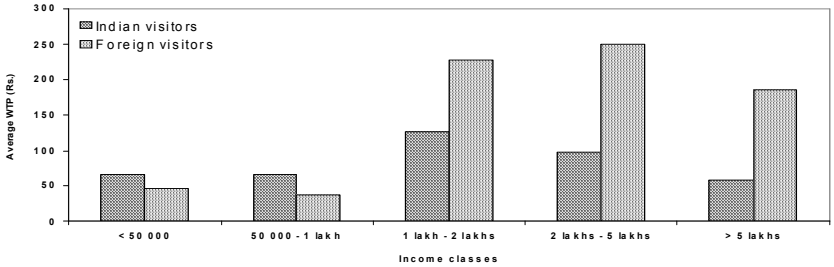

Fig. 2 Average WTP of visitors at Park belonging to different income classes

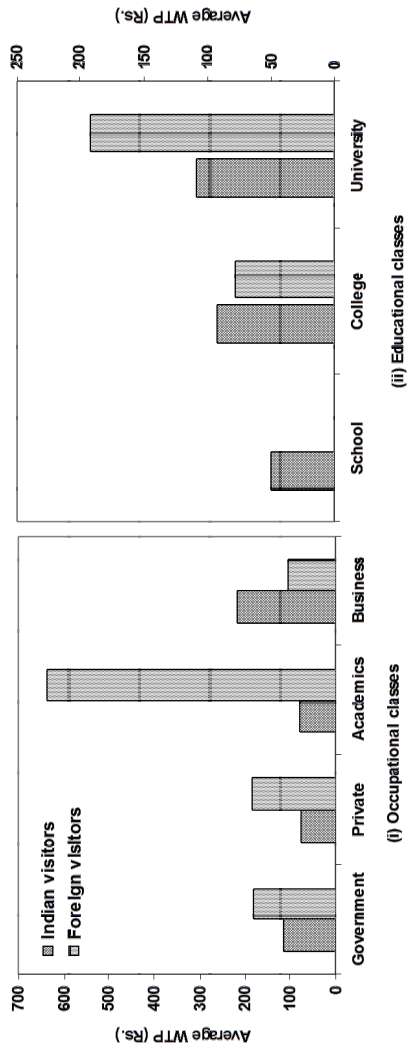

Fig. 3 Average WTP of an Indian and foreign visitors at the Park

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Whether optimum pollen germination and tube length attained in the same growth medium (sucrose + 2,4-D) by five cultivars of the Apocynaceae : Further Evidence of a Criticism of Banerji and Gangulee (1937), Brewbaker and Kwack's (1963), Sudhakaran (1967-Ph.D.Thesis), Dharurkar (1971 - Ph.D. Thesis), Nair, Nambudiri and Thomas (1973), Berg (1973), Brandt (1974), Vick and Bevan (1976), Rasmussan (1977), Navara, Horvath and Kaleta (1978), Mhatre (1980 - Ph.D. Thesis), Mhatre, Chaphekar, Ramani Rao, Patil, Haldar (1980), Shetye (1982 - Ph.D. Thesis) and Giridhar (1984 - Ph.D. Thesis) A Critical Review

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Abstract

All the different concentrations of simazine tried suppressed the germination of pollen of F-72 series of pink-flowered cultivar of *Catharanthus roseus.* The widest range of concentrations of 2,4-D were proved to be 10^{-17}- 40 and 10^{-17}-100 mg/ml which stimulated the pollen germination and tube growth respectively of successive flowers of the Apocynaceae. Tube length *in vitro* is 9.54% in F-48 series of pink-flowered cultivar of *C. roseus* of the tube length found *in vivo* is the longest of all the cultivars investigated of Apocynaceae

Key Word : *Palynology, Environmental Science, Toxicology, Pesticides*

Running Title : Pollen germination and tube length attained in sucrose + 2,4-D

Introduction

In spite of the very varied approach of study and the extensive work done, the larger number of herbicides being developed in industry and used in agriculture stand only in testimony of the necessity of more work in the field.

Materials and Methods

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 the 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. Pollen viability was tested by using 2,3,5-triphenyl tetrazolium chloride (Hauser and Morrison, 1964). 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 wide range of concentrations (10^{-17}-10^{-2}-10^{-3}, 1, 5, 10, 20-20-100 mg/ml) of 2,4-Dichlorophenoxy acetic acid

(2,4-D) (Table 1). However, the present investigation is mainly concentrated with the findings of the optimum concentrations of sucrose as well as in the optimum concentrations of sucrose supplemented with the optimum concentrations of 2,4-D. Observations were recorded 24 hours after incubation. For each experiment a random count of 200 grains was made to determine the percentage of pollen viability and germination. For measurement of length of pollen tubes 50 tubes were selected randomly and measured at a magnification of 100x. Percentage stimulation was also determined.

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 shows the variations in the percentage of 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.

Potentiality of the germinability of pollen is noted only in F series of pink- and white-flowered cultivars of *Nerium odorum*. Both of them are single-flowered cultivars (Salgare, 1983). Potentiality of the germinability of pollen was recorded in F and F-24 series of *Physalis minima* and *Solanum xanthocarpum* (Ram Indar, 1981-), in red-flowered (double-flowered) cultivar of *Nerium odorum* and in white-flowered cultivar of *Catharanthus roseus* (Salgare, 1983), in all the 5 cultivars of *Petunia grandiflora* (Sharma, 1984), in all the 5 cultivars of *Solanum melongena* (Singh, 1985) and in all the 5 cultivars (light-violet-, pink-, violet- and white-violet-flowered cultivars) of *Petunia axillaris* except for white-flowered cultivar (Salgare, 1986a). Pollen germination *in vitro* culture of sucrose was noted in F, F-24 and F-48 series of *Brunfelsia americana* and in violet-flowered form of *Datura fastuosa* (Ram Indar, 1981), in all the 3 cascades (Sharma, 1984) and in white-flowered cultivar of *P. axillaris* (Salgare, 1986a). However, it was the pollen of white-flowered form of *D. fastuosa* (Ram Indar, 1981) and pink-flowered cultivar of *C. roseus* (Salgare, 1983) showed their germination *in vitro* culture of sucrose in all the 4 series (F, F-24, F-48, F-72 series) investigated. Potentiality of the germinability of pollen in all the 4 series investigated was also noted by Salgare (1986h) in 3 Leguminous crops *viz. Cyamopsis tetragonoloba* Var. Pusa Navbahar – gawar, *Phaseolus aureus* Var. J-781- mung and *Phaseolus mungo* Var. T-9- urid. Theresa Sebastian (1987) observed the germination of pollen of one of the Leguminous crops *i.e. Vigna mungo* Type 9, of Uttar Pradesh in all the 4 series investigated *in vitro* culture of sucrose. Suwarna Gawde (1988) noted the germinability of pollen of 2 Leguminous crops *viz. Vigna unguiculata* Var. Pusa Barsati – cowpea and *Vigna radiata* . Var. Pusa Baisakhi of Delhi in all the 4 series investigated. Johri and Chowdhury (1957) stated that in *Citrullus colocynthis,* where pollen grains 'mostly remained attached in tetrads', satisfactory germination is observed.

Salgare (1983) observed the germination of pollen of F-72 series of pink-flowered cultivar of *Catharanthus roseus in vitro* culture of sucrose. However, Trisa Palathingal (1990) 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 points out that Brewbaker and Kwack's (1963) culture medium is not ideal for pollen culture of successive flowers. As a rule the percentage of pollen germination is always less than the pollen viability. However, Banerji and Gangulee (1937) and Dharurkar (1971) 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 (1986c, 95, 2000b, 06f) who stated that the observations of Banerji and Gangulee

(1937) and Dharurkar (1971) are exaggerating.

All the different concentrations (10^{-17}-10^{-2}-10^{-3}, 1, 5, 10, 20-20-100 mg/ml) of 2,4-D tried found to be toxic for the germination of pollen of F-72 series of pink-flowered cultivar of *Catharanthus roseus* as a result of which the failure of the germination of pollen was resulted (Salgare, 1983) (Table 1). Sharma (1984) stated that even the lowest concentration (10^{-17} mg/ml) of 2,4-D tried suppressed the germination of pollen of F series of duet and sonata, F-24 series of red and white cascades, duet and sonata and F-48 series of all the 3 cascades. All of them are the cultivars of *Petunia grandiflora*. Even the lowest concentration (10^{-17} mg/ml) of simazine tried caused the failure of the germination of pollen of F series of brinjal long and round and F-24 series of all the 5 cultivars of brinjal. All of them are the cultivars of *Solanum melongena* (Singh, 1985). This proves that the pollen of the said series are highly sensitive and acts as an ideal indicator of pollution. Thus it is confirmed that the pollen development and activity are more sensitive indicators of adverse factors in the botanical environment and the use of an entire vascular plant (Berg, 1973; Brandt ,1974; Vick and Bevan, 1976; Rasmussan, 1977; Navara, *et al.*, 1978; Mhatre, 1980; Mhatre *et al.* 1980; Shetye, 1982 and Giridhar, 1984) as an indicator of pollution is a very crude method and rather a wrong choice. There is no evidence of any entire vascular plant exhibiting this much degree of sensitivity. This is confirmed in the present critical review (Table 1). This was already proved earlier by the extensive work of Salgare (1983, 84, 85a-c, 86a, e-h, 2000a, 2001a-b, 05a, d-e, 06e, g), Salgare and Theresa Sebastian (1986), Salgare and Phunguskar (2002), Salgare and Sanju Singh (2002), Salgare and Sanchita Pathak (2005) and by the Research Group of Salgare (Ram Indar, 1981; Sharma, 1984; Singh, 1985; Theresa Sebastian, 1987; Suwarna Gawde, 1988; Trisa Palathingal, 1990).

The widest range of concentrations of the herbicide was proved to be 10^{-17}- 40 mg/ml which stimulated the germination of pollen of the Apocynaceae (*viz*. Pollen of F-24 series of red-flowered cultivar of *N. odorum*. However, 10^{-17}- 100 mg/ml 2,4-D proved to be the widest range of concentration which stimulated the tube growth of the Apocynaceae (viz. F-48 series of pink-flowered cultivar of *C. roseus*) (Table 1). 2,4-D produced as high as 400.00% stimulation in pollen germination of successive flowers of the Apocynaceae. However, 235.83% stimulation proved to be the highest produced by the herbicide in the pollen tube growth of successive flowers of the Apocynaceae (Table 1). Horticulturists and plant breeders often failed to get the fertile seeds in spite of all the care taken during artificial pollination. Unless sterility is the main cause, failure of seed setting may be due to slow growth of the pollen tube or its early degeneration in the style. Tube length *in vitro* is 9.54% in F-48 series of pink-flowered cultivar of *C. roseus* of the tube length found *in vivo* is the longest of all the cultivars investigated of the Apocynaceae (Table 1). Present investigation proves that the herbicides can be most successfully used as the growth substance which is very economical.

Pollen germination and tube elongation are two distinct processes differing in their sensitivity to different concentrations of the herbicide was confirmed with the present work (Table 1) as well as by the extensive work of Salgare (1979, 83, 86a, d, h, 2004, 05b-c, 06b, d), Salgare and Bindu (2002, 05) and Salgare and Tessy Mol Antony (2005a, b).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. With the present work (Table 1) it could be concluded that the observations of Nair *et al.* (1973) are superficial and misleading. This was also confirmed earlier by Salgare (1979, 83, 86a, d, h, 2004, 05b-c, 06b, d), Salgare and Bindu (2002, 05), Salgare and Antony (2005a, b) and by the Research Group of Salgare (Ram Indar, 1981-; Sharma, 1984; Singh, 1985;. Theresa Sebastian, 1987; Suwarna Gawde, 1988).

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, 86b, 2006a, c) 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, 86b, 2006a, c) also proved that Sudhakaran's (1967) observations are superficial and misleading.

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Table 1. Stimulatory effect of 2,4-D on pollen germination and tube growth of successive flowers of five cultivars of Apocynaceae

			In Optimum concentration of 2,4-D								
			Pollen germination			Pollen tube growth				ROCOHFS	
Species	Series	PV	H	%G	%S	H	µm	%S	%V/O	RG	RT
V*odorum* pink-flowered	F	80	10^{-15}	78	122.86	10^{-17}	0520	Nil	4.33	10^{-17}-10^{-3}	Nil
V*odorum* red-flowered	F	74	10^{-15}	60	200.00	10^{-17}	0590	Nil	5.36	10^{-17}-5	Nil
V*odorum* white-flowered	F	62	10^{-15}	42	110.00	10^{-17}	0200	Nil	1.67	10^{-17}-1	Nil
C*roseus* pink-flowered	F	90	10^{-15}	85	041.67	10^{-17}	1142	Nil	5.44	10^{-17}-10^{-9}	Nil
C*roseus* white-flowered	F	88	10^{-15}	86	115.00	10^{-17}	1420	013.06	7.10	10^{-17}-1	10^{-17}-10^{-13}
V*odorum* red-flowered	F-24	74	10^{-15}	30	400.00	10^{-17}	0425	Nil	3.86	10^{-17}-40	Nil
C*roseus* pink-flowered	F-24	90	10^{-15}	70	150.00	10^{-17}	0806	235.83	3.83	10^{-17}-10^{-3}	10^{-17}-100
C*roseus* white-flowered	F-24	88	10^{-15}	38	137.50	10^{-17}	0350	041.13	1.75	10^{-17}-1	10^{-17}-10^{-7}
C*roseus* pink-flowered	F-48	90	10^{-15}	40	185.71	10^{-17}	0533	461.05	9.54	10^{-17}-10	10^{-17}-20
C*roseus* pink-flowered	F-72	90	Ng	Ng	Ng	Ng	Ng	Ng	Ng	Ng	Ng

%G, % pollen germination; H, concentration of 2,4-D in mg/ml; Ng, no germination; RG, range of concentrations of 2,4-D for timulation of pollen germination; RT, range of concentrations of 2,4-D for stimulation of pollen tube growth; ROCOHFS, range of concentrations of 2,4-D for stimulation of pollen germination and tube growth; %S, % stimulation; %V/O, *in vitro* pollen tube length in compare to *in vivo* in %; µm, pollen tube length in µm.

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Assessment of hearing threshold and noise induced hearing loss in people engaged in different occupations

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Abstract

Hearing threshold was assessed in subjects engaged in different occupations at 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz and 8000 Hz, for left and right ear. The results revealed that the hearing threshold of truck drivers, auto drivers, traffic policeman, shop keepers, military personals, post office personals are significantly higher than the corresponding value for the normal subjects (persons not engaged in any particular profession). Among the different occupational categories, the truck drivers were found to have maximum hearing loss at higher frequencies which was followed by traffic police, army personals, auto drivers, shopkeepers and tailors.

Key words: *Noise, Occupation, Hearing threshold, Noise induced hearing loss.*

Introduction

Worldwide, noise pollution is an increasing problem and threatens to become particularly acute in developing world (Korfali and Massoud, 2003). The casual relationship between work place noise and hearing loss has been observed for centuries (Franks, 1988). In the developing countries like India, people generally do not follow the standards prescribed for noise exposure. Workers are forced to perform task in an environment having noise levels far greater than the recommended ones (Muzammil, *et al.,* 2004). Noise pollution affects health, comfort and efficiency of the workers. The most immediate and acute effect of noise to the workers is the impairment of hearing which diminished due to damage of auditory system (Madhuri, *et al.,* 2003). Noise Induced Hearing Loss (NIHL), are mainly attributed to the exposure to noise levels beyond the tolerance limit for longer than permissible time (Arutchelvan *et al.,* 2004). Depending on the exposure time loss of hearing ability may be temporary or permanent. Globally, some 120 million people are estimated to have suffered from disability hearing difficulties (WHO, 1999). Various countries of the world and international organizations have formulated ambient and occupational noise standards for safety of the workers. However, till today the problem of noise could not gather wide attention of the public and the authorities, compared to air, water and other pollutions, presumably due to insufficient study and lack of awareness among the general mass. The present study is an attempt to measure the hearing threshold level and to assess the noise induced hearing loss in people engaged in different occupations.

Methodology

A sample size of 94 subjects engaged in different occupations (namely, truck driving, auto driving, military, shop keeping, Post office employee, traffic police, tailors and persons without any particular profession (normal) was taken for the study. The selected subjects for the study were in the age group of 30-55 years and had no past records of hearing disabilities and were continuously in the same profession for more than 15 years when the test was conducted. For each subject, hearing threshold (*HT*) was measured separately for left and right ear in the frequency range of 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000

Hz and 8000 Hz. A portable audiometer (Arphii, 500 MK IS) was used for the study. Information about the age, occupation, working hours and medical history of each subject, was also obtained by filling up a questionnaire designed for this purpose. The data pertaining to the hearing threshold level of the subjects thus obtained was stored into a personal computer and analyzed with the help of statistical tools provided within the software SPSS.

Results and Discussion

The results of the study indicated that the hearing threshold level of the subjects varies widely with respect to (i) occupation engaged, (ii) the frequency of clear tone exposed and (iii) the individual ear exposed (whether left or right) of the subject (Table 1). The average hearing thresholds of subjects engaged in the various occupations were found to be consistently higher for all the tested frequency ranges compared to that of the normal subjects. The recorded average *HT* of the left ear at the frequency range of 1000 Hz for the persons involved in truck driving, auto driving, military, shop keeping, post office employee, traffic police and tailoring by profession respectively, were 31.88, 31.11, 22.11, 30.63, 30.00, 28.75 and 28.33 dB, whereas the corresponding value was 22.00 dB for a normal person. Among the different occupations categories, the truck drivers are found to have maximum hearing loss at higher frequencies that are followed by traffic police, army personals, auto drivers, shopkeepers and tailors. This higher hearing loss among the truck drivers might have been attributed to the long working hours under high level noise. Prolonged exposure to noise levels above 85 dBA can damage inner ear cells and lead to hearing loss. At first, hearing loss is usually temporary and recovery takes place over a few days. After further exposure, people may not fully recover their initial level of hearing causing deafness (Korfali and Massoud, 2003). All the truck drivers were in the same occupation for more than 15 years. Noise induced hearing loss typically affect the higher frequencies first. Melnick (1979) reported that usually the permanent threshold shift occurred at 4000 Hz and it becomes more pronounced at this frequency. With further increase in the noise exposure duration the hearing loss spread over a wide frequency range extending to 500, 1000, 2000 and 8000 Hz (Pondhe, *et al.,* 1998). If the average hearing level at 500, 1000 and 2000 Hz exceeds 25 dB, it is indicative of hearing loss, *i.e.* Noise induced deafness (Madhusudan , 1991). In the current study, it was found that the hearing threshold of the normal people was below 25 dB in all the frequencies tested for both the ears except at the 4000 Hz where the left ear HT was recorded 27.00 dB. This showed that among the normal people the hearing threshold shift is negligible. In contrast, people in occupation under high level noise environment have higher hearing threshold shift, crossing 25 dB. The average hearing thresholds among the military personals were within 25 dB in the lower frequency ranges (250 – 2000 Hz). This might be attributed to the comparatively noise free working environment in the army. In all the subjects tested the hearing threshold shift was found to be larger in the higher frequencies (4000 and 8000 Hz), but the shift was larger among the people with truck driving by profession followed by the post office employee. The recorded average hearing threshold of the truck drivers at the frequency range of 8000 Hz was 51.88 dB for the left ear and 50.00 dB for the right ear and is the highest hearing loss recorded among the subjects under study.The correlation matrix of hearing threshold levels at different frequencies for the left and right ear of the total number of subjects are illustrated in the Figure 1. It can be inferred from the figures that the correlation coefficient between hearing threshold level at neighbouring frequencies was much higher in comparison to the frequencies which were very different from each other. The pattern observed in these figures confirms the fact that specific hearing cells are present in different areas of the cochlea (inner ear) for different frequencies. This, in other words, means that the hearing cells corresponding to neighbouring frequencies occur

adjacent to each other in the cochlea. On the other hand, the hearing cells corresponding to frequencies that are wide apart occur in distant and distinct areas of the inner ear. Hence, the more is the difference in the frequencies the less will be the correlation between the hearing thresholds at those frequencies. The correlation coefficient between the hearing threshold level of left and right ear at different frequencies is shown in Table 2. On comparing the figures in the table it can be clearly seen that the correlation coefficients between the hearing thresholds of the same ear at two given frequencies are relatively higher in comparison to that between the hearing thresholds of different ears in the same two frequencies. This can possibly be explained on the basis of subtle difference in the noise environment to which the left and right ear of the subjects was exposed.

Suggestions to abate noise

During the course of the study it had been observed the *HT* for all the occupational categories exceeds 25 dB almost in all the frequency ranges tested. Hence, precaution and protection measures to reduce noise exposure become inevitable. Some of the suggestions that could reduce noise level are: (i) In working places such as shops, offices and cloth tailors the noise from the adjoining street can be minimize by constructing enclosures, shields and barriers. (ii) Treatment of working rooms with suitable sound absorbing materials such as acoustical tiles, perforated plywood on walls, *etc*. (iii) The noise exposed to the truck/auto drivers and traffic police includes honking of horns, vehicle body rattling and faulty designed silencers. Possible options to reduce the noise include maintenance of roads and vehicle and proper traffic management. (iv) Use of protective devices such as muffs and earplugs should be encouraged to the traffic policeman, truck/auto drivers and the military personals in the firing range. (v)

Workers should have periodic audiometric tests to check the effectiveness of the noise controls.

Conclusion

From the results of the current study the following three conclusions can be safely drawn: (i) the correlation coefficient between hearing threshold level at neighbouring frequencies was much higher in comparison to the frequencies which were very different from each other. (ii) the correlation coefficient between the hearing threshold of the same ear was relatively higher in comparison to that between the hearing threshold of different ears at any two frequencies and (iii) with regards to occupation, the hearing threshold of subjects engaged in different occupation are significantly higher than the corresponding values of the normal subjects. Among the different occupation categories the maximum hearing loss at higher frequencies was found to be in truck drivers. An attempt was also made to explain the *HT* level on the basis of occupation and other parameters influencing the subjects hearing but the model was discarded since its explanatory power was not found to be good enough for the predictive purposes. This indicates that exposure to noise pollution was just one of the factors which effects the hearing capability of the subjects. There may be a number of other factors, which were not explored in the present study, but may be responsible for the overall *HT* of the subjects. Therefore there is need of further studies before coming to a logical conclusion.

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Table 1. Average *HT* for the left and right ears in subjects from different occupations

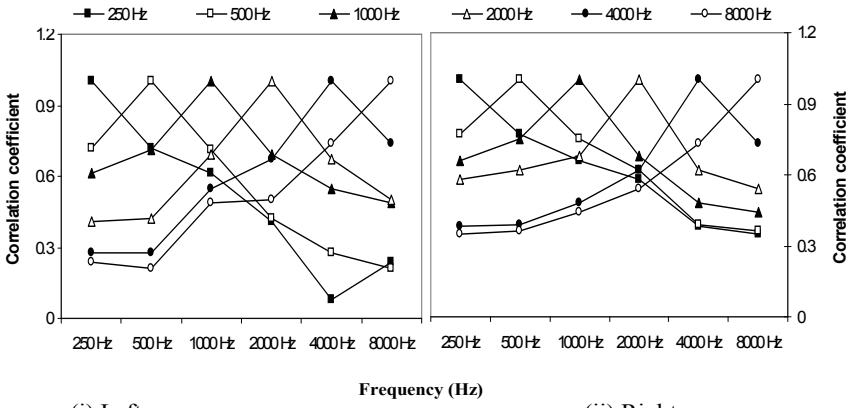
OCCUPATION		Average hearing threshold (dB) at					
		250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
NORMAL	LHT	13.00	13.00	22.00	13.00	27.00	24.00
	RHT	16.00	15.00	23.00	11.00	24.00	22.00
TRUCK DRIVERS	LHT	28.13	26.88	31.88	30.26	45.63	51.88
	RHT	30.63	33.13	36.25	31.25	46.25	50.00
AUTO DRIVERS	LHT	29.44	32.22	31.11	19.47	32.22	34.44
	RHT	36.11	33.89	38.89	23.89	36.67	30.00
MILITARY PERSONELS	LHT	22.25	20.56	22.11	17.22	29.06	35.00
	RHT	25.56	21.30	26.94	18.89	37.78	36.39
SHOP KEEPERS	LHT	29.06	27.81	30.63	21.25	29.38	36.39
	RHT	31.88	29.06	35.31	21.56	31.25	34.38
POST OFFICE EMPLOYEE	LHT	32.50	28.75	30.00	28.75	38 .75	40.00
	RHT	32.50	27.50	35.00	30.00	48.75	36.25
TRAFFIC POLICE	LHT	29.36	27.50	28.75	30.63	36.80	42.50
	RHT	35.00	31.25	36.25	23.13	40.63	40.63
TAILORS	LHT	28.33	23.33	28.33	18.13	26.67	22.50
	RHT	31.67	28.34	31.67	19.17	31.67	26.67

Table 2. Correlation between *HT* of the left and right ear at different frequencies

		RIGHT EAR					
		250 Hz	**500 Hz**	**1000 Hz**	**2000 Hz**	**4000 Hz**	**8000 Hz**
LEFT EAR	**250 Hz**	0.540 (0.000)	0.570 (0.000)	0.440 (0.000)	0.460 (0.000)	0.270 (0.009)	0.280 (0.035)
	500 Hz	0.520 (0.000)	0.565 (0.000)	0.430 (0.000)	0.430 (0.000)	0.160 (0.133)	0.075 (0.473)
	1000 Hz	0.460 (0.000)	0.555 (0.000)	0.634 (0.000)	0.570 (0.000)	0.270 (0.009)	0.330 (0.001)
	2000 Hz	0.390 (0.000)	0.330 (0.001)	0.440 (0.000)	0.640 (0.000)	0.380 (0.000)	0.410 (0.000)
	4000 Hz	0.290 (0.005)	0.310 (0.002)	0.480 (0.000)	0.550 (0.000)	0.550 (0.000)	0.630 (0.000)
	8000 Hz	0.280 (0.007)	0.270 (0.008)	0.400 (0.000)	0.410 (0.000)	0.500 (0.009)	0.710 (0.000)

**Figures in the numerator represent the correlation coefficient; **Figures in the denominator represent the significant levels of the corresponding correlation coefficient.*

Figure 1. Correlation between the *HT* of individual ear at different frequencies



(i) Left ear (ii) Right ear

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Bioremediation using artificial constructed wetland in combination with efficient microbial cultures

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Abstract

The paper highlights the use of constructed wetland in combination with effective microbial cultures (Bacterial and fungal) for the removal of BOD, COD and faecal coliform from untreated sewage water of STP2 of Karnal city (India). The constructed wetland consists of iron drums of 220-litre capacity with 60 litres of average loading rate having 85-cm length and filled with 35-cm coarse sand, 10-cm pebbles of 2-5 mm diameter, 35 cm gravel from top to bottom, was installed at CSSRI, Karnal in the state of Haryana. Drums in triplicate were planted with *Phragmite* and inoculated with bacterial cultures SWB1 (*Alcaligenes cupidus*, MTCC 6850), SWB19 (*Enterobacter intermedius*, MTCC 6849) and fungal culture SWF1 (*Aspergillus flavus*, MTCC 6589) added at an interval of one month having 1 litre of culture broth and control without inoculation. Other treatments comprised of: no plantation, *Eichhornia* and *Typha* both uninoculated. Constructed wetland was found to be influenced by season, retention time and inoculated microorganisms.Inoculated *Phragmites* showed better BOD, COD and faecal coliform reduction as compared to uninoculated *Phragmites* because of higher biomass buildup. The system being easy to operate and low cost, can provide an economical viable solution for wastewater management.

Keywords:*BOD, COD, faecal coliform, contructed wetland, Phragmites*, *Eichhornia*, *Typha, Alcaligenes cupidus, Enterobacter intermedius, Aspergillus flavus*

Introduction

Bioremediation is the use of microorganisms or plants to detoxify an environment, mostly by transforming or degrading, pollutants. Four basic techniques may be used: (1) stimulation of the activity of indigenous microorganisms by the addition of nutrients, regulation of redox conditions, optimizing pH conditions; (2) inoculation of the sites with microorganisms of specific biotransforming abilities; (3) application of immobilized enzymes; and (4) use of plants (phytoremediation) to remove, contain, or transform pollutants. *In situ* bioremediation involves the use of organisms to remove pollutants at the site of contamination. Often, these organisms are indigenous to the area and may even be adapted for growth on the chemical contaminants in that particular environment. An alternative to the enhancement of bioremediation by indigenous microorganisms is the use of an inoculum of an appropriate pure or mixed culture of degrading microorganisms to effect removal of the undesired compound (s) (Gibson and Sayler, 1992). Constructed wetland aim to control systematically and optimize the ability of a wetland system to remove or transform wastewater pollutants and in many cases to also create an aesthetic environment for the development of wildlife and social objectives. In recent years interest has increased in wastewater treatment through constructed wetlands because of their low cost and energy requirement (Gersberg *et al.*,1986).Several investigators have reported that wetlands may act as efficient water purificiation system and nutrient sink . Wetlands remove aquatic pollutants through bacterial transformation and physio-chemical processes like adsorption, precipitation and sedimentation .

Constructed wetlands are of low cost, simple to operate and are more suitable for treatment of domestic waste water. However, insufficient information is available on the design and operation of wetlands in the country. Therefore laboratory investigation was carried out to optimize conditions for bioremediation

using microbes in combination with aquatic plants best found under lab conditions using constructed wetlands.

Materials and Methods

Modified form (Wood, 1995) of wetland was constructed using iron drums of 220 lit capacity having 85-cm length and filled with 35-cm coarse sand, 10-cm pebbles of 2-5 mm diameter, 35 cm gravel from top to bottom. Drums in triplicate were planted with *Phragmite* and inoculated with SWB1, SWB19, consortium of SWB1 and SWB19, SWF1 and control without inoculation. Other treatments comprised of: no plantation, *Eichhornia* and *Typha* both uninoculated. Where SWB1&SWB19 were bacterial cultures *Alcaligenes cupidus* (MTCC 6850) and *Enterobacter intermedius* (MTCC 6849) while SWF1 was fungal culture *Aspergillus flavus* (MTTC 6589). It was down flow system with 60 litres of average loading rate.It was loaded regularly from inlet of STP2 sewage water of Karnal city having average BOD (161mg/l) and COD (340 mg/l). Efficient bacterial and fungus cultures were added at an interval of one month. Inoculum level was maintained at 1 litre culture broth per 60 litre of loaded sewage. Sampling was done in two different seasonal temperatures.

(1) Sampling was done in slightly moderate seasonal temperature (January-March, 2004) employing retention time of 72 hr. (January-February), 48 hr. (February-March) and 24 hr. (March) respectively for percent BOD and COD reduction.

(2) Sampling was made at high seasonal temperature (May-June, 2004) for retention time of 24 hr., 48 hr. and 72 hr. respectively for percent BOD and COD reduction. Faecal coliform count was also observed after retention time of 72 hr. Influent and effluent samples were collected regularly and BOD, COD and faecal coliform were analysed as per Standard Methods for the Examination of Water and Wastewater (1985).

Results and Discussion

Sub samples for total outlet were collected after retention time of 24 hr during March, May and June (Fig. 1a and 1b). The mean percent BOD, COD for different treatments having moderate seasonal temperature showed maximum percent BOD reduction by *Typha* (68.4%) followed by SWB19 inoculated *Phragmite sp*. (64.9%). Whereas maximum mean COD reduction was observed in *Phragmite sp*. (61.4%) inoculated with consortium and SWF1 inoculated. For samples at high seasonal temperature maximum percent BOD reduction was observed in *Typha* (69.6%) followed by SWB19 inoculated *Phragmite sp*. (68.0%) similarly percent COD reduction was maximum in *Typha sp*., 67.5%.Sub samples for total outlet were collected after retention time of 48 hr during February-March and May-June respectively (Fig. 2a and 2b). During moderate seasonal temperature the mean percent BOD reduction was observed maximum for SWB1 inoculated *Phragmite sp*. (82.8%) followed by SWB19 (82.7%) and maximum percent COD reduction was observed in consortium inoculated *Phragmite sp*. (76.9%) followed by SWB1 and SWB19 inoculated *Phragmite sp*. (75.5%). For samples at high seasonal temperature (extreme summer) maximum mean percent BOD reduction was observed in consortium inoculation (85.5%) followed by *Typha sp*. (85.0%) and COD percent reduction was maximum in SWB1 inoculation, 79.5%.Sub samples for total outlet of constructed wetland were collected after retention time of 72 hr during January-February and May-June respectively (Fig. 3a and 3b). The mean percent BOD reduction was maximum in consortium inoculation (46.3%) followed by SWF1 inoculated *Phragmite sp*. (45.5%) and COD reduction observed maximum in SWB19

inoculation (50.2%) during moderate seasonal temperature. While during high seasonal temperature maximum percent BOD reduction observed in *Typha sp*. (88.6%) followed by SWB19 inoculation (86.5%) and also COD reduction maximum in *Typha sp*. (83.6%) followed by consortium inoculated Phragmite sp. 83.8%.Thus it is concluded that mean percent reduction (BOD and COD) increased with increase in seasonal temperature with same retention time. However percent BOD and COD reduction increased with increase in retention time when subjected to same seasonal temperature. Percent BOD and COD reduction increased from 24 hr. retention time to 72 hr. retention time for outlet samples at high seasonal temperature (May-June, 2004). Long retention time and an extensive surface area in contact with the flowing water provides for effective removal of particulate and organic matter as reported by Wood (1995). Reduction in BOD and COD with three days retention during January-February was less as compared to two days retention in February-March. Similarly, for one day retention time in end of March, values of reduction were slightly less than two days but more than three days retention time in month of January-February .This indicates that bioremediation is a temperature dependent process. Maximum reduction obtained in summer can be easily ascribed to ideal temperature available for oxidation process (Trivedy and Nakate, 2002). Wetlands performance is affected by rainfall, temperature (Juwarkar *et al*. 1995). Heritage *et al*. (1995) suggested improvement in BOD reduction over the spring and summer. It might be due to temperature increase and increased plant growth over the period. Season is a significant factor in the removal of BOD (Kuehn and Moore , 1995). Faecal coliform reduction by constructed wetland after retention time of 72 hr. during high seasonal temperature (May-June, 2004) was tried (Table 1). The mean inflow of faecal coliform were $95x10^5$ per 100 ml which reduced maximum in SWF1 inoculated Phragmites ($71x10^2$/100 ml) followed by SWB19 inoculated *Phragmite* ($12x10^3$/100 ml). Unvegetated control observed reduction having mean outflow value of $48x10^4$/100 ml. This reduction in bacterial load may be because of (1) the bacteria are sedimented or trapped in the root hairs of wetland plants (2) wetland plants may have the capacity to secrete a chemical substance which could have bactericidal or bacteriostatic effects. Mandi (1994) reported faecal coliform reduction of 98.6% and 78% during summer and winter respectively by *Eichhornia crassipes*. Bavor *et al*. (1988) cited an average value of 1 million counts per 100 ml in the effluent from 9 trickling filter in NSW. Chick and Mitchell (1995) reported marked reduction in faecal coliform count from mean inflow value of 12 million counts per 100 ml to a mean for all VFWs of less than 150,000.

Inoculated *Phragmites* showed better BOD and COD and Faecal coliform reduction as compared to uninoculated *Phragmite* because of higher biomass of inoculated *Phragmite* compared to uninoculated *Phragmite* (Table 2). Ramesh *et al*. (1990) reported substitution of mango rhizosphere soil with dominant bacterial isolate resulted in maximal improvement of height and biomass of ber seedling. Fungal treatment alone or in combination with bacteria was less effective. Further studies will be required to optimize these conditions for effective treatment of wastewater under field conditions.

Conclusion

The results showed that constructed wetland with an average loading rate of 60 litre sewage in combination with effective bacterial cultures SWB1 (*Alcaligenes cupidus*, MTCC 6850), SWB19 (*Enterobacter intermedius*, MTCC 6849) and fungal culture SWF1 (*Aspergillus flavus*, MTCC 6589) added at an interval of one month having 1 litre of culture broth in *Phragmites* showed increased BOD,COD reduction with retention time of 24hr,48hr and 72hr and faecal coliform reduction with 72hr retention time (May-June 2004) as compared to uninoculated *Phragmites* because of increased biomass of culture supplemented Phragmites. Other treatments comprised of: no plantation, *Eichhornia* and *Typha* both uninoculated.

Mean percent reduction (BOD and COD) increased with increase in seasonal temperature with same retention time. However percent BOD and COD reduction increased with increase in retention time when subjected to same seasonal temperature. BOD and COD reduction with three days retention during January-February 2004 were less as compared to two days retention in February-March,2004. Similarly, for one day retention time in end of March,2004 values of reduction were slightly less than two days but more than three days retention time in month of January-February 2004. Faecal coliform reduction by constructed wetland after retention time of 72 hr. during high seasonal temperature (May-June, 2004) was tried. The mean inflow of faecal coliform were $95x10^5$ per 100 ml which reduced maximum in SWF1 inoculated *Phragmites* ($71x10^2$/100 ml) followed by SWB19 inoculated *Phragmite* ($12x10^3$/100 ml). Unvegetated control observed reduction having mean outflow value of $48x10^4$/100 ml. The constructed wetland seems to be cost- effective alternative to conventional treatment processes which involves huge cost and its efficacy further gets improved by addition of efficient microbial cultures. Wetland performance is affected by temperature, retention time etc. Since it is not site specific, the system can be implemented near the wastewater source.

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Table 1. Faecal coliform count in miniature wetland inlet and outlet, having retention time of 72 h (May-June 2004).

Plant type	Inoculation @1.0l/60l	Faecal coliform (MPN/100ml) range	Faecal coliform (MPN/100ml) (Mean)*	
			Inlet	Outlet
		$5x10^3$-$8x10^7$	$95x10^5$	
Phragmite	SWB1	$6x10^3$-$7x10^4$	---do-----	$22x10^3$
---do-----	SWB19	$4x10^3$-$5x10^4$	---do-----	$12x10^3$
---do-----	Consortium	$3x10^3$-$4x10^4$	---do-----	$15x10^3$
---do-----	SWF1	$2x10^3$-$5x10^4$	---do-----	$71x10^2$
---do-----	Nil	$2x10^3$-$5x10^4$	---do-----	$29x10^3$
Typha	Nil	$6x10^2$-$11x10^5$	---do-----	$28x10^3$
Eichhornia	Nil	$8x10^4$-$8x10^5$	---do-----	$23x10^4$
Unvegetated (UV)Control		$14x10^4$-$13x10^5$	---do-----	$48x10^4$

Table 2: Harvested fresh Biomass of miniature wetland.

Plant type	Inoculation @1.0l/60l	Range of biomass (kg)	Average* biomass (kg)
Phragmite	SWB1	3.5-4.0	3.6
---do-----	SWB19	2.75-4.5	3.6
---do-----	Consortium	3.5-4.5	4.0
---do-----	Cow dung	3.5-4.0	3.6
---do-----	SWF1	3.5-4.0	3.91
---do-----	Nil	3.0-3.0	3.0
Typha	Nil	4.0-6.0	5.0
Eichhornia	Nil	1.25-1.75	1.5

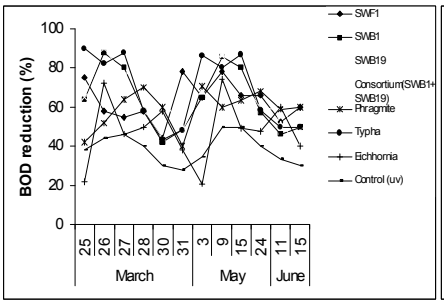

Fig 1a: Percent BOD* reduction in different treatments of wetland having retention time (24hr)
*** Values are mean of three replicates**

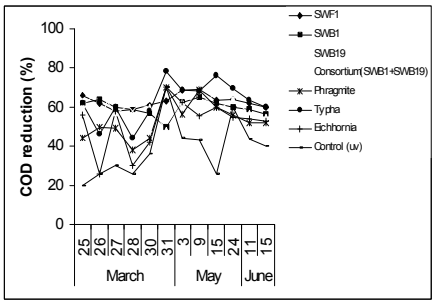

Fig 1b: Percent COD* reduction in different treatments of wetland having retention time (24hr)
*** Values are mean of three replicates**

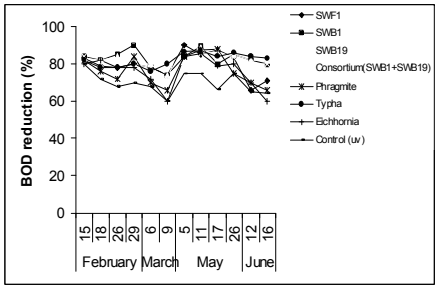

Fig 2a: Percent BOD* reduction in different treatments of wetland having retention time (48hr)
Values are mean of three replicates

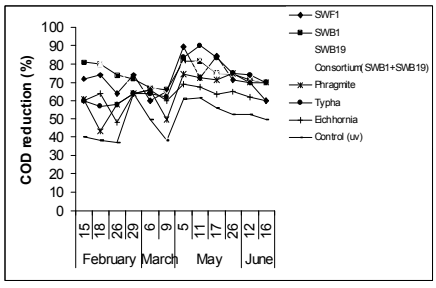

Fig 2b: Percent COD* reduction in different treatments of wetland having retention time (48hr)
*** Values are mean of three replicates**

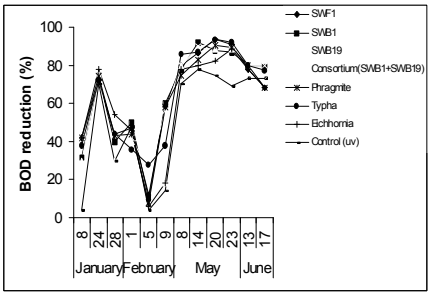

Fig 3a: Percent BOD* reduction in different treatments of wetland having retention time (72hr)
*** Values are mean of three replicates**

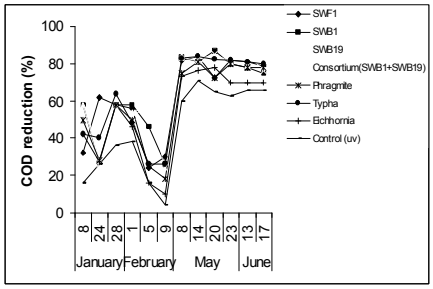

Fig 3b: Percent COD* reduction in different treatments of wetland having retention time (72hr)
*** Values are mean of three replicates**

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Impact of sugar industries of kushinagar district (U.P.) on water quality: Using remote sensing and Geographical information System (GIS)

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Abstract

Quality of water is an important aspect for drinking and other related requirement. Water has been the most exploited natural resource due to ever increasing demand of man for food, cloth, industrialization. In the present study effect of sugar effluent on water quality at given region in two seasonal conditions i.e. pre rainy season and post rainy season and the sampled data was analyzed separately for pH, Total dissolved solid (TDS), Nitrate, Phosphate, Dissolved oxygen (DO), Biochemical oxygen demand (BOD) and Chemical oxygen Demand (COD) and followed by G.I.S. to develop respective maps. It was found that the pH value was alkaline in pre rainy season and slightly acidic in post rainy season. TDS was found high in 66% area during pre rainy season and 74.6% in post rainy season above permissible limit . In pre rainy season 83.4% area and in post rainy season 98.4% area contains high electrical conductivity .In pre rainy season BOD was found more than 6mg/l in 80.9% in pre rainy season and in 84.2% area in post rainy season. COD was found above prescribed limit (>10mg/l) in 59.5%area in pre rainy season and in 93.6% area in post rainy season 33.3% area contain high phosphate in pre rainy season 46.03% area contains high phosphate in post rainy season .Nitrate was found in permissible limit in pre rainy season 46.6% area was found to contain nitrate in post rainy season 7.1% of the geographical area is having fluoride concentration more than 1.5mg/l and 28.5% area is having fluoride concentration below the normal limit .Thus 35.6% of total area is not suitable for drinking purpose.6.34% area contain fluoride above prescribed limit

Key words: - *Dissolved oxygen, BOD, COD, GIS.*

Introduction

Ground water is important source of fresh water for agriculture, drinking domestic uses in many regions of the world and also in India. Demand of ground water has been increasing day by day for irrigation by bringing area under cultivation. Water generally contains different species of cations and anions in varying amounts. The concentration of dissolved constituents in water is an important determinant for its quality. (Islam *et al*., 2003). Rapid growth of population, urbanization, coupled with industrialization pose serious concern to the vulnerability of water resources owing to regional imbalance of chemical parameters and eventual safe use of ground water for drinking purpose (Mathur and Priyakant, 2005).

In general most of sugar industries don't process the effluent for removal of organic and inorganic pollutants and release the entire effluent outside the premises which eventually spreads throughout the low lying area adjacent to the sugar factory or discharges into natural course. This in turn can migrate and mix with the shallow water aquifer system through seepage and therefore can cause detrimental effect on ground water quality. Total estimated amount of production of sugar industries in India is 7.5×10^6 tonnes/ year. Sugar mill consume 1500-2000 liters of water and generate about 1000 liters of waste water ton of crane crushed.The effluent is mainly floor washing waste water and condensate water, leakage in valves

and glands of pipeline add sugarcane juice syrup, molasses in the effluent. The sugarcane effluent has BOD 1000 -1500mg/l, but appears relatively clean initially, however after stagnating for some time it turns black and starts emitting foul odour if untreated effluent is discharged in water courses it also depletes dissolved oxygen in water and make environment unfit for aquatic life. If untreated effluent is discharged on land decaying organic solids ,oil and grease clog the soil pores .

The district Kushinagar lies between latitudes $26^0$50' and 27^0 0' N and longitude 83^0 40' and 84^0 0' E and fall in the survey of India toposheet No. 63N/9 and 63 N/13. Topographically the area exhibits a flat terrain with a gentle slope from north to south. It is situated in the doab of river (Gandak, Rapti and Ghagra). It comprises three tehsils of viz., Padrauna, Ramkola and Kaptanganj. The main surface water source is Banari nala, which traverses the entire area in a zigzag way flowing in North West direction. Western Gandak network canal is the main irrigation canal system. The other canals of the area include Kurmai minor, Barhara distributory, Padrauna minor, Khasai Branch and Sepaha distributory. A Number of lakes namely Kamaini tal, and Balkariyal tal are also located in the area, Climate of this area is moderate as compared to western part of state. The temperature is maximum in May and June seldom exceed 41^0C and generally it remains around 36^0C during winter, the average minimum temperature for December and January drops to about 10^0C. Average annual rainfall in the area is about 1145 mm. Bulk of the rainfall occurs during June to September due to South-West monsoon. The area under reference is a fertile alluvial plain with gentle slopes towards South-East. Major amount of sugar industries located in area of Padrauna and Ramkola Tehsils.

Material and Methods

Water samples were collected from 3 areas Kaptanganj, Ramkola, Padrauna in prerainy season (April to May) and in post rainy season (Oct. to Nov.). Samples were collected from different point and non point sources i.e. River, tube wells, canals, hand pumps etc. From each sampling site two samples were collected in chemical resistant pre cleaned plastic bottles, which were thoroughly washed twice with the some water required to be analyzed. The concentration of total dissolved solids was measured on the spot itself with the help of portable electric conductivity meter. TDS was determined by gravimetric technique . Dissolved Oxygen and Biological Oxygen Demand and COD were measured by winkler's-Iodometric method, 5-days BOD test, closed reflux colorimetric method respectively. Fluoride, Nitrate, Phosphate measured by UV-Vis. spectrophotometric method (APHA, 1992; Abbasi, 1998).

Result and Discussion

The monitoring parameters were measured on the basis of pre-rainy season and post rainy season effect on ground water and surface water. quality. The average analytical result of 42 water samples in pre-rainy season and 63 water samples in post rainy season, collected from hand pumps, river, tube wells, canals, drains etc are shown in table 1. All the eight parameters i.e. pH, TDS, Nitrate, phosphate,D.O., B.O. D.,C.O. D., fluoride in ground and surface water were compared with the permissible/tolerable limit laid dawn by B.I.S. (1991).

A pH range of 6.5-8.5 is normally acceptable as per guide line suggested by BIS (1991) and WHO (1993) pH values at Kaptanganj , Padrauna and Ramkola varies from 6.83-10.27 , 7.2-8.12 and 7.14-8.71 indicating alkaline nature of water at all stations. The pH range observed at, Padrauna and Ramkola were well among prescribed range and at kaptanganj were on alkaline side But in post rainy season the pH value of these stations Kaptanganj, Padrauna and Ramkola ranges from 7.24-8.51,6.8-8.2 and 4.4-8.5.

The electrical conductivity limit is300 µS /cm, normally acceptable as per guide line suggested by BIS (1991) and WHO (1993) .The conductivity value at Kaptanganj , Padrauna and Ramkola ranges from 189-1324.8, 484-1901and 690-1885 µS /cm respectively in pre rainy season. High conductivity values are observed in low flow periods at the above three stations. It is due to industrial waste disposal at water bodies and dissolved solids from water shed Figure 1shows spatial and percentage distribution of electrical conductivity in district. It clearly shows 83.4% of electrical conductivity in excess of prescribed limit only 16.6% suitable with electrical conductivity for drinking purpose. Electrical conductivity at Kushinagar district increases during post rainy season .High conductivity was observed in high flow periods at above three stations. The conductivity value at Kaptanganj, Padrauna and Ramkola ranges from 155-1480,600-2030 and 541-2000 µS /cm respectively (Table 1).

GIS analysis (Fig.1) revealed that 1.6% area of district Kushinagar contains less than 300 µS /c.m and safe for drinking purpose. Total dissolved solids (TDS) indicate general water quality or salinity and is usually related to conductivity. Water containing more than 500mg/dl of TDS is considered suitable for drinking .500mg/dl is the desirable limit and 2000mg/dl is the permissible limit (BIS,1991; WHO, 1993).The TDS Kaptanganj, Padrauna and Ramkola vary from 122-8611mg/dl, 305-1157mg/dl and 414 - 6329mg/dl respectively .High TDS at these three stations is due to industrial waste percolation or seepage in ground water .The G.I.S. analysis reveal that 66.6% area of district kushinagar contains TDS>500mg/dl and is not safe for drinking purpose (Fig 4).TDS in post rainy season in Kaptanganj , Padrauna and Ramkola vary from 88.35 - 837.9, 342 - 6441and 308..37 – 1140 (Table 1).

On the basis of spatial and percentage distribution of TDS in Kushinagarin post rainy season 74.60% area of Kushinagar contains TDS > 500 mg/L and is not safe for drinking purpose [Fig-2]. In pre-rainy season 83.40% area and in postrainy season 98.40% area of Kushinagar contains E. conductivity > 300 µS/c.m. Higher values of TDS at Kushinagar appear due to the contribution of dissolved solid from watershed and disposable of Industrial effluent on water bodies; one of the most important reasons are high amount of agricultural runoff and discharge of effluent on water bodies (Mathur, 2005). Contribution of watershed due to dissolution or weathering of rocks and soil as water passes over or percolates through them (Decoursey, 1985). A large amount of sediment load is transported from the watershed during the steep slopes of the land (Rai and Sharma , 1998).

Dissolved Oxygen (DO) is important parameter in the drinking water and is inversely related to the Biological oxygen demand (BOD) and chemical oxygen demand (COD). DO, BOD and COD values at Kaptanjanj range from 5.2 - 7.8mg/l, 2-55.0mg/l and 7.2 - 82.0 respectively. At Padrauna values of DO, BOD and COD range from 5.3 -8.2mg/l, 4.0-34.0mg/l and 5.8 -66.5 and at Ramkola values of DO, BOD and COD 4.9 - 6.3mg/l, 2.8 - 20.8mg/l and 5.2-24.6mg/l.These values are much higher than the permissible limit prescribed by WHO (1993) and BIS (1991) , D.O 4.0-6.0mg/l BOD<6mg/l and COD<10mg/l .At Kaptanganj these values are much higher than Ramkola and Padarauna due to positive loading of industrial waste at water bodies In the post rainy season values of DO, BOD and COD 5.4 - 7.6mg/l, 4.2-10.4mg/l and 8.42 - 22.42mg/l. In Padaurana values of DO, BOD and COD was 0.0-6.4 mg/l, 8.2-88 mg/l and 19.2-52.2 mg/l at Ramkola 5.1-7.0mg/l, 3.0-14.6mg/l & 7.42 - 28.9mg/l (Table 1). The condition in post rainy season of water quality at Kuhinnagar shows strong positive loading of BOD and COD and strong negative loading on pH and DO. This represent anthropogenic pollution sources and can be explained on the basis that high level of dissolved organic matter consume large amt of oxygen, which undergoes anaerobic fermentation processes leading to formation of ammonia and organic acids. Hydrolysis of this acidic material causes decrease of water pH values (Singh *et al*., 2004).

In the pre rainy season nitrate value at in Kaptanganj , Padrauna and Ramkola ranges from 0.09-3.95mg/l, 0.09-8.78mg/l and 0.29-1.4mg/l respectively .None of the samples contain nitrate beyond the permissible limit of 40.0mg/l as prescribed by BIS (1991) for drinking purposes. Concentration of nitrate in post rainy season at Kaptanganj, Padrauna and Ramkola 4.8-48mg/l, 11.09-84.79mg/l and 3.38-72.96mg/l respectively (Table 1).

Nitrate concentration in ground water is enhanced by shallow ground water table and excessive application of nitrogenous fertilizer (Steversen, 1996). In an around area of high urbanization, industrialization, municipal, industrial water may contribute high level of nitrate to ground water (Handa *et al.,* 1982). Nitrate concentration showed a clear seasonal pattern .The seasonable difference can be account for the variation in the amt of readily leachable nitrate within soil profile (Powlson , 1993). Autumn sown crops utilize only small amount of nitrate the large quantity being available for leaching. During summer month (pre rainy season) plant uptake is high available nitrate is low on the basis of percentage distribution of ground water in Kushinagar 47.6%of ground water contain nitrate above 45mg/l and is not safe for drinking.

The phosphate concentration at Kaptanganj, Padrauna and Ramkola ranges from 0.01- 0.63mg/l, 0.01-2.85mg/l and 0.01-2.85mg/dl respectively high as compared to 0.1mg/l limit .On the basis of percentage distribution of water quality 33.3% of area has poor water quality and 66.6% area has good quality. Phosphate concentration was high in post rainy season The phosphate concentration at Kaptanganj , Padrauna and Ramkola ranges from 0.09-0.98mg/l,0.02-0.91mg/l and 0.0-0.045mg/l respectively. On the basis of percentage distribution of ground water in Kushinagar 46.03% area contains phosphate above0.1mg/l and is not safe for drinking purpose and remaining 53.97% area contains phosphate above permissible limit. The high amount of phosphate in ground water in post rainy season due to increased weathering and break down of the soil structure and addition of mineral fertilizers (Jenkins, 1995).

On the basis of spatial and percentage distribution of ground water in Kushinagar district 6.4% area contain fluoride >1.5mg/l and is not safe for drinking purpose. Fluoride has considerable physiological significance for man and animal. Evidences so far accumulated shows that the upward adjustment of fluoride in drinking water to 1.0 mg/l result in a great reduction in the incidence of dental carries (Handa, 1975). As such the problem of high level of fluoride is encountered in many geographical zones of globe. The globe prevalence of fluorisis is reported to be about 32% (Srivastava, 1997). It is not surprising that 17 of the states and union territories are endemic for fluorosis (Ministry of Health, 1962 and Srinivansan, 1959).

Conclusion

The main objective of this study was to undertake drinking water quality survey of India in sugar industrial area of district Kushinagar. Eight parameters viz. pH, Electric Conductivity, TDS, DO, BOD, COD, Fluoride, Nitrate & Phosphate in ground water analyzed separately and further combined to delineate, suitable moderate and poor quality zones in the entire district. Areas having high concentrate of these parameters were highlighted and classify the nature of problem using chemical & GIS based techniques Release of entire effluent outside the premises which eventually spreads throughout the low lying areas adjacent to the sugar factory or discharges into natural water course. This in turn can migrate and mix with the shallow water aquifer system through seepage and therefore can cause detrimental effects on the ground water quality.

It may be inferred from the study that the areas, which contains the high Total Dissolved Solid values water, should be recharged with the rain water using the percolation wells. Since the untreated water is being used, the consumer will have the health effect due to high degree of residue. High concentration of

fluoride content in the study area need urgent attention to present possible health hazards by way of getting defluoridation plant and to inhibit discharge of sugar industry waste on water bodies. Other remedial measures like use of lime, alum, bone charcoal filters may be used on domestic scale (Valdiya, 1987).

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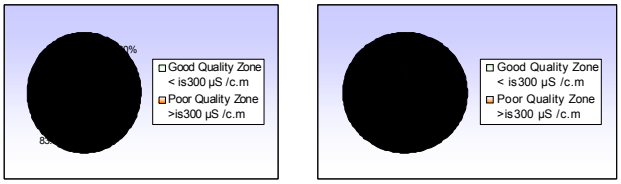
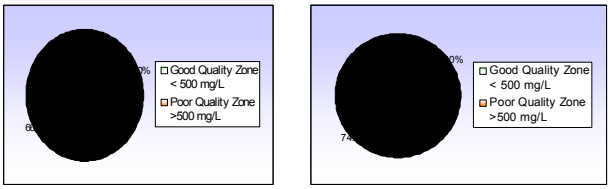
Table1. Comparitive data of various parameters in Kushinagar District during pre rainy and post rainy season.

Season	Site	Parameters								
		T.D.S (mg/l)	pH	E.C. (µS/cm)	D.O (mg/l)	B.O.D (mg/l)	C.O.D (mg/l)	NO_3^- (mg/l)	PO_4^{3-} (mg/l)	Fl (mg/l)
Pre rainy	Kaptanganj	122-8611	6.83-10.27	189-1324.8	5.2-7.8	2.0-55.0	7.2-82.0	0.09-3.95	0.01-0.63	0.35-1.50
	Padrauna	305-1157	7.2-8.12	484-1901	5.3-8.2	4.0-34.0	5.8-66.5	0.09-8.78	0.01-2.85	0.17-0.96
	Ramkola	414-6329	7.14-8.71	690-1885	4.9-6.3	2.8-20.8	5.2-24.6	0.29-1.4	0.01-0.66	0.34-1.56
Post rainy	Kaptanganj	88.35-8379	7.24-8.51	155-1480	5.4-7.6	4.2-10.4	8.42-22.4	4.8-48	0.0-0.98	0.37-1.78
	Padrauna	342-6441	6.8-8.2	600-2030	0.0-6.4	8.2-88	19.42-52.2	11.09-4.79	0.02-0.91	0.41-1.03
	Ramkola	308.37-140	4.4-8.5	541-2000	5.1-7.0	3.0-14.6	7.42-28.9	3.38-72.96	0.0-0.045	0.30-1.57



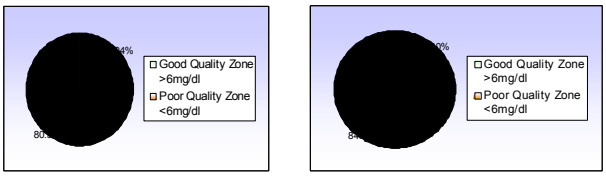
Pre rainy **Post rainy**

Fig1. Percentage distribution of electrical conductivity in Kushinagar district



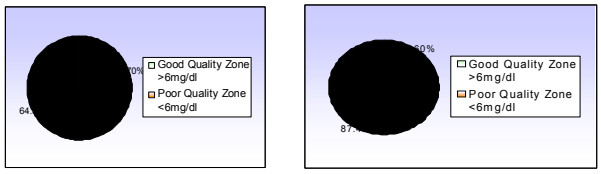
Pre rainy **Post rainy**

Fig. 2. Percentage Distribution of TDS inground water in District Kushinagar



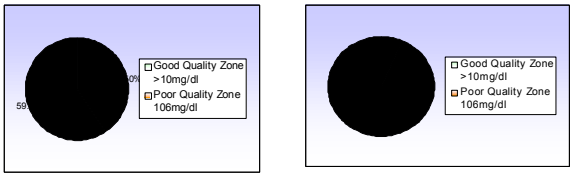
Pre rainy **Post rainy**

Fig 3 Percentage Distribution of DO in ground water in District Kushinagar.



Pre rainy **Post rainy**

Fig. 4. Percentage Distribution of BOD in ground water in District Kushinagar.



Pre rainy **Post rainy**

Fig. 5. Percentage Distribution of COD in ground water in District Kushinagar.

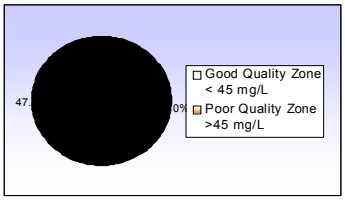
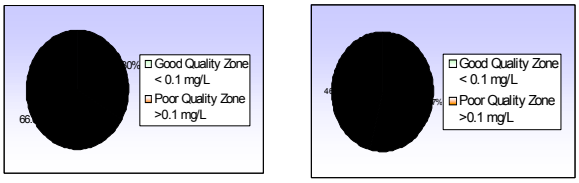
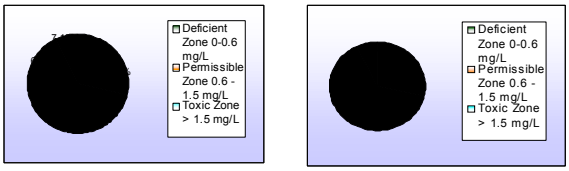


Fig. 6. Percentage Distribution of Nitrate in ground water on Post-rainy season, District Kushinagar



Pre rainy **Post rainy**

Fig. 7. Percentage Distribution of Phosphate in ground water District Kushinagar.



Pre rainy **Post rainy**

Fig. 8. Percentage Distribution of Fluoride in ground water on , District Kushinagar.

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Alteration of resting period of pollen of five cultivars of *Petunia axillaris* BSP. by Gramoxone: Further Evidence of a Criticism of Brewbaker and Kwack's (1963), Saoji and Chitaley (1972), Berg (1973), Brandt (1974), Vick and Bevan (1976), Rasmussan (1977), Navara, Horvath and Kaleta (1978), Mhatre (1980-Ph.D. Thesis), Mhatre, Chaphekar, Ramani Rao, Patil, Haldar (1980), Shetye (1982-Ph.D. Thesis) and Giridhar (1984-Ph.D. Thesis) – A Critical Review

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Abstract

Gramoxone altered the resting period of pollen of all the 11 series of *Petunia axillaris*. It extended the resting period of pollen of 10 series and reduced only in one series. Pollen of F and F-24 series of light-violet-flowered cultivar found germinated after one hour of sowing *in vitro* culture of sucrose did not germinate even 24 hours of sowing *in vitro* culture of sucrose supplemented with gramoxone. Pollen of F-24 series of white-violet-flowered cultivar of *P. axillaris* failed to germinate even 10 hours of sowing *in vitro* culture of sucrose were found germinated after 7 hours of sowing *in vitro* culture of sucrose supplemented with the herbicide.

Key Words : *Toxicology, Environmental Science, Herbicides, Palynology.*

Running Title : Alteration of resting period of pollen of *Petunia axillaris* by Gramoxone

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 which blooms in different seasons.

Materials and Methods

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 *Petunia axillaris* BSP. *e.g.* light-violet-, pink-, violet-, white- and white-violet-flowered cultivars 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 an optimum concentrations of sucrose supplemented by the optimum concentrations of gramoxone (Table 1). Pollen grains were incubated soon after the dehiscence of anthers. The cultures then transferred to a moist filter chamber, stored at room temperature (29-31°C) having RH 65% and in diffuse laboratory light. The experiments were run in triplicate and average results were recorded. 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. For each experiment a random count of 200 grains was made to determine the percentage of the germination of pollen.

Results and Discussion

Potentiality of the germinability of pollen is noted only in F series of pink- and white-flowered cultivars of *Nerium odorum*. Both of them are single-flowered cultivars (Salgare, 1983-). Potentiality of the germinability of pollen was recorded in F and F-24 series of *Physalis minima* and *Solanum xanthocarpum* (Ram Indar, 1981-), in red-flowered (double-flowered) cultivar of *Nerium odorum* and in white-flowered cultivar of *Catharanthus roseus* (Salgare, 1983), all the 5 cultivars of *Petunia grandiflora* (Sharma, 1984), in all the 5 cultivars of *Solanum melongena* (Singh, 1985) and in all the 5 cultivars (light-violet-, pink-, violet- and white-violet-flowered cultivars) of *Petunia axillaris* except for white-flowered cultivar (Salgare, 1986a-). Pollen germination *in vitro* culture of sucrose was noted in F, F-24 and F-48 series of *Brunfelsia americana* and in violet-flowered form of *Datura fastuosa* (Ram Indar, 1981), in all the 3 cascades (Sharma, 1984) and in white-flowered cultivar of *P. axillaris* (Salgare, 1986a). However, it was the pollen of white-flowered form of *D. fastuosa* (Ram Indar, 1981) and pink-flowered cultivar of *C. roseus* (Salgare, 1983) showed their germination *in vitro* culture of sucrose in all the 4 series (F, F-24, F-48, F-72 series) investigated. Potentiality of the germinability of pollen in all the 4 series investigated was also noted by Salgare (1986e) in 3 Leguminous crops *viz. Cyamopsis tetragonoloba* Var. Pusa Navbahar – gawar, *Phaseolus aureus* Var. J-781- mung and *Phaseolus mungo* Var. T-9- urid. Theresa Sebastian (1987) observed the germination of pollen of one of the Leguminous crops *i.e. Vigna mungo* Type 9, of Uttar Pradesh in all the 4 series investigated *in vitro* culture of sucrose. Suwarna Gawde (1988) noted the germinability of pollen of 2 Leguminous crops *viz. Vigna unguiculata* Var. Pusa Barsati – cowpea and *Vigna radiata* Var. Pusa Baisakhi of Delhi in all the 4 series investigated. Johri and Chhaya Roy Chowdhury (1957) stated that in *Citrullus colocynthis,* where pollen grains 'mostly remained attached in tetrads', satisfactory germination is observed.

Salgare (1983) observed the germination of pollen of F-72 series of pink-flowered cultivar of *Catharanthus roseus in vitro* culture of sucrose. However, Trisa Palathingal (1990) 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.

It should be pointed out that even the lowest concentration (10^{-17} mg/ml) of gramoxone tried suppressed the germinability of pollen of F and F-24 series of light-violet-flowered and F-24 and F-48 series of white-flowered cultivars of *Petunia axillaris* (Salgare, 1986a, Table 1). The germinability of pollen of F-72 series of pink-flowered cultivar of *Catharanthus roseus* was suppressed even by the lowest concentration (10^{-17} mg/ml) of gramoxone tried (Salgare, 1983). Sharma (1984) stated that the germinability of pollen of F and F-24 series of duet and sonata and F-48 series of pink and red cascades was prevented even by the lowest concentration

(10^{-17} mg/ml) of gramoxone tried. Al of them are the cultivars of *Petunia grandiflora*. This proves that the pollen of the said series are highly sensitive and acts as an ideal indicators of pollution. Thus it is confirmed that the pollen development and activity are more sensitive indicators of adverse factors in the botanical environment and the use of an entire vascular plant (Berg,1973; Brandt, 1974; Vick and Bevan, 1976; Rasmussan, 1977; Navara, Horvath and Kaleta, 1978; Mhatre, 1980; Mhatre, Chaphekar, Ramani Rao,

Patil, Haldar, 1980; Shetye, 1982 and Giridhar, 1984) as an indicator of pollution is a very crud method and rather a wrong choice. There is no evidence of any entire vascular plant exhibiting this much degree of sensitivity. This is confirmed in the present critical review (Table 1) as well as by the previous extensive work of Salgare (1983, 84b, 85a, c-d, 86a-c, e, 2000, 01a, c, 05a, c, e, 06a, c), Salgare and Theresa Sebastian (1986a), Salgare and Phunguskar (2002), Salgare and Sanju Singh (2002), Salgare and Sanchita Pathak (2005) and Salgare's Research Group (Ram Indar, 1981; Sharma, 1984; Singh, 1985; Theresa Sebastian, 1987; Suwarna Gawde, 1988 and Trisa Palathingal, 1990).

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 for the first time that the pollen require resting period before germination and it was the failure of Saoji and Chitalay (1972) who misinterpreted the resting period for pollen maturity.

Gramoxone altered the resting period of pollen of all the 11 series of *Petunia axillaris* (Table 1). The herbicide extended the resting period of pollen of *Petunia axillaris* in 10 series and reduced only in one series (Table 1). Pollen of F and F-24 series of light-violet-flowered cultivar found germinated after one hour of sowing *in vitro* culture of sucrose failed to germinate even 24 hours of sowing *in vitro* culture of sucrose supplemented with gramoxone. Pollen of F-24 series of white-violet-flowered cultivar of *P. axillaris* failed to germinate even 10 hours of sowing *in vitro* culture of sucrose were found germinated after 7 hours of sowing *in vitro* culture of sucrose supplemented with the herbicide (Table 1). Alteration of the resting period of pollen by the herbicide was also noted by Ram Indar (1981), Salgare (1983, 84a, 85b, 86a, d, e, 2001b, 04, 05b, d, 06b), Salgare and Theresa Sebastian (1986b), Sharma (1984) and Singh (1985). Alteration of resting period of pollen of successive flowers by the minerals was noted by Salgare and Shashi Yadav (2002, 05). Recently Salgare and Sanchita Pathak (2002) noted the alteration of resting period of pollen by the heavy metal.

With the present work (Table 1) as well as the previous extensive (Ram Indar, 1981; Salgare, 1983, 84a, 85b, 86a, d, e, 2001b, 04, 05b, d, 06b; Sharma, 1984; Singh, 1985; Salgare and Theresa Sebastian, 1986b; Trisa Palathingal, 1990; Salgare and Sanchita Pathak, 2002 and Salgare and Shashi Yadav, 2002, 05) it is further confirmed that it was the failure of Saoji and Chitaley (1972) who misinterpreted the resting period for pollen maturity. It is also proved that the resting period differs species to species or even cultivars/forms of the same species. It is also confirmed that this resting period is altered by the different chemicals as well as by the environmental factors.

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Table 1. Effect of gramoxone on the rate of pollen germination of successive flowers of five cultivars of *Petunia axillaris* BSP.

		Conc.		trfpg		
Cultivars	Series	PV	SC	HC	C	T
Light-violet-	F	76	50	Ng_2	1	Ng_2
Pink-	F	93	50	10^{-17}	4	6
Violet-	F	80	50	10^{-17}	1	5
White-	F	95	30	10^{-17}	1	7
White-violet-	F	90	30	10^{-17}	1	5
Light-violet-	F-24	76	30	Ng_2	1	Ng_2
Pink-	F-24	93	10	10^{-17}	4	8
Violet-	F-24	80	60	10^{-17}	2	5
White-	F-24	95	10	Ng_2	3	Ng_2
White-violet-	F-24	90	30	10^{-17}	Ng_1	7
White-	F-48	95	10	Ng_2	4	Ng2

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

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Consevation of migratory and local birds of satpura hills of Madhya Pradesh (India)

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Abstract

In the present study a survey of migratory and local birds of satpura hills were examined. During the course of study a total of twenty eight species of migratory birds belonging to twenty two families were noticed.

Keyword : *Migratory birds, Betul District, Nesting, Flycatcher.*

Introduction

Satpura hills are full of Teak, Sal,Beeja and Bamboo trees. The minimum rain fall is approximately 45 inches per anum.Number of migratory and local birds establish their nest here.Canoy fly catcher, Yellow weg tail, Hornbills,Orange necked thrush,Ruby checked sunbirds are among them, found during winter season.Holy Narmada and Tapti rivers are two main water reservoirs. Hoshangabad,Betul are major district of this area. This vast area covers near about 200 km.

Origin of the Research Problem

Although above these birds are significant in forest ecosystem but their survival and existence is highly threatened in Betul today due to human impact on their habitat. Nesting trees are logged or cavities of nest holes removed as a part of forest operation poaching and capturing activity hits the population in many tribal areas of Betul district.During the period of survey Author noted approximately 20 species of birds are going to extinct and there habitats are going to spoil by the different prey.Government of MadhyaPradesh and local peoples are trying there best to conserve these birds but more and more efforts are needed to fulfill this lacuna.

Interdisciplinary Relevance

The subject is commonly related with zoology and need more and more effort to conserve these birds to maintain our ecosystem.Betul District of Satpura hills is the place of great biodiversity of bird fauna.Several factors have contributed to its conservation over past twenty years.There were geographical isolation inhornitable environment for successibility and wise management procedure used by local inhabitants. High rate of endemecess among its fauna and flora has qualified it to be an endemic bird area .This dense forest attracts paradise flycatcher, Tree pie,Horn bills,Yellow weg tail,Ruby check sun birds.Cockoo,Ducks,Hawks,Heron, Vultures,Black Drongo,Hoopoe, Black Headed Oriole etc. birds from neighbouring districts and of other parts of India.Paradies flycatcher is probably one of the most striking of the birds that occur in this area and easily recognizable atleast in the case of the adult male by the two extremely long tail feather which in same localities have earned the name of Robin bird .Verditer flycatcher(*Eumyias thalassina thalassina*),genusTchirrea,are generally found here.They breed from early April right through to August. They make their nests very frequently under overhanging nanks along side forest roads and paths in holes of tree of rocks. The present study is an effort to report the need of

conservation of these valuable birds,which are our best friends and also helpful to our environment.

Material and Methods

Field observation was specially made in the area like Multai,Ranipur,Bori sanctuary ,Pachmarhi etc . The study of birds was conducted by field observations. Records of birds are mostly based on Field study and information provided by the local tribes of the village, Ranipur, Sarni, Bhoura and adjacent areas of Bori wild life sanctuary. All the relative data of species encounted during this survey were enlisted. This list was tallied with a general survey conducted by the working plan officer of forest department and observer of such studies. Finally the checklist of these birds habitat in Hoshangabad and Betul was prepared.About 120 species of local and migratory birds might be described as a common occurence in the hills and of these large proportion may be seen,at one time or another.It is not possible to include all of these and therefore some of the birds could be selected for inclusion.

Result

The Hoopoe is found chiefly in open and is essentially a ground bird.This bird feeds on catterpillers,cricket ,termites.Hoopoe is very useful to the farmer.This is destroyer of cutworms and cockchafer grubs.The Hoopoe is most decidedly amongst the farmers best friends and deserves every encouragment and protection.

The Black Drongo or ‘king crow ‘is one of our most common and familiar birds,occuring specially in all cultivated areas.It can swoop down to secure its prey,either on the wing or on the ground.The prey consists almost wholly of the insects and practically wholly of injurious insects.This bird is distinctly a valuable of the farmers and deserves every encouragment and protection.

Black Headed Oriole the ‘Mango bird’ is a seasonal visitor arriving near end of March and leaving in November.During the rains this bird often makes a whistling.It feeds chiefly on wild fruits and insects among them 70% are injurious to plants .It has not been noted to attack cultivated fruits.

The ‘seven sister ‘Babblers which have terrestrial habits is a mixed feeder subsisting largely on insects mostly Grass hoppers,small lizards,frog,worms,weed seeds.This bird may be regarded as beneficial to the farmers.

The “Paradies Flycatchers” form a group of birds feeding manly on injurious insects .This is migratory bird which appears during the month of June and leaves at the endof january . Majority of this bird seem to migrate in summer.Paradies Flycatchers feed on small beetles,flies,bugs,ants and spiders.It is, therefore, a useful bird to the agriculturists.

Discussion

Although these birds are significant in forest ecosystem but their survival and existence is highly threatened in Betul today due to human impact on their habitat. Nesting trees are logged or cavities of nest holes removed as a part of forest operation poaching and capturing activity hits the population in many tribal areas of Betul district.Literate person of the area set up a group to help birds they are trying to teach villagers ,how to build and renovate the nests.Wild life conservation act is implimented by the government but it is the duty of a person to initiate the protection.Only two to three bird sanctuaries are working well in whole MadhyaPradesh state. It is necessary to establish more and more sanctuaries.Many

birds were indiscriminatly shot on their migration.Man has always treasured the bright plumage of many birds and uses these feathers in their customs, but now a days after knowing the facts many tribal persons have stopped this type of practices.Many school and college going students have given projects on conservation of these birds within the area, they usually visit to their surrounding villages .They are teaching the villagers,and collecting the data regarding population of the almost all the birds including rare birds.

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SN.	Name of the Bird	Name of the family
1.	Painted Stork (*Ibis leucocephalus*)	Ciconiidae
2.	White Stork (*Ciconia ciconia*) (Migratory)	
3.	Grey Heron (*Ardea cinerea*)	Ardeidae
4.	White-rumped vulture (*Gyps Bengalensis*)	Accipitridae
5.	Common Coot (*Fulica atra*)	Rallidae
6	Spotted Dove (*Streptopelia chinensis*)	Columbidae
7.	Alexender Parackette (*Psittacula euptria*)	Psittacidae
8	Rose king parakette	
9.	PiedCockoo(*Clamator jacobinus*)	cuculidae
10	Pied King fisher(*ceryle rudis*)	Alcedenidae
11.	Common king fisher (*Alcedo atthis*)	
12.	White throated king fisher(*Halcyon smyrnensis*)	
13.	Indian Roller (*Coracias benghalensis*)	Coraciidae
14.	Hoopoe (*Upupa cpops*)	Upupidae
15	Indian Pied Horn bill (*Anthracocrvose albirastris*)	Bucerotidae
16.	Red Vertted Bulbul (*Pycnonotus cafer*)	Pycnonidae
17.	Black Drongo(*Dicrurus macrocercus*)	Dicruridae
18	Ashy minivet (*Pericrocotus divaricatus*)	Camphaphagidae
19.	Black Hooded Oriole (*Oriolus xanthornus*)	Oriolidae
20.	House crow (*Carvus splendens*)	Corvidae
21.	large billed crow (*Carvus macrorhynchos*)	
22	JungleBabbler(*Turdoides terricolor*)	Timallidae
22.	Orange necked Thrush (rare)	Turdidae
23.	Paradies Flycatcher (Rare Meghalaya)	Muscicapida
24	Forest Wagtail (Rare	Motacillidae
25.	Rubycheked sunbird	Nectariniidae
26.	Purple Sun bird	
27.	Purple Rumped Sun bird	
28.	House Sparrow (*Passer domesticus*)	Ploceidae

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A Study of Ground Water quality of Hand pumps situated in the vicinity of Slaughter houses at Aligarh U.P. (India)

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Abstract

A study has been made to assess the water quality of ground water of hand pumps situated around the slaughter houses in respect of physico-chemical characteristics . Samples were collected within the range of 500 meter from the Makhdoomnagar slaughter house situated at Mathura bye pass road, Aligarh and 1km from slaughter house named as M\s- Hind agro industries ltd., situate towards Anupshahar road, Aligarh. There are two main slaughter houses out of which one is functioning in open area near Makhdoom nagar and other M/s Hind agro industries. Samples were collected from the hand pumps situated around slaughter houses and results of these collected samples revealed that water quality of ground water has been contaminated in most of the hand pumps situated near the slaughter houses in respect of physico- chemical characterisitics like colour, pH, conductivity, dissolved solids, hardness, chloride, DO, and BOD. Hence, in the vicinity of these slaguther houses lot of pungent, untolerable, bad odour affects the area up to approximately 5km.

Key Words: *Conductivity, TDS, DO, BOD and Hardness*

Introduction

Aligarh city is famous for the lock making industries, door fittings and Aligarh Muslim University. A Mathura bye pass road from Sarsol links to Aligrah Mathura road and a road from Aligarh to Anupshahar goes to Moradabad via Dibai and Narora Atomic Power Plant (NAPP). Aligarh city has mainly two types of communities i.e. Hindus and Muslims having population more than 8 lacs. There is no water supply from surface water sources. So, majority of people use ground water through hand pumps and submersible. In the new developed housing colonies public water distribution system is yet to be laid and hence the residents solely depend upon ground water. The city is yet unsewered. No scientific study of ground water quality has been carried out so far.

A study was conducted to assess the water quality of ground water of hand pumps situated in vicinity of stored effluents of slaughter houses in low lying areas. There are two main slaughter houses out of which one is functioning in open area near Makhdoom nagar situated Mathura bye pass road and other named as M/s- Hind agro industries situated near Central Dairy Farm (CDF) complex about 1 km away from Aligarh- Anup shahar road. In these slaughter houses approximately 2-5 thousand animals are slauhtered daily and their effluents and wastes reach in low lying areas/fields. Although M/s Hind agro industries has well mechanized closed system and established ETP to treat effluent of their industries but due to malfunctioning of ETP and bye pass drainage of effluents generates a bad smell. On the other hand, slaughter house situated near Makhdoom nagar has no mechanized closed system and ETP which creates a lot of pungent, untolerable, bad smell and affects inhabitants badly. Three samples were taken from the hand pumps situated within the range of approximately 500 metre from Makhdoom nagar and four sample from the hand pump situated within the range of about 1 km from m/s Hind agro industries.Number of workers have conducted their studies on water quality of surface and ground water in terms of physico-chemical characteristics (Singh *et al.*, 1988-89,1991,1993 and 1994); Soren and Julian, 1977; Mowli and Seshaian, Pande *et al.*, 1979). As far as it is reviewed that no such type of study has been made to assess the water quality of ground water of hand pumps situated near the slaughter houses. Therefore it is

proposed to carry out investigations on water quality of hand pumps in respect of physico- chemical characteristics.

Materials and methods

The ground water samples were collected in a neat and clean two liter capacity white plastic Jericanes for general parameters and samples for DO were taken in 300 ml capacity borosil glass bottles and DO was fixed by using $MnSO_4$ and alkaline azide reagents.Methods of analysis, sampling and preservation of samples were adopted as per standard methods of APHA (1985); Trivedi and Goel,(1984); and Kotiah and Kumaraswamy, (1994).

All the chemicals, reagents, and glasswares were used of A.R. grade and glasswares of borosil make. Instruments related parameters were used of best company make. Parameters studied were colour, odour, pH, conductivity, dissolved solids, DO, BOD, total hardness, Ca/Mg hardness and chloride.

Sampling sites were selected as per following points and map.

1. Hand pump situated just adjacent to Makhdoom nagar slaughter house, Mathura bye pass road, Aligarh. This sampling point is denoted as - (A).
2. Hand pump situated at adout 100 metre away from Makhdoom nagar slaughter house, Mathura bye pass road, Aligarh.This sampling point is denoted as -(B).
3. Hand pump situated at about 250 metre away towards Talaspur Khurd village from Makhdoom nagar slaughter house, Mathura bye pass road, Aligarh. This sampling point is denoted as -(C).
4. Hand pump situated in the premises of Central Dairy Farm (CDF) at approximately 200 metre away from M/s Hind agro industries, Anupshahar-road, Aligrah. This sampling point is denoted as -(D).
5. Hand pump situated near police check post at approximately 500 metre away from M/s. Hind agro industries, Anupshahar-road, Aligarh. This sampling point is denoted as-(E).
6. Hand pump situated on road at Chherat approximately 1 km away from M/s Hind agro industries, Anupshahar road, Aligarh. This sampling point is denoted as -(F).
7. Hand pump situated on road of Jamalpur bye pass tiraha near Manjoorgarhi approximately 1km away from m/s Hind agro industries, Anupshahar- road, Aligarh. This sampling point is denoted as -(G).

All these hand pumps have been installed approximately 30-40 feet deep.

Results and Discussion

Results of ground water quality of hand pumps are given in Table-1 with respect to colour, odour, pH, conductivity, Total Dissolved Solids (TDS). DO, BOD, Total hardness, Ca/Mg hardness nd chloride. To compare these charateristics in respect of ground water quality for drinking purposes, prescribed standard limits of BIS-1991and CPCB-1997 are given in Table-2.As it is evident from the Table-1 that colour noted was straw, light straw, reddish, at sampling points A,B,D,E respectively and unpleasant odour at sampling point A,B,D while at other sampling points colour and odour found normal. The values of the parameters pH, conductivity, TDS, DO, BOD, Hardness and chloride ranged from 7.3-9.3, 0.803-1.96 mmhos/cm, 1107-2209 mg/1, 2.1-6.7mg/1, 0.9-3.8 mg/1, 295-674 mg/1, 177-387 mg/1,114-287mg/1 and 86-312 mg/1 respectively (Table-2) within the range of study areas. The values of total dissolved solids were found beyond prescibed standards 500 mg/1(Table-2)at all sampling points while the values of pH, Conductivity , BOD, chloride and hardness were observed higher than prescribed standard (BIS,1991and CPCB,1997) at sampling points (A,D,and E); (A,B,D and E); (A); (A,C and E) and (A,B,C,D,E and G,) respectively where as level of Dissolved Oxygen was observed below the standard limit of drinking purposes at all sampling point except

sampling point-G. Minimum DO (2.1)mg/1 and maximum values of Biochemical Oxygen Demand (3.8 mg/1); pH(9.3); conductivity (1.96 µmhos/cm); TDS (2209mg/1); Total hardness (674mg/1), calcium hardness (387 mg/1),magnesium hardness (287 mg/1)and chloride (312 mg/1), at sampling - A indicates that ground water quality is most polluted which may be due to percolation of stored effluents of slaughter house in low lying areas/fields. The hand pump(samping -A)is situated adjacent to slaughter house. The values of these characteristics decreases as distances of hand pumps increases from the main sources of effluents of slaughter house. Ground water quality of hand pump (sampling -D) installed within the premises of M/s-Central Dairy Farm complex is not fit for drinking puroposes in respect of pH, conductivity,TDS,DO,Total hardness calcium hardness , magnesium hardness while ground water quality of sampling point-C,F and Cr is some what better as compared to other points on respect of pH, colour, odour, conductivity, DO and BOD. The values of pH of ground water samples are found alkaline in nature at all sampling points.

Presences of BOD almost at all sampling points reveals that the ground water quality upto some extent is being contaminated due to precolation of most polluted stored effluents of slaughter houses which may caues different kinds of diseases to human beings on drinking such contaminated water. Therefore , it is the duty of the concerned authorities to take necessary measures to control further contamination of ground water by such type of water polluting industries.

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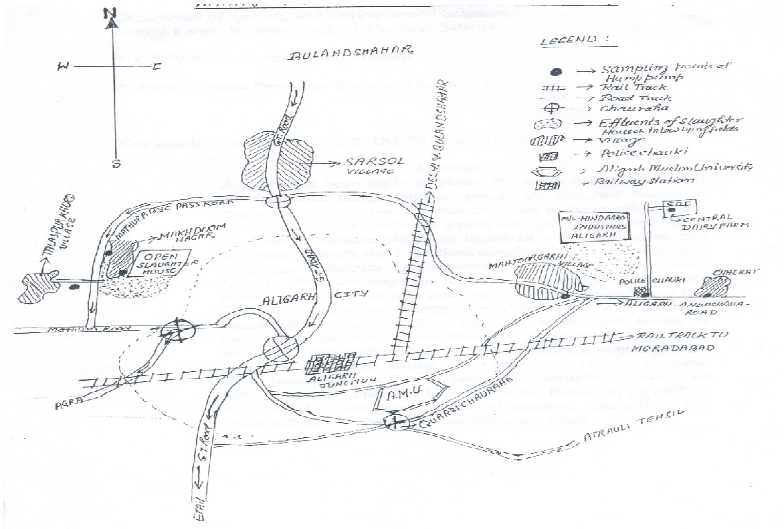
Table 1: Results of Physico-chemical characteristics of ground water quality of hand pumps situated in the vicinity of slaughter houses at Aligarh (U.P.)

S. No.	Sampling point	Date of Sample Collection	Analysed parameters										
			Colour	Odour	pH	Conductivity (Mmhos/cm)	TDS (mg/l)	DO (mg/l)	BOD (mg/l)	Total hardness (mg/l)	Ca-hardness (mg/l)	Mg-hardness (mg/l)	Chloride (mg/l)
1.	A	5/06/05	Straw	Unpleasant	9.3	1.96	2209	2.1	3.8	674	387	287	312
2.	B	5/06/05	Light Straw	Unpleasant	7.7	1.33	1874	3.2	1.8	480	290	190	228
3.	C	5/06/05	Colourless	No-Specific	7.4	0.819	1640	4.3	1.5	329	215	114	276
4.	D	5/06/05	Redish	Unpleasant	8.7	1.93	2166	4.1	1.4	380	258	122	109
5.	E	5/06/05	Light Straw	No-Specific	8.6	1.88	1832	4.8	1.6	366	184	182	256
6.	F	5/06/05	Colourless	No-Specific	7.7	0.812	1422	5.9	1.2	295	177	118	86
7.	G	5/06/05	Colourless	No-Specific	7.3	0.803	1107	6.7	0.9	336	197	139	94

Table 2: Drinking water quality standard- BIS (Bureau of Indian Standard)- IS:10500-1991 Manual for Water Testing Kit : 1997-CPCB

S. No.	Characteristics	Standard
1.	Colour	Colour
2.	Odour	Unobjectionable
3.	pH	6.5 - 8.5
4.	Conductivity (mmhos/ cm)	1
5.	TDS (mg/l)	500
6.	DO (mg/l)	>6
7.	BOD (mg/l)	2
8.	Total hardness (mg/l)	300
9.	Ca-hardness (mg/l)	200
10	Mg-hardness (mg/l)	100
11	Chloride (mg/l)	250

Figure 1: Map Showing situation of Sampling sites in the vicinity of slaugter house at Aligarh



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Biomonitoring and interspecies comparison of metal precipitation through bryophytes at petrol pumps on Kumaon hill.

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Abstract

The number of pollution sources raises heavy metal contamination of the environment and become increasingly higher in Kumaon hill. This problem particularly manifests itself around the petrol pump. The objective of our investigation was to measure the pollution load of Pb, Zn, Cu and Cd in near by area of Kumaon hill. Keeping this in mind present investigation was undertaken to study the adverse effect of intensity of these metal load on the ecology and human population in near by area of respective study site. Moss sample were collected from pure and undisturbed habitat in Mukteswar and were transplanted on four petrol pumps and one control site Analysis of harvested transplants shows a significant seasonal increase in the metal in moss, which could be due to automobile exhaust and petroleum product consumption.

Key Words: *Biomonitoring, Metal, interspecies comparison, Petrol pump, Ecology.*

Introduction

The significance of heavy metal deposition in different cryptogam at petrol pump can be looked from different viewpoint. Because their potential to bioaccumulate heavy metal from respective source varies from species to species and also their contribution in environmental pollution rescue is increasing. Due to no other source of transport, dangerously petroleum consumption and automobile exhaust are the major source to put pollution load on the atmospheric condition in the near by area of petrol pumps (Krishnayya & Bedi 1986; Huang *et al.* 1994; Xuolong *et al.* 1994; Saxena *et al.* 2000a).

Monitoring of air contaminant at petrol pumps is necessary to determine upon locality of the near by population. Bryophytes have a long history to use as biological indicators of air quality. High deposition of heavy metal through dry deposition is a specific biology of cryptogams in biomonitoring studies (Saxena *et al.* 2000; Ruhling *et al.* 1987; Ferguson *et al.* 1984).Despite the large number of publication dealing with interaction of cryptogam with heavy metal (Nash 1989; Meenk and Tuba 1992; Saxena and Saxena 1998, 2000, 2001), detail knowledge on environmental condition of the petrol pump of Kumaon hill is in need of more attention.

Indirect or transplant bag method is best-suited technique to study the atmospheric condition (i.e. heavy metal) of petrol pumps (Saxena *et al.* 2000, Kirchoff and Rudolph 1989). The main objective of present work was to gain understanding of the metal accumulation potential of three different experimental species i.e. *Racomitrium crispulum*, *Bryum cellulare* and *Plagiochasma appendiculatum* and pollution load at different petrol pumps of Kumaon hill.

Materials and methods

The area of our investigation is located on the Western Himalaya i.e. Kumaon hill. Catchment areas are the four petrol pumps of Almora, Nainital, Ranikhet and Pithoragarh of Kumaon hill. The moss species

Racomitrium crispulum, Plagiochasma appendiculatum, Bryum cellulare was applied in our investigation. The seasonal and annual transplantation were started in year 2003 with the start of winter season (i.e. in the month of November). Seasonal transplantation was carried out for the fixed period of four months (i.e. 120 days, which represents the exposure of only one season and there is no intermittent mixing of seasonal harvesting of transplant). Sampling and transplantation were carried out by the method of Saxena and Saxena (2000). The catchment site of same height were chosen, to avoid the misleading of data. Samples were digested and analyzed using HNO_3 and $HClO_4$ (4:1 V/V) analysis by atomic absorption spectrophotometer (Model no. E 4139) by following the method of Bengston (1982).

The percent heavy metal loading of each location in proportion to control were calculated using the formula of Tuba and Csintalan (1993). Grodzinska *et al.* (1993) put forwarded the formula for PI (Pollution Index) value, on the basis of each metal, total number of metals, total amount of metals and number of sampling stations. The analysis of experimental heavy metal (i.e. Pb, Zn, Cu and Cd) for every study area were carried out in triplicate and data were presented with ± S.E. Significance (*) differs from control site (Pd" 0.05).

Results

Table 1, 2 and 3 shows the result of metal analysis of three different species i.e. *Plagiochasma appendiculatum*, *Bryum cellulare* and *Racomitrium crispulum* harvested periodically after a fixed period of exposure in Kumaon hill. Experimental site i.e. petrol pumps of Almora, Nainital, Ranikhet and Pithoragarh, are highly populated area of Kumaon hill. Data obtained after every seasonal exposure transplant shows comparative variability in seasonal deposition as well as in interspecies variation in metal accumulation. There is a high accumulation of lead observed i.e. 211 ppm in winter exposure in both bryophyte *Plagiochasma appendiculatum* and *Racomitrium crispulum* in Nainital. *Racomitrium crispulum* shows a significant high value of Cu i.e 142 ppm in Nainital under comparative study with *Bryum cellulare* and *Plagiochasma appendiculatum* in winter season. There is no such significant variability in the Cd content in any of the catchment area of the Kumaon hill and same is observed in all the experimental species.

Summer is the season for the higher vehicular input in the tourist place i.e. in the present experimental sites. A significant high value of Pb were observed in summer in *Plagiochasma appendiculatum* (335.84 ppm) in Nainital, while the highly populated area of Kumaon hill i.e. Almora shows maximum value of Pb input, which were observed in all the three experimental cryptogams. There is no such significant difference in Cd content all the three seasons; while it is striking that rain exposed experimental bryophytes transplant impart Cd in non-detectable limit. There is a positive correlation between metal accumulation and vehicular input in the catchment site (data not shown).

Significant variability in the metal content of annual transplant and summation of seasonal transplant, treated as annual fall out data was observed only in the transplant of *Plagiochasma appendiculatum* (Table- 4, 5, 6).

Undertaken metals i.e. Pb, Zn, Cu and Cd accumulation are the index of vehicular pollution and were useful to indices the vehicular input, in particular area. Percent metal loading at each location signifies that the study area is highly loaded with experimental metal. While the inter species comparison implicit

that *Racomitrium crispulum* is much better accumulator than *Bryum cellular* and *Plagiochasma appendiculatum* respectively. It is in doubt that the undertaken control site Mukteswar forest is free from metal load and need more attention in further studies. The site Almora which were observed to be highly loaded with metal is justifiable through % loading value (Fig- 1, 2, 3).

The percent decrease in the metal content in winter season with respect to summer in *indirect* biomonitoring study, through experimental bryophytes imparts that Cu and Cd value decrease up to the range of 80-90 %. While there is no such significant difference in metal concentration observed in case of Pb and Zn in all the three species of bryophytes in winter with respect to summer (Fig- 5). There is an up to 100 % decrease in Cd were observed in rainy season under comparative study with summer (Fig- 6). We can not over rule the role of rain in pollutant leaching. Same could be the reason for decrease in Pb, Zn and Cu value up to 70-80 % in rainy season in all the three experimental cryptogams.

There is a statistically significant correlation found between metal accumulation, an increment in their source type and intensity of source with respect to PI (pollution index) value. The PI value were observed highly positive at Almora i.e. + 4.965 in *Bryum cellulare* signifies that the pollutant intensity among other petrol pump catchment area, while the site of Pithoragarh petrol pump shows negative value – 2.4406, -2.48094, -1.60022 in *Racomitrium crispulum, Plagiochasma appendiculatum, Bryum cellulare* respectively (Fig- 4).

Discussion

We have seen that the study and comparison of the moss transplant of petrol pumps of different site in Kumaon hills give more authentic picture of atmospheric surrounding of petrol pumps and near by areas. The experimental data of seasonal and annual exposure demonstrate that all the three experimental bryophytes have positive potential to accumulate and retain heavy metal pollutant of petrol pumps. However, there efficiencies vary from species to species.

Present study also demonstrate that seasonal transplant of moss bag technique for liverwort is more reliable than annual transplant one. Chlorosis, thallus degradation, ageing, and low surface area by mass ratio could be the reason for lower metal input value in annual transplant of *Plagiochasma appendiculatum*. Ranikhet is relatively clean site as compared to Almora and Nainital, though that the catchment area is in the heart of the city. This further supported by lower % metal loading.

Cu industry in Kumaon region is also a probable additional reason for high metal input value in Almora. Kerosene mixing is also one of the addition facts for increment in Cu in the petrol pump transplants, as $CuSO_4$ is mixed as an impurity in kerosene. Perhaps Cd is also present as a mining impurity in petrol. High input of these two metals (i.e. Cu and Cd) in summer season in all the three experimental bryophytes were reasonable.

The relative cleanness of control site i.e. Mukteswar is over ruled by the metal concentration observed in respective transplant in all the three bryophytes. Though their concentration is low and comparable with the other study areas. Increment in the use of Cu, Zn and Cd fertilizers could be the reason for this high value of metal in Mukteswar. Percent loading value of Nainital and Almora signifies that there is an abrupt increment of consumption of diesel and petrol. This is a matter of serious concern, as the ecosystem flora may not be able to bear the burden of increasing metal level and other pollutant, released on the consumption of petrol and diesel.

Genetic constituent may be assumed to have considerable significance in respect to heavy metal uptake and excretion. The different uptake capacity of heavy metal and retention / excretion by interspecies survey shows variability (Ruhling *et al.* 1987; Ross 1990; Birg *et al.* 1995). This need further harmonization and research in Kumaon region. Research is in continuation by present authors in the survey area of Kumaon hill. Accumulation of heavy metal especially lead through various cryptogams is well known study and several authors described the moss capability to accumulate vehicular pollution (Ruhling and Tyler, 1968; Onianwa and Eunyomi, 1983; Ferguson *et al.* 1984; Makinen 1987; Ross, 1990; Steinnes *et al.* 1994; Saxena 1995).

High Pb value i.e. 600 - 800 mg / L in petrol is a direct evidence of their high concentration in bryophyte transplanted at petrol pumps. Study has also confirmed that the relationship between the environmental quality and metal accumulation in bryophytes. Present investigation confirms that *Bryum cellulare* had a lower potential to monitor the metal, while *Racomitrium crispulum* has the maximum capability to absorb the vehicular pollution on petrol pumps and might be due to this they maintained their physiology throughout the year of transplantation. This was confirmed by the non-significant difference in annual transplant metal data and summation of the seasonal transplant metal data which were treated as annual precipitation data.Seasonal and annual transplantation data of *Plagiochasma appendiculatum* further recommends that biomonitoring by liverworts is better through seasonal way.

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Table 1: Seasonal variation in metal precipitation in winter, summer and rain in year 2003-04 in moss *Plagiochasma appendiculaum*. Each value is mean of 3 replicates ± S.E. Significance (*) differs from control (Pd"0.05).

SITE No.	CATCHMENT AREA	WINTER EXPOSURE				SUMMER EXPOSURE				RAIN EXPOSURE			
		Pb	Zn	Cu	Cd	Pb	Zn	Cu	Cd	Pb	Zn	Cu	Cd
1	MUKTESWAR FOREST	32.42±0.12	3.15±0.02	22.4±0.15	1.124±0.21	41.25±0.24	10.49±0.6	40.3±0.54	6.32±0.22	41.5±0.14	93.95±0.65	8.59±0.25	2.66±0.01
2	ALMORA	318.5*±0.24	25.2*±0.05	46.93*±0.3	0.62*±0.05	298.4*±3.5	173.2*±5.6	50.33*±0.6	1.9*±0.05	33.9*±0.3	18.1*±0.42	41.6*±0.3	ND
3	RANIKHET	42.04*±0.52	42.1*±0.32	62.1*±0.56	1.3*±0.2	54.9*±1.25	56.6*±0.98	83.4*±1.25	2.2*±0.05	37.7*±0.1	36.8*±0.25	47.6*±0.5	ND
4	NAINITAL	211.05*±0.3	59.07*±0.2	44.2*±0.58	2.42*±0.2	335.4*±7.5	60.93*±0.8	69.72*±1.0	3.6*±0.09	33.9*±0.2	14.2*±0.84	32.0*±0.2	1.9*±0.05
5	PITHORAGARH	47.3*±0.35	62.1*±0.5	26.3*±0.25	0.12*±0.02	57.2*±0.22	72.1*±0.65	32.4*±0.36	0.3*±0.01	52.8*±0.5	ND	25.5*±0.9	ND

Table 2: Seasonal variation in metal precipitation in winter, summer and rain in year 2003-04 in moss *Bryum cellulare*. Each value is mean of 3 replicates ± S.E. Significance (*) differs from control (Pd" 0.05).

SITE No.	CATCHMENT AREA	WINTER EXPOSURE				SUMMER EXPOSURE				RAIN EXPOSURE			
		Pb	Zn	Cu	Cd	Pb	Zn	Cu	Cd	Pb	Zn	Cu	Cd
1	MUKTESWAR FOREST	32.42±0.12	3.15±0.02	22.4±0.15	1.124±0.21	41.25±0.24	10.49±0.6	40.3±0.54	6.32±0.22	41.5±0.14	93.95±0.65	8.59±0.25	2.66±0.01
2	ALMORA	318.5*±0.24	25.2*±0.05	46.93*±0.3	0.62*±0.05	298.4*±3.5	173.2*±5.6	50.33*±0.6	1.9*±0.05	33.9*±0.3	18.1*±0.42	41.6*±0.3	ND
3	RANIKHET	42.04*±0.52	42.1*±0.32	62.1*±0.56	1.3*±0.2	54.9*±1.25	56.6*±0.98	83.4*±1.25	2.2*±0.05	37.7*±0.1	36.8*±0.25	47.6*±0.5	ND
4	NAINITAL	211.05*±0.3	59.07*±0.2	44.2*±0.58	2.42*±0.2	335.4*±7.5	60.93*±0.8	69.72*±1.0	3.6*±0.09	33.9*±0.2	14.2*±0.84	32.0*±0.2	1.9*±0.05
5	PITHORAGARH	47.3*±0.35	62.1*±0.5	26.3*±0.25	0.12*±0.02	57.2*±0.22	72.1*±0.65	32.4*±0.36	0.3*±0.01	52.8*±0.5	ND	25.5*±0.9	ND

Table 3: Seasonal variation in metal precipitation in winter, summer and rain in year 2003-04 in moss *Racomitrium crispulum*. Each value is mean of 3 replicates ± S.E. Significance (*) differs from control (Pd" 0.05).

SITE No.	CATCHMENT AREA	WINTER EXPOSURE				SUMMER EXPOSURE				RAIN EXPOSURE			
		Pb	Zn	Cu	Cd	Pb	Zn	Cu	Cd	Pb	Zn	Cu	Cd
1	MUKTESWAR FOREST	35.42±0.21	3.15±0.03	23.65±0.25	0.321±0.54	61.25±0.15	6.49±0.28	32.65±0.24	0.40±0.02	39.62±0.2	ND	9.12±0.24	ND
2	ALMORA	318.5*±9.25	342*±8.645	5.43*±0.55	2.57*±0.05	224.4*±5.3	173.2*±0.5	59.46*±0.4	3.6*±0.32	35.8*±0.1	8.79*±0.24	50.81*±0.5	ND
3	RANIKHET	46.32*±0.55	43.16*±4.5	69.3*±0.13	1.06*±0.05	53.4*±0.65	53.26*±0.9	88.9*±0.54	1.9*±0.05	35.8*±0.5	ND	42.73*±0.6	ND
4	NAINITAL	22.10*±0.54	59.07*±0.5	63.48*±9.5	0.3*±0.004	33.54*±2.2	68.93*±0.9	84.74*±0.4	4.7*±0.14	14.6*±0.5	32.9*±0.33	52.74*±0.5	1.25±0.66
5	PITHORAGARH	42.64*±0.41	60.26*±0.2	20.4*±0.24	0.25*±0.06	57.7*±0.24	78.2*±0.84	25.46*±1.5	0.92*±0.2	43.3*±1.5	ND	18.5*±0.5	ND

Table 4: Variation in metal precipitation value in annual transplant and summation value of three seasons in year 2003-04 in moss *Plagiochasma appendiculaum*. Each value is mean of 3 replicates ± S.E. Significance (*) differs from control (Pd" 0.05).

SITE No.	CATCHMENT AREA	SUMMETION OF SEASONAL TRANSPLANT DATA TREATED AS ANNUAL PRECIPITATION				ANNUAL EXPOSURE OF MOSS BAGS METAL DATA			
		Pb	Zn	Cu	Cd	Pb	Zn	Cu	Cd
1	MUKTESWAR FOREST	115.17±0.2	107.59±1.22	71.29±2.33	10.11±1.25	95.17±0.65	79.61±3.25	52.64±2.65	7.11±0.32
2	ALMORA	650.86*±9.6	216.62*±6.42	138.95*±1.35	2.58*±0.35	425.01*±8.32	198.6*±4.2	99.64*±4.65	3.58*±0.63
3	RANIKHET	134.67*±2.3	135.51*±2.35	193.18*±5.65	3.5*±0.33	101.94*±4.35	100.2*±2.3	159.67*±2.65	2.7*±0.36
4	NAINITAL	580.49*±5.6	134.29*±2.35	145.97*±3.65	7.96*±0.62	420.16*±5.65	98.64*±2.2	111.94*±6.35	6.46*±0.55
5	PITHORAGARH	157.33*±1.2	134.2*±1.65	84.23*±4.25	0.44*±0.03	133.21*±4.94	98.66*±3.2	89.64*±5.656	0.39*±0.05

Table 5: Variation in metal precipitation value in annual transplant and summation value of three seasons in year 2003-04 in moss *Bryum cellulare* Each value is mean of 3 replicates ± S.E. Significance (*) differs from control (Pd" 0.05).

SITE No.	CATCHMENT AREA	SUMMETION OF SEASONAL TRANSPLANT DATA TREATED AS ANNUAL PRECIPITATION				ANNUAL EXPOSURE OF MOSS BAGS METAL DATA			
		Pb	Zn	Cu	Cd	Pb	Zn	Cu	Cd
1	MUKTESWAR FOREST	136.29±0.3	9.64±0.34	65.43±0.74	0.72±0.33	131.24±0.1	8.94±0.32	62.23±0.233	0.7*±0.001
2	ALMORA	578.74*±0.3	524.08*±0.5	115.71*±0.51	6.171*±0.35	572.24*±5.25	520.7*±0.2	111.11*±2.33	5.24*±0.04
3	RANIKHET	135.57*±0.5	96.42*±0.51	200.93*±0.69	2.96*±0.098	130.52*±3.25	95.02*±0.6	193.54*±4.22	2.96*±0.3
4	NAINITAL	70.25*±0.5	160.90*±0.73	200.98*±0.54	6.25*±0.25	69.25*±2.54	158.9*±0.3	192.98*±0.35	6.75*±0.32
5	PITHORAGARH	143.74*±0.7	138.46*±0.54	64.36*±0.254	1.17*±0.5	139.74*±0.65	135.4*±0.6	59.37*±0.35	1.34*±0.03

Table 6: Variation in metal precipitation value in annual transplant and summation value of three seasons in year 2003-04 in moss *Racomitrium crispulum*. Each value is mean of 3 replicates ± S.E. Significance (*) differs from control (Pd" 0.05).

SITE No.	CATCHMENT AREA	SUMMETION OF SEASONAL TRANSPLANT DATA TREATED AS ANNUAL PRECIPITATION				ANNUAL EXPOSURE OF MOSS BAGS METAL DATA			
		Pb	Zn	Cu	Cd	Pb	Zn	Cu	Cd
1	MUKTESWAR FOREST	128.17±0.3	17.48±2.65	75.10±2.34	0.68±0.02	124.47±0.21	14.48±4.35	73.17±1.22	1.25±0.02
2	ALMORA	760.29*±8.6	537.37*±6.35	153.12*±0.25	0.32*±0.02	755.79*±9.66	529.7*±2.3	150.12*±0.5	1.49*±0.05
3	RANIKHET	133.54*±3.2	102.27*±4.35	225.46*±0.55	2.3*±0.23	125.44*±0.55	99.27*±5.3	220.46*±2.35	2.3*±0.05
4	NAINITAL	500.49*±7.6	138.48*±2.325	327.00*±6.35	7.17*±0.35	489.47*±4.2	135.4*±0.5	320.4*±0.512	7.07*±0.04
5	PITHORAGARH	109.23*±4.2	159.29*±2.35	74.80*±2.1	0.9*±0.025	100.24*±2.32	149.7*±0.5	77.80*±4.5	0.9*±0.03

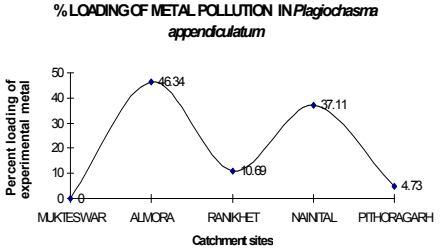

Fig 1: Percent metal loading in Plagiochasma appendiculaum in the experimental catchment area of Kumaon Hill in year 2003-04.

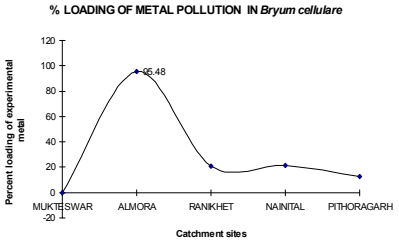

Fig 2: Percent metal loading in *Bryum cellulare* Hook. in the experimental catchment area of Kumaon Hill in year 2003-04

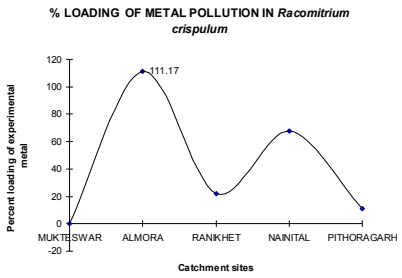

Fig 3: Percent metal loading in *Racomitrium crispulum* in the experimental catchment area of Kumaon Hill in year 2003-04

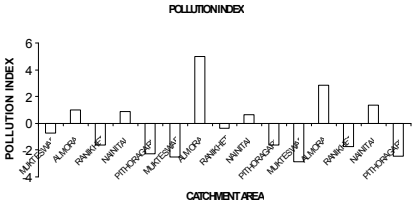

Fig 4: Pollution index value by undertaken bryophytes in the experimental catchment area in year 2003-04

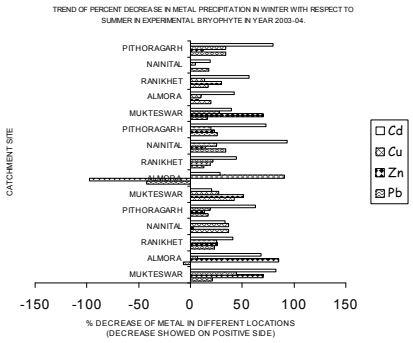

Fig 5: Trend of percent decrease in metal recipitation in winter with respect to summer in experimental catchment areas in experimental bryophytes in year 2003-04.

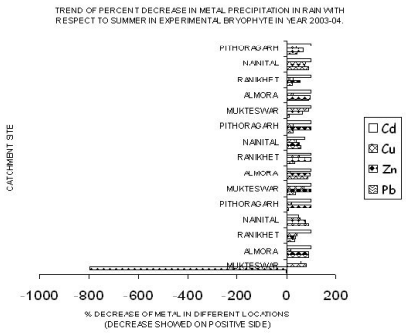

Fig 6: Trend of percent decrease in metal precipitation in rain with respect to summer in experimental catchment areas in experimental bryophytes in year 2003-04

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Study of Water quality of River Suswa Near Raiwala, Uttaranchal

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Abstract

The present study was performed to estimate the quality of Suswa river at Raiwala. Test for both, physico-chemical and heavy metals were carried out at different sites of the Suswa river near Raiwala.

Key words *: Suswa, Pollution, Physi co-chemical, status, water quality*

Introduction

Suswa is spring fed river confluencing into the river Ganga. The water of the river Suswa is used by the people mainly to meet their daily water requirements. Raiwala is situated at the right bank of this river. The population of Raiwala is approximately 60,000 to 70,000. Recently, few hotels & recreational centers have been set up at Raiwala, just near the river bank. A few meat shop are also situated in Raiwala. The city garbage and the leftout wastes from these meat shops, hotels, restaurants and shopping complexes find their way into the river along with the domestic sewage without any prior treatment. Therefore, the quality of Suswa water gets affected, which needs a continuous monitoring to assess the impact of all the above stated activities. This assessment is a necessary step for sustaining the ecology of the Suswa river. Various scientists have investigated the quality of water of different rivers in this region. But, no such study has been conducted solubility far to assess the water quality of Suswa river. The present paper is an attempt to present the finding of the recent investigation carried out between 2003 and 2004. The may serve as a data base for future investigations. There different sites were selected on the basis of assesibility, uniformity of concentration & well mixed zone. The selected side are as below-

1- Site A-	5 Kms. upstream from Raiwala town.
2- Site B-	Near Raiwala town
3- Site C-	5 Kms. downstream from Raiwala town.

Materials and Methods

The physico-chemical parameters and heavy metals (Cu, Pb, Cr, and Zn) were estimated by the following the standard methods of APHA (1989) and Trivedy and Goel (1984). The samples from all the three sites were collected on monthly basis, at the same date and time. The test for heavy metals were performed by the atomic absorption spectroscopy method using AA S .

Result

The heavy metals and physico-chemical parameters are represented in Figure.1and Figure.2a-2f . In the Suswa river at Raiwala, a difference in the fluctuation of water temperature was maximum ($23.65^0C \pm 3.44$) observed at sampling site-B and minimum ($22.65^0C \pm 4.12$) at site-C. The water temperature showed an upward trend from winter season to summer season followed by a downward trend from monsoon season

onwards. A more or less similar trend has been observed in the river Yamuna by Chakrabarty *et al*. (1959). The fluctuation of temperature was well within the limit for survival of fishes. Similar types of fluctuations were reported by Dwivedi *et al.* (1995) in two ponds at Patna.The temperature showed negative relationship with the dissolved oxygen almost throughout the study as also reported by Das and Srivastava (1956a), Dobriyal (1985), Khanna *et al.* (1993) and Chugh (2000). Maximum average dissolved oxygen was recorded (8.74 mg/l ± 0.24) at sampling site- B and minimum (8.01 mg/l ± 0.46) at site-C. The dissolved oxygen reduced gradually from summer to monsoon season due to turbidity, which retarded the photosynthetic activity of aquatic flora.This trend was also reported by Singh *et al.* (1982) in the river Brahamputra of Guwahati. Again the dissolved oxygen increases from monsoon to winter season it was due to the activity of plankton in water, which are found more active when temperature was not too high. Similar trend was also reported by Badola and Singh (1981) in the river Alaknanda, Khanna (1993) in the river Ganga, and Chugh (2000) in river Ganga. It has been recommended that a minimum of 4 mg/l of dissolved oxygen should be maintained in water for healthy growth of fish and other microbial population. Highest values of dissolved oxygen were recorded in river Cauvery by Somashekar *et al*. (1984), and in river Kosi by Bhatt *et al.* (1984).The maximum average velocity was recorded (0.39 m/s ±0.05) at sampling site- B and minimum (0.31 m/s ± 0.02)at sampling site - A . The velocity started increasing after winter season and beyond monsoon season, the velocity started decreasing in winter. In the present study it has been observed that the velocity and the total solids showed positive relationship. Most of Indian rivers showed a similar tendency with respect to fluctuations of total solids (Kudesia and Verma, 1985). The maximum average total solids were noted (907.12 mg/l ± 255.1) at sampling site-C and minimum (745.10 mg/l ± 3.14) at site- A. The total solids were recorded minimum in winter due to gradual sedimentation of the filterable residue, at the bottom and also due to the minimum velocity of the river, which favored effective sedimentation. The total solids were maximum in monsoon season due to increased velocity, which favored soil-erosion. Similar condition was also reported by David (1956) in Bhadra river. The BOD (Biochemical oxygen demand) was observed maximum (0.81 mg/l ± 0.04)at sampling site-B and minimum (0.68 mg/l ± 0.29) in winter season. A negative relationship has been observed between BOD and DO contents. A similar pattern has been reported by Khanna (1993), Chugh (2000). BOD determination is a most useful technique to assess the level of organic pollution in river system. The maximum average value of COD (Chemical oxygen demand) was observed (3.68 mg/l ± 0.87) at sampling site-A and minimum (3.35 mg/l ± 0.65) at site- B. The carbon dioxide content of the water depends upon the temperature of water, depth of water, rate of respiration,and decomposition of organic matter in water. The carbon dioxide content of the water increases with increase in temperature. Free Carbon dioxide average value was observed maximum (3.02 mg/l ± 2.88) at sampling site-C , and minimum (2.37 mg/l ± 0.74) at site-A. Chakrabarty *et al*. (1959) recorded the maximum free CO_2 in Jamuna during monsoon at Allahabad. The dissolved oxygen and free carbon dioxide are usually inversely related to one another because of the photosynthetic and respiratory activities of the biota. Conductivity determines the total amount of ionisable salts in water. It is due to ionization of dissolved inorganic solids. The fluctuations in conductivity were caused mainly by variations in the ionic precipitations and the diluting effect of rains (Welch, 1948).In the present study maximum conductivity was observed (0.22siemens/cm ± 0.01) at sampling site-B and minimum (0.04 siemens/cm± 0.008) at site-C. The maximum turbidity was found (12.47 JTU ± 18.23)at sampling site-C. At sampling site-B the average value of turbidity was found minimum(10.99 JTU ± 19.56). The turbidity and total solids were closely interrelated with one another and cause common effect upon the river and aquatic life as also stated by Verma *et al.* (1984). Bhatt *et al.* (1984) attributed that during monsoon months, the river water contained large amount of silt, fine sand particles, organic matter and clay. According to Basu *et al.* (1973), the

measurement of pH has great importance because chemical and biochemical reactions in an aquatic body take place at a particular pH. The maximum average value of pH was recorded (8.11 ± 0.08) at sampling site-C,and the minimum observed (7.52 ± 0.42) at site-A. Meshram (1996) reported lower pH values during summer and higher pH during rainy season.The oxidation-reduction potential (Eh) and oxidation-reduction index (rH_2) showed its higher values during summer and monsoon, while lower during winters. Similar observations were also reported by Gautam (1990).The maximum value of alkalinity was observed (291.12 mg/l ± 32.43) at sampling Site C and minimum (275.33 mg/l ± 39.78) sampling site A.Similar types of findings were observed by Venkateshwarlu and Jayanti (1968) in the river Sabarmati. pH and alkalinity showed a positive correlation with one another as suggested by Freiser and Fernando (1966) in the ionic equilibria in analytical chemistry. According to Hays and Anthony (1958), the decomposition of organic matter leads to the high alkalinity of the waters. The maximum and minimum values of hardness were recorded (264.25 mg/l ± 21.73) and (247.32 mg/l ± 19.02) at sampling site A and B respectively. Hardness showed a negative relationship with chloride Chopra and Patrick (1994) observed positive relationship between chloride and hardness in river Ganga at Rishikesh. Hardness showed a positive relationship with alkalinity while Chopra and Patrick (1994) observed negative relationship in river Ganga at Rishikesh.Maximum amount of calcium in Suswa was found as (69.49mg/l ± 13.73) at site A and minimum (64.66 mg/l ± 7.73) at site B. pH and calcium showed positive relationship to one another. The value of magnesium was observed maximum (48.13 mg/l ± 4.17) at site C and minimum (37.33 mg/l ± 3.82) at site B. Singhai (1986) reported a positive correlation between magnesium and total hardness as also observed in present study. Maximum value of chlorides was observed (20.14 mg/l ± 6.58) at site B and minimum (17.99 mg/l ± 1.35) at site B. Chloride is one of the important chemical indicator of pollution. . Sengar *et al.* (1985) and Raina *et al.* (1984) also showed significant levels of chloride content.The observed low value of phosphorus are not to be taken as indication of low productivity.In the present study all the heavy metals as Lead, Copper, Chromium and Zinc were taken for observation and revealed that all heavy metals are having partial or some how positive relation with velocity and negative relation with plankton life. Concentrations of all the heavy metals in different seasons were quite favorable for the biota and not in favorable to the water quality as suggested by Mathur (1982). Heavy metals get contaminated into aquatic systems as a result of various natural activities (weathering of soils and rocks from volcanic eruptions) and from a variety of human activities involving the mining, processing or use of metals or substances.

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Fig.1 The graph of different Heavy Meatals of River Suswa at three sampling site in the year 2003-2004

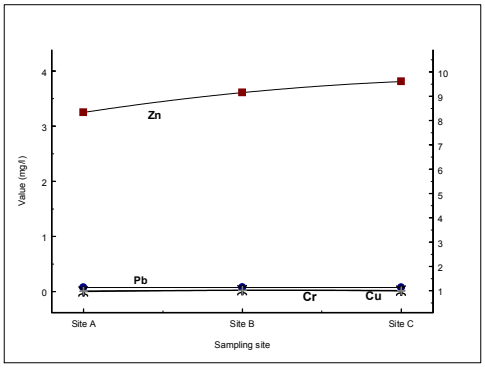
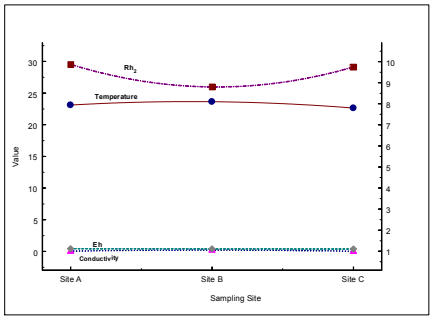


Fig.1 The graph of different Physico- chemical Parameters of River Suswa at three sampling site in the year 2003-2004



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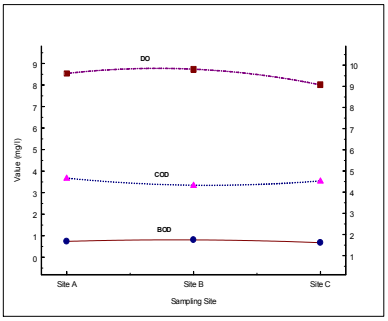

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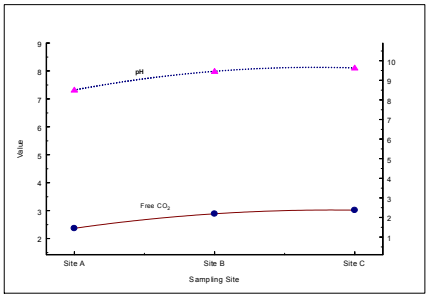

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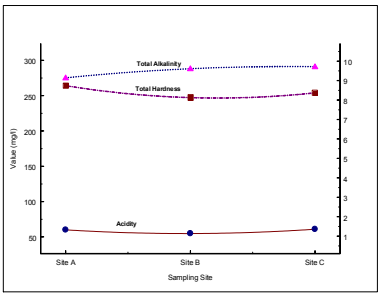

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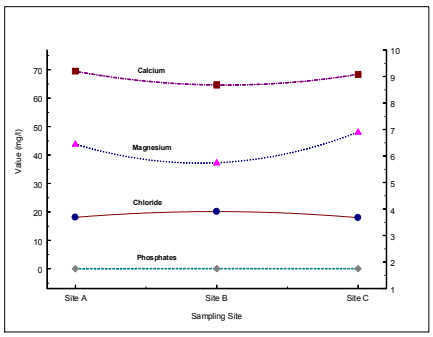

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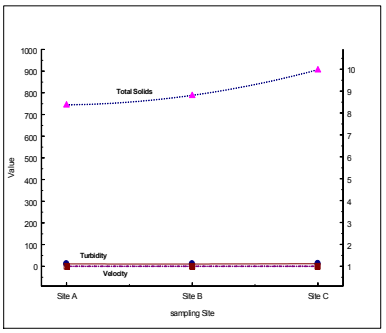

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Study of Leachability characteristics of fly ash and its effect on soil and ground water contamination

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Abstract

In the present study the leachability characteristics of fly ash and its effect on soil and ground water contamination. During the course of study it was found that despite the presence of the only trace amount of heavy metal in coal and coal ash, these material have the potential to accumulate in soil and increase in concentration by food chain biomagnification.

Key words: *Thermal power plant, fly ash, leachate*

Introduction

The use of coal for electricity generation was resulted in increasing environmental problems associated with gaseous and particulate emissions from coal fired power plants. Ash management is one of the key aspects of environmental management in coal fired thermal power stations. The ash production in thermal power plant result from the combustion of coal , consisting roughly 20% bottom ash and 80% fly ash. India is trying to expand the electric power generation capacity, as current generation is seriously below peak demand. About 110million tones of coal consumed in these power stations during a year produce about 30-40 million tones of fly ash i.e. at the rate of one lakhs per day. Only about 10% is utilized in the manufacture of bricks and cement. For the disposal of rest, nearly 28000 hectares of land has already been converted into ash dumps. Chemical constitutents of fly ash mainly depend on the chemical composition of the coal. Fly ash is the finer size particle.(Patil *et al*. 1991)

Leachate contamination may severely pollute neighboring ground and surface waters. The chemical quality of land fill leachate differs greatly from one landfill to another and fluctuates seasonally within individual landfill.Leachate composition is waste and site specific depending on waste type, landfill age, amount of infiltering water. Thus land disposal of fly ash creates the potential for ground water pollution via the migration of heavy metals from the fly ash. The disposal ponds are in interaction with surface and ground water systems and there is a risk of contamination of these water systems. Study of physico-chemical characteristics of fly ash, its trace metal contents and their leaching behavior are very important requirement for environmentally safe disposal management strategy. (Wasay SA, 1992)

Study Area

Ground water sampling site was identified during the site survey done at TPS. Panki thermal power station located between Kalpi road and G.T. road. Anpara TPS is located at the Anpara distt. Sonebhadra(U.P.), situated at longitude of 82º 48'E and the latitude of 24º 12'. The height above sea level is 275meters. Fly ash sample were collected from both the TPS and analyzed for parameters. At Panki TPS three samples were collected at the nearby area of ash pond. At Anpara TPS two samples were collected from the existing sources at nearby area of ash pond where one sample was collected about 3km. away from the ash pond.

Experimental Procedure

Fly ash sample were collected from both TPS and were analyzed for the parameters particle size, pH, Conductivity, Magnesium, Sodium, Potassium, Total chromium, Copper, Iron ,Lead ,Nickel, Silica, Zinc, Manganese, Aluminium, Mercury, Arsenic, Phosphorus.

Leachability Studies

Evaluation of ground water pollution potential require the condition of testing protocols to determine constituent concentrations in produce leachates. The leachability test was performed at different pH and contact time using standard TCLP (Toxicity characteristic leaching procedure) test of EPA. Alternately, batch test and column test were also conducted in order to evaluate the extent of dissolution of fly ash contents in the leachates.

These methods provide useful information as to the degree of leachability of many major and trace elements.(APHA, 1998)

TCLP Test

The TCLP test is used in a generic manner for the prediction of leaching trends of wastes. TCLP test is appropriate for the screening of fly ash for potential environmental impact.(USEPA Method 1311)

Batch Test

Batch test was conducted using 100g of fly ash with one liter of D.W for both the TPS maintaining liquid solid ratio of 1:10 for making fly ash slurry i.e. being disposed to the ash pond for 1 to10 days at 150 RPM in order to stimulate the actual condition . After the desired contact time , the sample was filtered and analyzed in accordance with the standard Method for water and waste water analysis APHA(1998).

Column Test

Glass columns of 90cm. height and 6cm. diameter was used to study the influence of flow rate on water quality obtained through leaching of fly ash. The column was filled with fly ash and D.W. and having pH-6.5 and 7.5 was allowed to pass through the fly ash column continuously , keeping the head constant leachates of sample were collected at regular intervals of 24hrs.

Each column is leached with approximately 230mL/day using ash of both analysed for metals sulphate, pH, Alkalinity, Hardness, Calcium, Magnesium, Chloride and Conductivity.(APHA, 1998)

Results and Discussion

The analysis of fly ash and Panki TPS and Anpara TPS was conducted in the laboratory. When compared with each other, It was observed that all values of the parameters analysed are high in Panki TPS ash compared to the fly ash of Anpara TPS (Table 2).

Characteristics of Ground water of Panki TPS

The ground water table encountered at the depth 7.5-9.2m depth from the GL during the period of the field exploration in Nov-2002 adjacent to Panki TPS.

Characteristics of ground water of Anpara TPS

The ground water table encountered at the depth 7.5-9.2m depth from the GL during the period of the field exploration in Nov-2002 adjacent to Anpara TPS.

Observation of Batch Test

If compared with each other it is seen that in case of water of pH 6.5 the total quantity of conductivity, Alkalinity,Chloride, Hardness, Ca, SO_4, SiO_2, Mn, Zn, Pb released are more compared to the water of 7.5 where as the total quantity of fluoride , Iron , Cu, Na,Al released when pH of 7.5 water was used. In terms of toxicity of heavy metals use in the fly ash of Panki TPS it is inferred that 6.5 pH water released comparatively more toxic metals compared to the water of 7.5 pH.

Observation of column test

The concentration of conductivity, Fe, SiO_2, Zn, Cu, Al, and SO_4 showed maximum values in the pH of 6.5. Whereas at pH 7.5 concentration of Alkalinity, Cl, Hardness, Mg, Ca, F, Cr^{+6}, Mn, Pb and Na were found to be more.The variation of release of various substances may be due to the resultant pH available at contact time. Variation of concentration of metal ions exhibit maximum absorbency at a specific pH.

It is possible that some of the heavy metals stripped from fly ash would be reprecipitate within the pile along leachate flow path, particularly if the leachate encountered higher pH material prior to just collection of leachates.

Comparison of fly ash of Panki TPS and Anpara TPS

The experimental results of leachates of both the TPS as indicated in table -7 & 8 reveals that with reference to total release potential of both the fly ash varies with the different metals nonmetals which could be due to the solubility behavior which is a function of particle size characteristic of fly ash.

As depicted from the table -5,6,7 and 8 at pH 7.5 concentration F, Cu, Al and Na indicated elevated concentration in the leachate of both the samples irrespective of variation in the fly ash characteristic. Whereas at the pH 6.5 the increased values of Cl, Ca, Sio_4, Zn, and Pb was recorded.

It is also possible that some of the heavy metals stripped from fly ash would reprecipitate with in the pile along leachate flowpaths, particularly if the leachate encountered higher pH materials prior to just collection. The data indicated that the potential for heavy striping from fly ash if an alkaline excess within these disposal zones is not maintained over the long term.

Findings and Recommendations

The variation in the concentration of various substances in the leachate may be due to differences in the particle size distribution of the fly ash,Smaller particles have a greater surface area related to their volume thus tending to become enriched in absorbed volatile elements. The relative distribution of trace element on the surface and in the internal matrix of fly ash particle has important environmental implication. Surface deposited metals may be easily mobilized in leaching waters, while metals in the silica metals are released only after periods extended weathering.

Both the power plants burning coals from these states produced alkaline flyash. Preliminary investigations have shown that the physical and chemical properties of fly ash and its alkaline nature. Different species of metal ion exhibit maximum absorbance at a specific pH. At some point of time it was observed that there is a change in resultant pH and increase in metals content in the water column due to the unloading of fly ash particles. pH is one of the main control of the solubility of metal is also closely related to the surface crystalinity. For some trace metals, the relationship between pH and solubility in an intricate process. The observations obtained suggests that some of the metals are released by dissimilar forms at the beginning and at the end of the experiment.

Thus, despite the presence of the only "trace" amount of heavy metals in coal and coal ash, these material have the potential to accumulate in soil and increase in concentration by food chain biomagnification it is important to use bioassays to evaluate toxicity.

The result indicates that if pH of water 7.5 is used for making ash slurry the ash in contact with eluting media increases the resultant pH of leachate after about 15 days if the sub soil pH is alkaline the leachate percolating down to meet ground water may increase the pH of the ground water.(WHO, 1993)

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Table-1 TCLP test for ash samples of Anpara and Panki TPS

Parameters	Unit	Conditions	
		Panki	Anpara
pH	-	5.1	5.2
Conductivity	Mmhos/cm	3.46	3.45
Chloride	mg/L	29.9	54.9
Hardness	mg/L	244	152
Magnesium	mg/L	45.7	28.4
Sulphate	mg/L	40	10
Fluoride	mg/L	0.843	0.299
Copper	mg/L	0.098	0.124
Chromium hexavalent	mg/L	0.06	0.07
Silica	mg/L	7.528	3.386
Maganese	mg/L	0.344	0.111
Zinc	mg/L	0.352	0.32
Iron	mg/L	1.05	2.93
Lead	mg/L	0.75	0.09
Sodium	mg/L	197	209
Potassium	mg/L	12.7	3.8

Table-2: Comparision of fly ash of Panki and Anpara

Parameters	Unit	Values obtained	
		Panki TPS	Anpara TPS
pH		7.9	7.6
Conductivity	Mmhos/cm.	0.112	0.062
Magnesium	mg/L	1200	425
Sodium	mg/L	1400	680
Potassium	mg/L	5300	4200
Total Chromium	mg/L	51.0	28.0
Copper	mg/L	37.0	30.0
Iron	mg/L	15000	14800
Lead	mg/L	52.0	47.0
Nickel	mg/L	35.0	30.0
Silica	mg/L	70.0	62.0
Zinc	mg/L	84.0	82.0
Fluoride	mg/L	412	500
Maganese	mg/L	139	110.0
Phosphorus	mg/L	712	680
WHC	%	58.1	27.5
Porocity	%	53.0	29.2

Table 3: Physico-Chemical characteristic of ground water quality of TPS during the post monsoon

Parameters	Obtained values			Desirable limit	Permissible limit
	Near township	Near ash pond	100m away from the pond		
pH	7.4	8.0	6.9	6.5-8.5	NR
Conductivity	0.70	1.20	0.97	-	-
Alkalinity	350	380	400	200	600
Hardness	135	190	200	300	600
Calcium	45	69	44	75	200
Magnesium	18	42	40	-	-
Sulphate	10.0	60.0	50.0	200	400
Chloride	5.8	25.0	21.0	250	1000
Copper	ND	0.03	0.01	0.05	1.5
Chromium+6	ND	0.02	0.01	0.05	NR
Maganese	0.05	0.10	0.08	0.1	0.3
Zinc	0.04	0.12	0.10	5.0	15.0
Iron	0.12	0.20	0.15	0.3	1.0
Nickel	ND	ND	ND	-	-
Lead	0.02	0.03	0.04	0.05	NR
Arsenic	ND	ND	ND	0.05	NR
Cadmium	ND	ND	ND	0.01	NR
Fluoride	0.44	0.43	0.583	1.0	1.5
Total Dissolved Solid	600	689	733	500	2000

Table 4: Physico-chemical characteristic of ground water quality of TPS during the post monsoon

Parameters	Obtained values			Desirable limit	Permissible limit
	HP Near Ash pond	Near village Anpara	Junction on way of Anpara		
pH	7.9	7.8	8.3	6.5-8.5	NR
Conductivity	0.133	0.092	0.450	-	-
Alkalinity	76	52	272	200	600
Hardness	88	68	176	300	600
Calcium	30.1	40	62	75	200
Magnesium	10	38.0	42	-	-
Sulphate	86	78	80	200	400
Chloride	4.5	2.5	10.5	250	1000
Copper	30	0.05	0.22	0.05	1.5
Chromium+6	0.08	0.03	0.24	0.05	NR
Maganese	0.07	0.01	ND	0.1	0.3
Zinc	0.22	0.1	0.035	5.0	15
Iron	0.115	0.40	0.01	0.3	1.0
Nickel	0.01	0.01	0.01	-	-
Lead	0.02	0.01	0.01	0.05	NR
Arsenic	ND	ND	ND	0.05	NR
Cadmium	ND	ND	ND	0.01	NR
Fluoride	0.710	0.613	0.643	1.0	1.5
T.D.S.	152	88	471	500	2000

Table-5 Analytical results of leachates test of Panki TPS

Duration	pH	Conductivity	Alkainity	Cl	Hardness	Mg	Ca	SO_4	F
1st	7.3	0.28	32	13.9	92	17.3	20.4	55	1.00
2nd	7.5	0.30	36	15.9	94	18.6	22.8	40	1.06
3rd	7.6	0.23	44	16.9	108	21.6	19.2	60	1.00
4th	7.3	0.23	44	12.9	104	20.2	20.8	50	0.96
5th	7.3	0.27	48	6.99	100	18.4	24.1	60	1.52
6th	7.3	0.28	48	4.99	104	18.2	28.9	64	1.63
7th	7.4	0.27	52	3.99	100	20.8	14.4	60	1.50
8th	7.6	0.27	56	3.99	100	20.8	14.4	56	1.88
9th	7.5	0.28	56	3.99	100	20.0	17.6	45	1.49
10th	7.5	0.27	54	3.0	92	20.0	17.0	44	1.34

Duration	Fe	Cr^{+6}	Sio2	Cu	Zn	Pb	Na	Mn	Al
1st	0.77	0.08	4.029	0.04	0.37	ND	17.0	0.16	0.54
2nd	0.68	0.08	40729	0.02	0.23	ND	20.8	0.076	0.54
3rd	0.66	0.08	5.221	0.04	0.23	ND	21.8	0.062	0.56
4th	0.65	0.06	5.864	0.03	0.21	0.01	20.4	0.033	0.57
5th	0.57	0.05	8.474	0.02	0.09	0.01	20.3	0.005	0.59
6th	0.45	0.08	9.288	0.004	0.006	0.02	20.2	0.005	0.68
7th	0.34	0.03	9.401	0.003	0.003	0.03	2.25	0.004	0.71
8th	0.32	0.04	10.29	0.002	0.002	0.04	2.3	0.001	0.71
9th	0.30	0.04	10.44	0.001	ND	0.04	2.0	ND	0.72
10th	0.29	0.04	10.40	ND	ND	0.05	2.0	ND	0.72

Note: All values are in mg/gm of fly ash except pH and conductivity in μmhos/cm

Table-6Analytical results of leachates test of Anpara TPS

Duration									
	pH	Conductivity	Alkainity	Cl	Hardness	Mg	Ca	SO_4	F
1st	7.6	0.11	36	19.9	80	17.1	9.62	20	0.09
2nd	7.3	0.14	36	18.9	72	15.5	8.02	35	0.17
3rd	7.3	0.18	38	17.9	68	14.5	8.02	40	0.26
4th	7.2	0.19	40	16.9	68	13.4	12.8	45	0.28
5th	7.5	0.19	44	12.9	64	12.4	12.8	45	0.45
6th	7.6	0.20	48	8.9	64	12.1	14.4	46	0.48
7th	7.8	0.16	52	7.9	60	11.5	12.8	25	0.74
8th	7.7	0.14	52	7.7	60	12.2	9.62	15	1.34
9th	7.5	0.11	51	6.9	56	11.3	9.62	13	1.38
10th	7.5	0.12	51	6.6	54	11.0	9.5	13	1.37

Duration									
	Fe	Cr^{+6}	Sio_2	Cu	Zn	Pb	Na	Mn	Al
1st	0.46	0.06	0.26	1.31	0.321	1.2	40.1	0.132	3.43
2nd	0.49	0.08	0.45	0.02	0.152	1.0	27.8	0.041	1.25
3rd	0.37	0.06	0.47	0.03	0.132	1.3	4.3	0.088	0.35
4th	0.31	0.07	1.00	0.02	0.120	1.2	4.4	0.070	0.49
5th	0.34	0.04	5.62	0.01	0.089	0.080	3.6	0.005	0.59
6th	0.36	0.06	6.60	0.008	0.049	0.049	1.9	0.006	0.77
7th	0.47	0.02	6.52	0.004	0.032	0.039	1.7	0.005	0.98
8th	0.74	0.05	6.69	0.001	0.027	0.041	1.7	0.004	1.19
9th	0.78	0.01	7.07	ND	0.020	0.040	1.6	0.004	1.0
10th	0.77	0.01	7.0	ND	0.010	0.039	1.5	0.003	0.79

Note: All values are in mg/gm of fly ash except pH and conductivity in μmhos/cm

Table-7 Quantification of substances released from fly ash of Panki TPS at different pH during 20 days contact period

Condition	Parameters							
pH of deionised water	Conductivity	Alkalinity	Cl	Hardness	Mg	Ca	SO_4	F
6.5	3.034	914	256.42	1432	257.42	372.48	313	22.49
7.5	3.81	738	221.92	1130	230.55	214.54	235.38	33.69

Condition	Parameters								
pH of deionised water	Fe	Cr+6	Sio_4	Mn	Zn	Cu	Pb	Na	Al
6.5	12.95	1.32	91.981	0.183	1.955	2.98	6.02	26.25	18.74
7.5	15.21	1.24	71.578	0.003	0.499	5.34	0.182	370.58	30.83

Table-8 Quantification of substances released from fly ash of Anpara TPS at different pH during 20 days contact period

Condition	Parameters							
pH of deionised water	Conductivity	Alkalinity	Cl	Hardness	Mg	Ca	So_4	F
6.5	1.926	371	204.6	456	89.47	87.04	79	7.11
7.5	2.205	580	201.9	650	139.44	73.86	57.5	14.31

Condition	Parameters								
pH of deionised water	Fe	Cr+6	Sio_4	Mn	Zn	Cu	Pb	Na	Al
6.5	15.7	0.42	46.08	0.11	0.764	0.070	0.298	12.84	11.67
7.5	4.73	0.64	31.34	2.12	0.22	2.01	0.054	74.89	26.88

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Botanical derivative in mosquito control programme to minimize pesticide pollution hazards

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Abstract

Alkaloid compound has been isolated from the P. ether chloroform , methanol and water extract of the aerial part of the *Lantana camara* L. The compound demonstrated strong insecticidal activity against *Culex quinaquifasciatus*. the chemical derived from plants have been projected as weapons in future mosquito control programme as they shown to toxic growth and reproductive inhibitor .

Key Words: *Pollution, Botanical drivatives, Culex quinaquifasciatus, Lantana camara*

Introduction

Long before the invent of synthetic insecticides plants and their derivatives were used in agriculture veterinary and public health importance. The chemical derived from plants have been projected as weapons in mosquito control program as they are shown to function as general toxic growth and reproductive inhibitor of laboratory test and fields trials of a series of a plant extract as well as purified phyto-chemical as mosquito larvicidal concentration have shown promising result. The present study project plants species against the early fourth instars larvae of *Culex quinquefasciatus*. The study is a part of our continuous effort for the last ten year or more to investigate the phytochemical against vector control.

Material and Methods

Lantana camara L. (Verbenaceae) is wildly grown shrub. It was collected from Vidisha and Bhopal voucherspecimen plant is produced in herbarium and maintained at pest control research laboratory. the collected plant material leaf of *Lantana camara* was washed with tap water and air dried material was extracted in soxlet apparatus.

Culture of test insects

Culex quinfasciatus, larvae were collected from cesspools and ditches. It was then cultured in laboratory. The larvae were fed on yeast tablet and dog biscuits (3:1) powdered material. The culture was maintained in insectary at controlled temperature 27+2C.R.H.75% and L:D 14:10 photoperiod.

Extraction and Purification

Extraction was done in soxhlet apparatus using following solvent n-haxane, Benzene, Chlroform, P.ether, methanol water. Purification was done by column chromatography using solvent system. Alkaloid is reported by Harnbone (1984).

1.The biological concentration of purified fraction applied on larvae.

2. W.H.O (1971) Methods for bioassay adopted.

Bioassay Procedure

The larvicidal activity of the extracts was evaluated as per the method recommended by WHO the stock solution of the plant extract was volumetrically diluted to 250 ml. with filtered tap water to obtain the test solution of 10,20,40,60,80 mg the test solution for assaying the larvae of *culex quinquefasciatus*.

It were prepared in saline water of salinity 15, 10.3 was used emulsified at a concentration of 0.001% in these test solution two control were maintained at a time. One consisted of acetone and the other tap water only early fourth instars larvae (25) were introduced to each of the test solution as well as control for each set of stock solution and with three different batches of mosquito larvae. Botanical evaluation by Finney (1971)ANOVA was carried out.

Result and Discussion

The result maintained on the effect of Lactic acid of *Culex quinquefasciatus* . Fecundity and fertility of larvae treated adults showed significant difference (PLO.05) than control and loss was markedly observed in *Lantana camara* and decrease in hatching % noticed in *Lantana camara* than control some developmental different and some morphological abbreviation were observed. Botanical derivatives and ecocompatible and do not cause any pollution hazards. They are quite so be to the non target oranisms including human beings. hence use of natural products for vector control program is quite promising.

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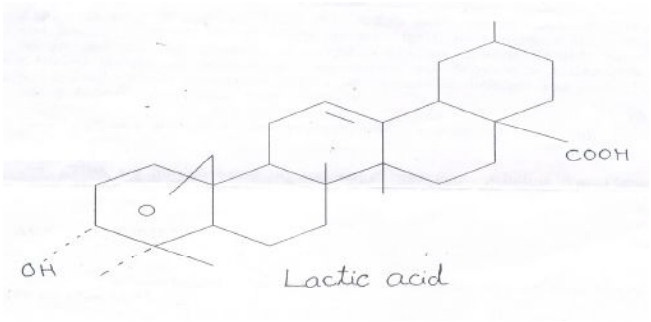

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Role of glutathione in modifying hepatotoxicity induced by copper in rats

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Abstract

Impact of glutathione against copper poisoning with special reference to liver through enzymological parameters have been studied in rats. Intake of copper significantly inhibited the activities of phosphatases, dehydrogenases, cholinesterase and lipase, however, alkaline phosphatase activity increased insignificantly. Reversal of key enzymes activity after supplementation of glutathione to copper fed rats reflects a repair in membranes.Other pharmacotoxicological aspects of glutathione are also discussed.

Key words: *Glutathione, copper, liver, enzymes, rats.*

Introduction

Glutathione is a small protein composed of three amino acids- cysteine, glutamic acid and glycine- that is involved in detoxification and antioxidant mechanisms. It is one of the most important conjugating compounds in helping the body to eliminate fat soluble toxins such as heavy metals, solvents, and pesticides to transform them into a water soluble form allowing more efficient excretion via the kidney. Reduced level of glutathione increases the risk of health problems (Flagg *et al.* 1994). Its dietary role in enhancing detoxification and protection against several anomalies have been reported (Sechi *et al.*1996, Sen, 1997). But the information on the protection offered by glutathione against heavy metal toxicities particularly copper is meager. Whereas, the toxicity of copper is now well known which constitutes inactivation of enzymes (Kumar and Rana1982), lipid peroxidation (Rana and Kumar 1984), interference with mitochondrial function (Nomiyama et.al. 1985) and DNA breakage (Reeves *et al.* 1994) due to their accumulation in different tissues of animals and man in liver, kidney and brain (Kumar and Chandra 1989). Therefore, the present study reports on the influence of glutathione in modifying hepatotoxicity particularly liver dysenzymia induced by copper in albino rats *Rattus rattus* albino.

Materials and Methods

Thirty healthy, intact, pathogen free, colony bred male albino rats (*Rattus rattus* albino), weighing 100 ± 10 g were selected for this study. Each rat was housed separately in a plastic cage bedded with rice- husk and fed on laboratory diet(Hindustan Lever Ltd., Bombay) and tap water *ad libitum*. The animals were divided at random into three groups each containing 10 rats. Rats of group I served as controls, received the laboratory diet alone and tap water *ad libitum*. Rats of group II and III in addition to receiving pellet diet, were fed by gavage copper as copper sulfate at the dosage of 0.1gm/kg body weight on each day for 30 days. Whereas, rats of group III were supplemented with glutathione at the dosage of 0.25gm/kg body weight, in addition to copper sulfate on each day for the same duration.

After 30 days, all the rats were starved for 24 hr. and then sacrificed by decapitation. Slices of liver were quickly excised from the bodies and immediately frozen at 4°C . 10% (w/v) homogenates of liver

were prepared in 0.25 M ice cold sucrose solution. Temperature near 0° C was maintained throughout the period of homogenization. The homogenates were centrifuged for 20 min. at 1500×g and the clear supernatant fluids were used as the source of enzymes. The activity of alkaline and acid phosphatases (Bodansky, 1933), glucose- 6-phoshatase (Swanson, 1955), fructose-1,6 diphosphatase (Pontremoli and Melloni, 1975), lactate dehydrogenase (Bergmeyer and Bernt, 1975), isocitrate dehydrogenase (Bernt and Bergmeyer, 1965), succinate dehydrogenase (Beatty *et al.* 1966), Cholinesterase (Rappaport et.al.1959), and lipase (Bier, 1955) were determined. The protein contents in the homogenates were determined (Lowry *et al.*1951). The student "t" test (Fisher, 1950) was used to calculate the statistical significance between control and experimental values.

Results and Discussion

Enzymological alteration in the liver of copper poisoned rats and effects of supplementation of glutathione are presented in Table 1, from which it is evident that nutritional conditions did affect the key enzymes.Intake of copper inhibited the activity of phosphatases, dehydrogenases, cholinesterase and lipase significantly. However, an insignificant elevation was observed in the activity of alkaline phosphatase.Whereas, supplementation of glutathione to the diet of copper fed rats were found capable in reversing the lost enzyme activity. Maximal reversal was found in the activity of acid phosphatase.

Heavy metal toxicity in animals can be affected by a variety of dietary components. One of these components is protein/amino acid containing sulfhydryl groups like glutathione, methionine and cysteine (Kumar *et al.*1987, Kumar and Kumar 2003). Protection offered by sulfur containing amino acids against copper toxicity in chicks was observed (Jensen and Maurice 1979). Present study was undertaken to confirm the protective role of glutathione on copper induced hepatic dysenzymia- a major event in metal toxicity. Enzymological study chosen as markers of cellular components and parameters of metabolic pathway revealed that copper inhibited the activities of all the enzymes studied except alkaline phosphatase, probably via I the removal of essential metal ion leaving the apoenzyme and (II) replacement of some of the protein groups giving a mixed enzyme inhibitor metal complex. Thus it appears that the presence of free metal ion caused inhibition. Maximum inhibition was found in the activity of acid phosphatase indicating the damage to lysosoms by copper have been reported earlier also by Ishmael *et al.* (1972) and Kumar and sharma (1987).

The efficiency of any hepatoprotective drug is essentially dependent on its capacity on either reducing the harmful effects or in maintaining the normal physiology, which have been disturbed by a hepatotoxin. In the present study, supplementation of glutathione to copper fed rats provides certain amounts of protection and has the capacity to correct liver dysfunction as evidenced by a significant elevation in the activities of all key enzymes studied. Present results confirmthe protective role of glutathione as reversal of key enzymes activity occur, suggest repair in cell membrane/organelle like lysosomes and plasma membrane and normal metabolic pathway. Reversal effects of glutathione (Dalhoff *et al.* 1992) may be affecting the synthesis or functional level of enzymes directly or indirectly by altering the cytomorphology of hepatic parenchymal cells.This may be due to extensive changes in liver beyond the limits of recovery.

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Table 1: - Effect of glutathione on key enzymes in the liver of copper poisoned rats.

	Experimental				
Control	Copper	Alteration Cu +	Glutathione	Alteration	
Enzyme	Group I	Group II	%	Group III	%
Alkaline phosphatase [a]	0.37± 0.020	0.42 ± 0.040 ^{NS}	13.51(+)	0.48 ± 0.38 ^{NS}	14.28 (+)
Acid phosphatase [a]	0.46 ± 0.012	0.08 ± 0.006 ***	82.60 (-)	0.30 ± 0.020 ***	275.0 (+)
Glucose-6-phosphatase [b]	18.62 ± 0.140	12.20 ± 0.110 **	34.47 (-)	15.60 ± 0.210 *	27.86 (+)
Fructose-1-6-diphosphatase [b]	3.12 ± 0.160	0.96 ± 0.120 ***	69.23 (-)	2.02 ± 0.560 **	110.41 (+)
Lactate dehydrogenase [c]	270.50 ± 12.86	92.40 ± 8.50 ***	65.84 (-)	186.40 ± 10.02 ***	101.73 (+)
Isocitrate dehydrogenase [c]	28.00 ± 2.02	10.20 ± 1.56 ***	63.57 (-)	17.10 ± 2.02 **	67.64 (+)
Succinate dehydrogenase [c]	38.40 ± 1.92	22.20 ± 2.02 **	42.18 (-)	30.16 ± 3.98 **	35.85 (+)
Cholinesterase Units	42.00 ± 3.60	26.00 ± 2.80 **	38.09 (-)	32.00 ± 3.02 *	23.07 (+)
Lipase units	23.00 ± 1.98	10.02 ± 1.08 ***	56.43 (-)	16.80 ± 2.20 **	67.66 (+)

All values are mean ± S.E of 5 observations., (+), % stimulation; (-), % inhibition ; NS, not significant ; a, Activity is expressed in mg of inorganic phosphate liberated / mg of protein /hr at 37ºC ; b, Activity is expressed in µ mole of inorganic phosphate / min / gm fresh tissue; c, values expressesd as international units / gm fresh tissue. Values are significant at *P <0.05 **P< 0.01; *** P< 0.001 (Fisher's 't' test), When values of Group –II compared with Group- I; Group-III compared with Group-II.

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Isolation and Identification of Food Spoiling Bacteria

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Abstract

Raw fruits and vegetables have been known to serve as vehicles of human disease for at least a century.In the present study a survey of different hospitals and clinics of Srinagar was done to investigate the cases of food borne diseases in the valley. It was found that *Staphylococcus aureus* was predominant in banana and grapes, which is known to cause Staphyloccocal food poisoning.

Key words : *Bacterial contamination, food spoilage,Staphylococcus aureus.*

Introduction

Food is one of the most important requirements for life of single cell microbes to human. Except plants and some algae most of the organisms are dependent to others for their nutritional requirements and use varied food materials. Microbes are present almost everywhere in the environment (except fire) and use a vast range of food substances. All microbes comes under different categories on different characters they have, they may be harmful, beneficial or neutral. Among these under harmful category we consider pathogenic microbes which can cause diferent disease in humans, animals as well as in plants.

In humans the most common source of disease is due to spoiled food which is result of microbial growth, mainly by bacteria and their byproducts. There are more than 250 food borne diseases, many of which cause other symptoms other than vomiting and diarrhea. Bacterial contamination is most common cause of food poisoning, followed by viruses and parasites. Among the common bacterial species, *Camphylobacter, Salmonella, E.coli, Staphylococcus aureus, Shigella, Clostridium perfringens, Botulinum cereus* are encountered most frequent. In the present study a survey of different hospitals and clinics of Srinagar was done to investigate the cases of food borne diseases in the valley.

Material And Methods

Sample collection

Vegetables, fruits and meat samples were collected from the roadside market and were packed in presterile autoclavable polybags to bring in lab. Sample were washed with 100 ml sterile distill water for 2-3 times. 10 ml of this water was then taken into presterile tube and was considered as test samples.

Isolation and identification of bacterial species

Isolation and identification of bacterial species responsible for food spoilage was done following the standards methods of APHA(1998).

Results

The results of the present study is given table 1-4 while the data collected from Govt. Hospital for food and water related disorders is given in table 5.During the course of study total number of colonies obtained from different samples were 607. In case of banana (Orange 54, yellow 13, white 47) , in case of grapes

(Orange 60, yellow 03, creamy 150) while in case of tomato (Orange3, yellow 7, creamy 150) and in case of meat (yellow 20 , white 100) number of colonies were found (table 1).On the basis of different parameters viz. morphology colour and size 11 groups were prepared. One representative of each group was taken for further assay.

Gram staining reveal that all the representatinve isolates were 11 gram positive (table 2) Cells which were found round shaped i.e. Coccus and clustered like grapes were Staphylococcus sps. while those which were coccus in shape but individual in arrangement were of micrococcus Sps. Series of biochemical test were performed for each bacterial colony. Catalase test (positive 9, negative 2) , mannitol test (positive 9, negative 2)

Bile esculin test and 6.5 % NaCl (positive1, negative 1) Table 3 and Fig 1 (a -c).

For determining spoilage rate fresh food articles (Banana, meat and tomato) were brought from market. Bacterial colony present on the surface of thease food articles cultured onnutrient agar medium.These food articles were then kept at room temperature (40^{o} C) for determining the bacterial species responsible for spoilage. After 24 hour meat sample showed bacterial growth, produced bad odour and lesion appereance While in case of banana all the above conditions were seen after 48 hrs. Tomato relatively showed only bacterial growth and foul odour on 3rd day.These material was taken and were treated as sample for obtaining bacterial growth of media plates.

After incubation same bacterial colonies were observed which shows that same bacterial species are responsible for spoilage of food.

Discussion

Raw fruits and vegetables have been known to serve as vehicles of human disease for at least a century. In1899 Morse linked typhoid infection to eating celery. Warry(1903) attributed an outbreak of typhoid fever to eating watercress grown in soil fertilized with sewage. Pixley (1913) recorded two cases of typhoid from eating uncooked rhubarb which was grown in soil known to have been fertilized with typhoid excreta. Melick (1917) recovered typhoid bacilli from mature lettuce and raddish harvested from soil that has been inoculated at the time seeds were planted. Similiarly in the present Staphylococcus aureus was predominant in banana and grapes, which is known to cause Staphyloccocal food poisoning.

Staphylococcus aureus is known to be carried in the nasal passages of healthy food handlers and has been detected on raw produce (Abdelnoor *et al.* 1983). According to Hauschild, 1992 cases of botulism that have been linked to fresh produce are very rare.De Roever, 1998 reported outbreaks involving cooked/ processed vegetable products 9 e.g. garlic in oil, mushrooms).

Pao and Brown (1998) studied human pathogens associated with the surface of citrus from seven commercial packing house. They found no generic *E. coli* on fruit .In the present study orange samples which were serially diluted and plated were contaminated with *S. aureus, S, bovis, B, cereus and E .facecalis.*

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Table 1: Morphology and number of bacterial colonies in different food samples

SAMPLES	ORANGE	YELLOW	WHITE	CREAMY	TOTAL
BANANA	54	13	47	--------	114
GRAPES	60	3	--------	150	213
TOMATO	3	7	--------	150	160
MEAT	--------	20	100	--------	120

Table2 Number of bacterial colony showing Gram- Positive and Gram Negative test

SAMPLE	COLONY	GRAM REACTION	SHAPE	ARRANGEMENT	INFERENCE
BANANA	ORANGE	POSITIVE	COCCUS	CHAIN LIKE	*STREPTOCOCCUS*
	YELLOW	POSITIVE	COCCUS	CHAIN LIKE	*STREPTOCOCCUS*
	WHITE	POSITIVE	COCCUS	GRAPE BUNCH LIKE	*STAPHYLOCOCCUS*
GRAPES	CREAMY	POSITIVE	COCCUS	GRAPE BUNCH LIKE	*STAPHYLOCOCCUS*
	ORANGE	POSITIVE	COCCUS	GRAPE BUNCH LIKE	*STAPHYLOCOCCUS*
	YELLOW	POSITIVE	COCCUS	GRAPE BUNCH LIKE	*STAPHYLOCOCCUS*
TOMATO	YELLOW	POSITIVE	ROD	INDIVIDUAL	*BACILLUS*
	CREAMY	POSITIVE	COCCUS	GRAPE BUNCH LIKE	*STAPHYLOCOCCUS*
	ORANGE	POSITIVE	COCCUS	GRAPE BUNCH LIKE	*STAPHYLOCCCUS*
MEAT	YELLOW	POSITIVE	COCCUS	GRAPE BUNCH LIKE	*STAPHYLOCOCCUS*
	CREAMY	POSITIVE	COCCUS	GRAPE BUNCH LIKE	*STAPHYLOCOCCUS*

Stain +ve -Positive test ; Stain -ve- negative test; Coccus- round
Bacilus- rod; Individual single; Irregular- grapes like

Table 3; List of biochemical test and organism identified

SAMPLE	ISOLATE	G.R.	SHAPE	PIGMENT	Biochemical test				INFERENCE
					CATALASE	MANNITOL	BILE TEST	NACL TEST	
BANANA	B.B.O1	+	COCCUS	ORANGE	-	------	+	-	MAY BE S. BOVIS
	B.B.C2	+	COCCUS	CREAMY	-	-----	+	+	E.FAECALIS
	B.B.Y3	+	COCCUS	YELLOW	+	+	------	------	S. AUREUS
GRAPES	G.B.C4	+	COCCUS	CREAMY	+	+	----	------	S. AUREUS
	G.B.O5	+	COCCUS	ORANGE	+	+	------	------	S.AUREUS
	G.B.Y6	+	COCCUS	YELLOW	+	+	------	-------	S. AUREUS
TOMATO	T.B.Y7	+	ROD	YELLOW	----	-	---	-----	B. CEREUS
	T.B.C8	+	COCCUS	CREAMY	+	+	------	-----	S. AUREUS
	T.B.O9	+	COCCUS	ORANGE	+	+	-----	-----	S.AUREUS
MEAT	M.B.Y10	+	COCCUS	YELLOW	+	+	-----	----	S.AUREUS
	M.B.C11	+	COCCUS	CREAMY	+	+	------	------	S.AUREUS

B.B. O1 - banana bacterial orange isolate 1
B.B. C2 - banana bacterial orange isolate 2
B.B. Y3 - banana bacterial orange isolate 3
G.B. C4 - banana bacterial orange isolate 4
G.B. O5 - banana bacterial orange isolate5
G.B. Y6 - banana bacterial orange isolate 6
T.B. Y7 - banana bacterial orange isolate 7
T.B. C8 - banana bacterial orange isolate 8
T.B. O9 - banana bacterial orange isolate 9
M.B.Y10 - banana bacterial orange isolate 10
M.B. C11 - banana bacterial orange isolate 11
G.R. -Gram reaction

0

Table 4: Rate of Spoilage of different food samples

SAMPLES	TEMP	DAYS	B.G	ODOUR	LESIONS
BANANA	40	2ND	+	+	+
MEAT	40	24 HRS	+	+	+
POTATO	40	3 RD	+	+	-

Table 5: Food and water related disorder of the year 2004 collected from Govt. Hospital Srinagar

DISORDER	CASE	AGE GROUPS					RECORDED IN MONTH											
		0-15	15-30	30-45	45-60	60-75	J	F	M	A	MY	JN	JU	AU	S	O	N	D
Colitis	26	6	9	5	5	1	-	-	2	-	-	3	12	5	3	3	-	-
Diarrhea	12	4	3	1	1	3	1	-	3	2	-	3	3	-	-	-	-	-
Dysentry	30	5	10	10	3	2	-	1	1	-	3	5	15	2	1	2	-	-
Gastroentritis	10	--	3	5	2	--	2	-	-	4	1	3	-	-	-	-	-	-
Acute abdomine	15	---	9	3	2	1	5	2	-	-	3	2	1	-	-	2	-	-

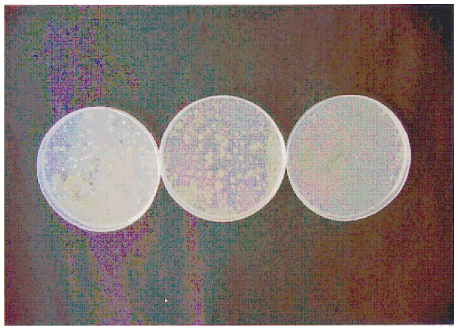
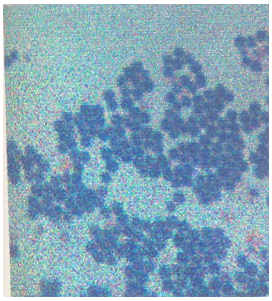
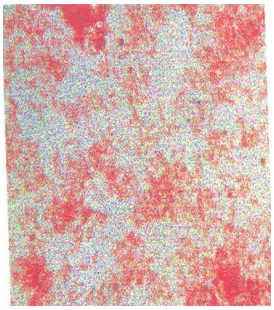


Fig : 1: Slide showing gram staining results

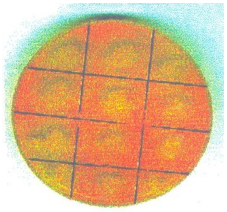


Gram positive



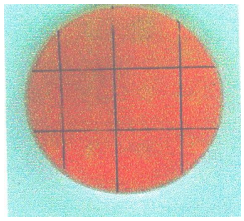
Gram Negative

Fig : 2: Slide showing gram staining results



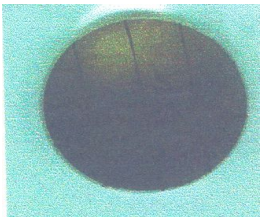
Mannitol positive test

Presence of yellow zone around bacterial colony



Mannitol negative test

Absence of yellow zone



Positive bile esculin test

Light brown colour changes to blackish brown

Fig : 3: Evaluation of isolate for different biochemical test

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Morphological details of new irregular Echinoid fossil from Zirabad, India

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Abstract

Echinoids offer a unique opportunity to investigate the evolution. Our efforts of exploring extensively the fauna of Zirabad (Lat. 22°24'30" : Long. 75°04'30") has yielded some of the new irregular Echinoid fossils not cited before from this area. The present paper documents detailed morphology of one such well preserved sample of Nucleopygus sp from the nodular lime stone formation exposed at Zirabad near Manawar, Dhar district of Madhya Pradesh, India. The investigation enhances our knowledge on irregular Echinoids from bagh group.

Key words - *Echinoids, Irregular echinoids, Invertebrate fossils, Bagh Beds, Nucleopygus.*

Introduction

Echinoids are one of the most diverse and successful echinoderm groups today, including familiar echinoderms such as the sea urchins and sand dollars. A tough skin studded with spines covers the nonfossilized echinoderms, but in ofssilized forms skeleton is composed of many calcareous plates arranged in a five-fold symmetry. Most echinoids have rigid tests, their ability to fossilize is greater than that of more delicate echinoderms. But the fossil record of echinoids is poor because soon after death they break apart into isolated plates. They are morphologically complex, which makes them relatively straightforward to classify taxonomically and phylogenetically, and they are unusual among marine invertebrates because their mode of larval development can be simply and unambiguously determined from inspection of the adult test in both extant and extinct forms (Jeffery and Emlet, 2003). In the present seas regular echinoid species outnumber irregular species; whereas, in the Tertiary only 20% of the known echinoid species are regular. This suggests that regular echinoids are less likely to be preserved than irregular echinoids. The tests of regular echinoids are exposed to scavengers and currents of water upon their death, but irregular echinoids generally live burined in the sediment and are protected from these destructive forces (Smith and Jerffery, 2000).

Fossil invertebrates have outnumbered the vertebrae fossils in India. While the southern foothills of Himalaya yield a rich store to fossils bones, its northern flanks in Kashmir, Kumaun, Spiti, Malla, Johar, Tibetean plateau, Sikkim and Assam displayed a wealth of invertebrate animal remains representing all geological ages. These fossils consisted of bivalves, ammonites, Nautilus etc. The most important outcome of the studies of Sahni (1947) is that the present site of Himalaya range was submerged at the dawn of Tertiary Era. The Tethya sea had started receding and gave birth to emerging Himalayan to its present status in a series of devastating earth movements. the salt range of Punjab surpasses all fossil localities

in richness. The Permian floating and swimming fauna of this zone suggested a much wider distribution of fauna in the Tethyan sea.

Ever since the appearance of the account of Panchu Pandoo caves near Bagh town of Barwani by Dangerfield (1818) these beds have attracted attention during last two centuries. Persons from most varied occupations like military officers, civil servants and missionaries have devoted their time to the study of these beds with different point of views like lithology, palaentology, the status of stratigraphic component units and other aspects. But it was Keatinge (1857) who for the first time reported these beds to be fossiliferous.The fossiliferous nature of these rocks extend to a very vast area up to Jabalpur but discovery of non-marine fauna like reverine fish *Igdabatis indicus* and *Lepidosteus indicus* (Khosla *et.al.* 2004) indicates the limitation of marine arm upto Dhar district only.The fossiliferous nature of these rocks extend to a very vast area up to Jabalpur but discovery of non-marine fauna like riverine fish *Igdabatis indicus* and *Lepidosteus indicus* (Khosla et.al. 2004) indicates the limitation of marine arm upto Dhar district only.The study of Bagh group of sediments has been done by some workers but they could not give much attention to the fauna of a small village Zirabad also known as Jirabad. This area has very rich and varied marine fauna. Among the irregular echinoid, we have collected some very well preserved specimens of *Nucleopygus,*which is being reported for the first time.

Geological Setting of Zirabad Area

The sediments of bagh Group (BG) are deposited in the Narbada basin, an intracratonic trough and trends roughly east-west which is also the direction of present day Narmada river (Acharyya and Lahiri, 1991). The name is derived after a township Bagh (Lat. $22^0$24'30" : Long. $75^0$04'30") of Kukshi Tehsil, a type area for fluvial - marine sediments of BG.The out crops of BG occurs as series of detached inlineers in the Deccan Trap surrounding mostly along the northern bank of Narmada river in various localities of central India and eastern part of Gujrat state.The sedimentary rocks of BG rest on the Archean metamorphics. The lower part of the beds is arenaceous while the upper part is mainly calcareous. The generalized stratigraphic succession of BG, in order of superposition is as, Nimar sand stone formation (NSF) which is in shades of red, pink, purple; Nodular lime stone formation (NLF), which is argillaceous and light grey coloured; Chirakhan (or Deola) Marl Coralline lime stone formation CLF) which is red and yellow coloured. The overall BG sediments suggest an upper Albian-Turonian age (Chiplunkar *et al*. 1977).

It is noted that bioturbation is one of the important features o f middle and top portions of NSF and rich, diversified ichnoassemblages have yielded from the top of NSF exposed at Baria and Karondia localities (Kundal *et al.,* 2000). The overlying calcareous units contain abundant and well preserved micro and mega fossils. The CLF contains abundant fragments of Bryozoa Corals etc. The Chirakhan (Deola) Marl is the chief fossiliferous horozon, but closely related fossils also occur in the lime stones above and below it. There are many species of Foramanifera, Brachiopods, Cephalopods, Lamellibranchs, Gastropods, Echinoderms etc.

The depositional environment of NSF shows two distinct phases. In the begnning the deposition commenced with distinctly fluviatile sediments which uninterruptly passed into the marine estuarine sediment towards its top. The calcarious units of BG are regarded as the product of short lived eastward marine transgression of an arm of Tethyan sea i.e. arm of Arabian sea invaded from Kachchha of Gujrat to present day Zirabad areas (29 km. from amjhera on the way to Manawar on Kukshi-Manawar Road and 51 km away from Dhar.) of Manawar tehsil of district Dhar, Madhya Pradesh.

Material and Method

Among the out crops of BG of central India those in main river velly near Zirabad is unique as it represent the most complete fossiliferous succession for the paleontological investigation.

The standard methodology for palaeonological studies was adopted. This included survey and demarcation of the fossiliferous area of this village and surrounding area.Fossils were collected by digging the fossiliferous area upto the depth of two to three meters. Echinoids were also collected from the cliffs of the lime stone quarries with the help of Geological hammer, Chisel etc. Brunton Compass was used to mark the location of irregular Echinoid fossils on the Geological map . Magnifying lens was used for the field study and identification of the collected genera. Fossil specimens were numbered and details were recorded in the field note book. After returning from the field, the fossil specimens were cleaned as per standard methods for laboratory investigations and for further confirmation of the genera. For the paleontological studies we followed the systematic arrangements suggested by Smith and Jeffery (2000). Length (L) and diameter (D) of the test are in centimeters.

Observation

The sample has following dimensions - length - 35 cms. Width from oral side is 2.2 cms. height 1.1 cms. Circumference 7.5 to 8 cms. Ambulacra number 2, 3 and 4 are 1.5 cms and Ambulacra 1 and 2 are 2.2 cms long. Distance of anal sulcus from Apical Disc is 0.7 cms and length of anal sulcus is 1 cm long.

Test bilaterally symmetrical, ovate to sub quadrate in outline. Adoral surface is flat, depressed towards peristome. Subanal heel in side view is very clear.

Aboral View

Peristome is small. Buccal notches are absent. In front and rear of Peristomial area is broad naked and pitted. Plating of all the five inter ambulacral zones on the oral surface are similar. There is no plastron.

Oral View

Ambulacra with differentiated tube feet are present. Pore pairs forming Phyllodes and petals. Phyllodes (adoral zones of food harvesting tube feet) developed adorally. Single irregular series of pore pairs (Tube feet) to each ambulacral plate beneath petals. Pore zones expanded close to peristome. Plating simple or with small adradial pyrenoid elements.

Apical Disc

Apical disc is on anterior side and is monobasal. Apical plate with genital plate 3 is perforated by a gonopore. Four gonopores are present.

Periproct

Periproct is aboral and supra marginal. It is transversely elongated and associated with a shallow subanal ledge or short and groove called as anal sulcus. Anal sulcus is not in contact with apical disc.

Distribution - Albian to Turonian

Classification: Echinoidea, Irregularia, Cassiduloida, Apatopygidae, *Nucleopygus Sp.*

Discussion

Nucleopygus is similar to Apatopygus in having a tetrabasal apical system, with four gonopores, a supramarginal periproct with an anal sulcus and simple phyllodes with only a well defined outer series of single pores Desor, (1842). It differs from Apatopygus and Porterpygus in lacking pyrinoid plating ambulacra beyond petals. Kier, (1962). Nucleopygus is superficially similar to the nucleolitids, however, these genera are double pored beneath the petals and lack buccal pores (Smith, and Jeffery, 2000).

It is worth while to point out that Cement industries and Man irrigation project have already damaged the lime stones and fossils bearing localities. Therefore authors suggest that looking to the presence and diversity of the marine fossils in Zirabad area sediments of BG must be properly preserved for future generation and study.

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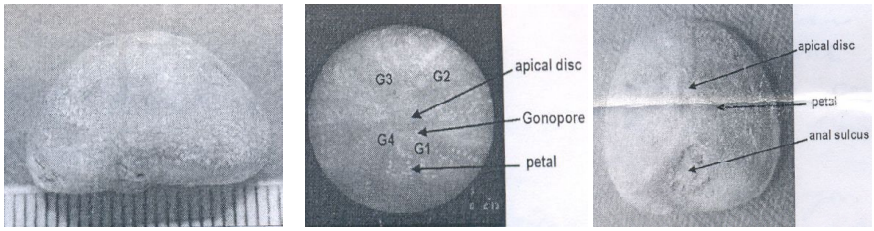
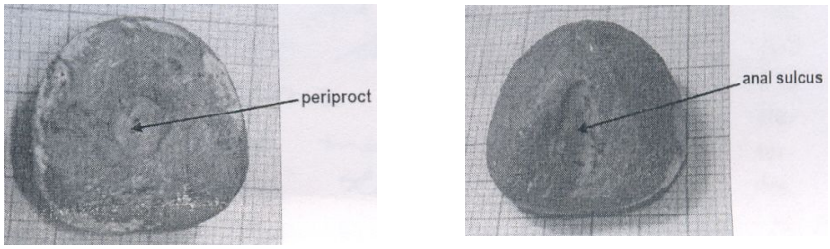


Posterior view **Aboral view**



Oral view

Fig 1: Morphological details of *Nucleopygus sp.*

Social cost benefit analysis of Sultanpur National park, Haryana