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ECOLOGY OF COLIFORM BACTERIA IN A HEAVY METALS CONTAMINATED RIVER AT MIDNAPORE DISTRICT AREA, WEST BENGAL

M.K. DEY, A.K. HAZRA AND S.K. CHAKRABORTY*

Zoological Survey of India, M-Block, New Alipore, Kolkata-700 053

INTRODUCTION

A series of workers have published ecology as well as microbial communities of different aquatic ecosystem in India and abroad *viz.* Arnal (1958, 62), Carpelan (1961), Segers (1995), Rajkumar, Ramanibai and Devraj (1994), Krishnamoorthi and Sarkar (1979), Pandit (1986), Chattwal (1989), Sinha, Bruah, Singh and Sharma (1994), Verma and Delela (1975), Prasad (1988), Masood and Krishnamurthy (1990), Chakraborty and Asthana (1989), Chakraborty *et al.*, (2004). Several workers have studied the impact of heavy metals on microfauna *viz.* Failkowski and Newman (1998), Deshpande (1988), Gadd and Griffiths (1978). From the above literature it appeared that the hydro biological research have been oriented to assess the impact of different biotic and abiotic factors on the distribution and diversity of aquatic micro fauna with special reference to total coliform and fecal coliform. In addition, impacts of polluting agents like heavy metals and pH gradation on the population of aquatic bacteria have also been studied. This pollution affects the growth of beneficial microorganism in water bodies and resulting to increase of population of total coliform and fecal coliform. So far there is no record have available on these aspects from Subarnarekha River in Midnapore Dist area. For this reason the present investigation was undertaken. Total area was about 60 km along the riverbed each station was about 20km apart from other. From each station 3-sample unit were taken and a total of 9 sample plots have been selected and collections were made at an interval of one month for a period of one year (Oct. 2002–Sept. 2003). During pre winter the P^H of river water was acidic ranges from 5.5–6.7 as a result level of heavy metals concentration was found to be maximum and the population of micro fauna minimum in number, might be due to increase level of heavy metals toxicity released from the industries

**Department of Zoology, Vidyasagar University, Midnapore*

situated on the bank of the river. The interrelationship between micro fauna and the aquatic factor and heavy metals and also between the physico-chemical factors and the heavy metals have been analysed and discussed.

CHARACTERISTICS OF SAMPLING SITE

Area is located on both side of river Subarnarekha, it contain grasses like *Cynodon dactylon* etc. and also some herbs and shrubs with some trees. The soil was sandy loam in texture and reddish yellow in colour.

MATERIAL AND METHODS

A. Sampling sites :

A total of 3 collection sites were chosen for this study. Each site includes three subsampling sites (one in the middle and two along the embankment of the rivers) (Fig. 1). Samples were collected at an interval of one month (Oct. 2002–Sept. 2003) and a total of 108 samples have been collected.

B. Collection of Sample and Preservation :

Composite water samples from each study site were collected from three different areas of both sides of riverine flow and also from the point of the river. Samples were taken in sterilized glass bottles for laboratory analysis of COD, BOD, Heavy Metals and Total and Faecal coliform following APHA, (1998). Other water quality parameters such as DO, pH, Temperature were measured by water quality checker (WQC-22A, TOA, Japan).

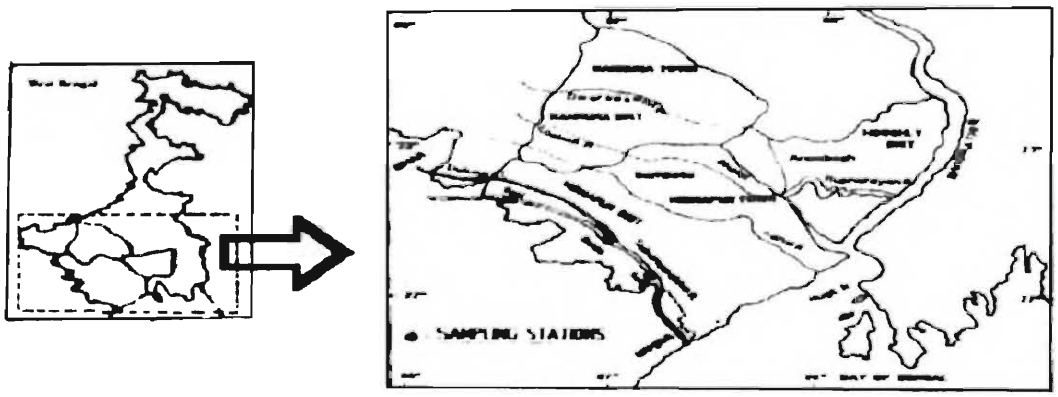

Fig. 1.

b. Chemical and Microbiological analysis :

BOD was measured by titration method. The results are expressed in terms of mg/l. BOD was determined

– after 5 days of incubation (APHA1998). COD was measured by rapid titration method. The result is expressed in terms of mg/l. The heavy metals were estimated by atomic absorption spectro-photometer (APHA1998) and were expressed in terms PPM. Total and Fecal Coliform study by a number of tubes containing specific growth media were inoculated with different amount of the samples and incubated for a particular time at a prescribed temperature. The results were expressed in terms MPN/100ml.

RESULTS AND DISCUSSION

The total and faecal coliform bacteria and physio-chemical parameters are presented in Table-1. The average monthly total coliform and faecal coliform bacterial population in the river Subarnarakha during the course of investigation were found to range from respectively 560 to 2133.33 MPN/100ml and varied from 240 to1373.33 MPN/100ml. The monthly abundance of total coliform bacteria varied form 560MPN/100ml in July to 2133.33MPN/100ml in March. In general there, total count showed a decline trend from May to August, while there was a fluctuation trend through out the year. The annual fluctuating trend of total and faecal coliform population in Subarnarekha river can be represented as Pre monsoon > winter > monsoon. (Fig. 1)

The pH showed an overall acidic condition in monsoon, which ranged from 5.5–6.7, but in other seasons the pH was neutral either alkaline (Graph-1).

Temperature being considered as an important physical factor that influence the chemical changes of water, was found to range in between 16. 43ºC in December to 32.83ºC in July. Similar results were also obtained by Hazrika *et al.*, (1996) Tasek lake of Meghalaya.

Dissolved oxygen content was found to be considerably higher in winter. While BOD level registered higher in level in winter and pre monsoon period but in monsoon period it expressed minimum level. Such findings corroborated the observation of Yousuf *et al.*, (1986).

Heavy metals concentration was found to be low throughout the year except during the monsoon season. In monsoon, the value of pH was also low as a result the river water was acidic in nature, so the conjugated form of heavy metals are easily dissolved in acidic water and formed the free heavy metals. These free-formed heavy metals might have adverse effect on the microbial population. This also coincides with the findings of Kebbekus and Mitra (1998). It could be concluded from the present study that the abiotic components evaluated here in conjunction with other biotic and abiotic components not considered collectively responsible for the distribution and fluctuations of microbial fauna in the river.

SUMMARY

The pH of Subarnrekha river water during monsoon ranges from 5.5–6.7 and level of heavy metals concentration was maximum. The population of micro fauna was minimum in number during monsoon. The interrelations between micro fauna and the aquatic parameters along with the heavy metals in the river ecosystem have been discussed.

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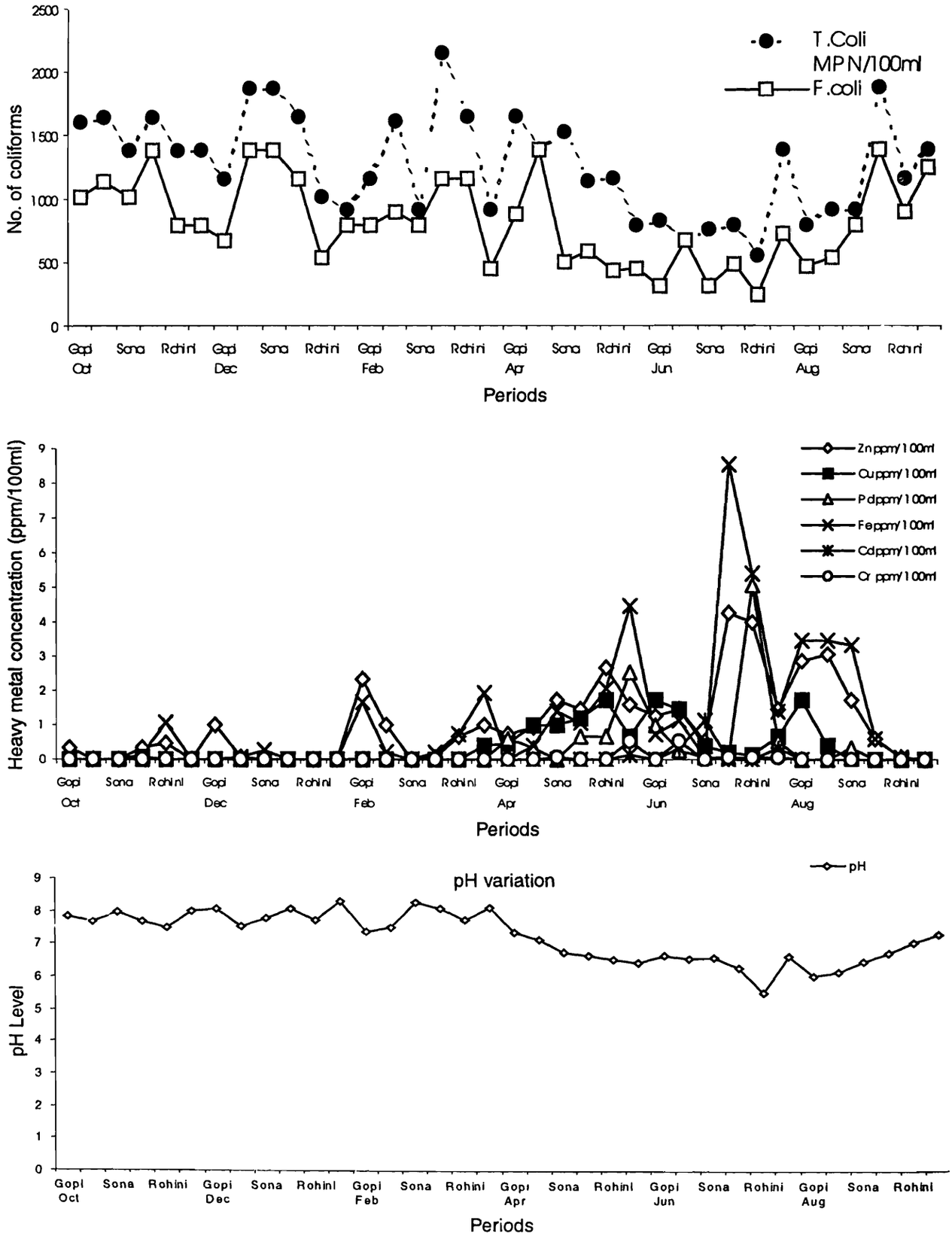

Fig. Monthly fluctuating of pH level, Heavy concentration and no. of total and faecal coliform bacteria.

Table 1. : Mean value of all Hydrological. Total and Faecal coliform data.

Month	SITE	Temp. °C	pH	Do mg/l	COD mg/l	BOD mg/l	T. Coli MPN/ 100 ml	F. Coli MPN/ 100 ml	Zn ppm/ 100 ml	Cu ppm/ 100 ml	Pd ppm/ 100 ml	Fe ppm/ 100 ml	Cd ppm/ 100 ml	Cr ppm/ 100 ml
OCT	Gopi	29.33	7.84	7.13	18.66	1.46	1600	1020	0.33	0.01	0	0	0	0
	Rohini	29	7.67	6.66	23.33	0.96	1640	1146	0	0	0	0	0	0
	Sona	29.16	7.97	6.35	21	1.41	1373.33	1020	0	0	0	0	0	0
NOV	Gopi	25.56	7.66	7	25.66	1.06	1640	1373.3	0.33	0.09	0	0.12	0	0
	Rohini	18.93	7.5	6.9	30.33	1.9	1373.33	793.33	0.47	0	0	1.07	0	0
	Sona	23.13	7.98	6.73	30.33	1.83	1373.33	793.33	0	0	0	0	0	0
DEC	Gopi	18.46	8.05	8.13	21	0.8	1146.66	666.66	1	0.02	0.02	0	0	0
	Rohini	16.43	7.53	7.55	21	1.71	1866.66	1373.3	0.07	0.01	0	0.09	0	0
	Sona	21.4	7.76	6.95	23.33	1.3	1866.66	1373.3	0	0.01	0	0.27	0	0
JAN	Gopi	19.46	8.04	8.13	28	0.91	1640	1146.6	0	0	0	0	0	0
	Rohini	18.1	7.72	7.33	25.66	0.56	1020	540	0	0	0	0	0	0
	Sona	23.23	8.26	7.24	28	0.48	920	793.33	0	0.003	0	0.02	0	0
FEB	Gopi	24.66	7.36	6.16	16.33	1.19	1146.66	793.33	2.33	0	0	1.69	0	0
	Rohini	22.2	7.48	6.35	16.33	0.83	1600	893.33	1	0	0	0.22	0	0
	Sona	23.46	8.25	6.96	28	0.86	920	793.33	0	0	0	0	0	0
MAR	Gopi	30.4	8.06	6.25	14	1.2	2133.33	1146.6	0.06	0	0	0.2	0	0
	Rohini	32.43	7.7	6.1	28	0.97	1640	1146.6	0.7	0	0	0.76	0	0
	Sona	32.33	8.1	6.7	11.66	0.55	920	440	1.03	0.4	0	1.96	0	0

Table 1. : *(Cont'd.)*

Month	SITE	Temp. °C	pH	Do mg/l	COD mg/l	BOD mg/l	T. Coli MPN/ 100 ml	F. Coli MPN/ 100 ml	Zn ppm/ 100 ml	Cu ppm/ 100 ml	Pd ppm/ 100 ml	Fe ppm/ 100 ml	Cd ppm/ 100 ml	Cr ppm/ 100 ml
APR	Gopi	30.66	7.33	6.53	32.66	0.81	1640	886.66	0.73	0.5	0.62	0	0	0
	Rohini	29	7.1	6	37.33	0.67	1380	1380	0.96	0.97	0.36	0.4	0	0
	Sona	33	6.73	6.8	23.66	0.97	1516.66	503.33	1.73	1.03	0.02	1.4	0	0.07
MAY	Gopi	31.16	6.63	6.86	42	0.43	1146	580	1.46	1.23	0.7	1.08	0	0
	Rohini	30	6.5	6.96	37.33	0.37	1146.66	433.33	2.66	1.76	0.66	2.06	0	0.01
	Sona	30	6.4	6.9	30.33	1.04	793	441.33	1.61	0.66	2.55	4.47	0.11	0.53
JUNE	Gopi	36	6.63	6.7	23.8	0.56	830	306.66	1.26	1.73	0.97	0.76	0	0
	Rohini	30.16	6.53	6.21	30.33	0.17	666.66	666.66	1.46	1.45	0.3	1.13	0.36	0.53
	Sona	30	6.56	6.65	36.66	0.16	766.66	306.66	0.53	0.4	0.06	0.06	1.13	0
JULY	Gopi	29	6.26	5.84	114.33	0.92	793.33	476.66	4.27	0.2	0.08	8.56	0	0.09
	Rohini	30.66	5.5	5.5	53.66	0.49	560	240	4	0.11	5.05	5.43	0	0.08
	Sona	31	6.6	6.08	81.66	1	1373	730	1.5	0.7	0.56	1.43	0.36	0.1
AUG	Gopi	30.33	6	6.76	30.33	0.75	793	466.66	2.86	1.76	0.03	3.46	0	0.003
	Rohini	29.83	6.13	6.83	28	0.65	920	540	3.1	0.4	0	3.46	0.006	0.006
	Sona	30.83	6.43	6.66	27.66	1.07	920	793.33	1.76	0	0.36	3.33	0	0
SEPT	Gopi	29.33	6.7	6.73	32.66	1.72	1866	1373.3	0.6	0	0	0.6	0	0
	Rohini	29.83	7	6.96	35	1.09	1146.66	893.33	0.1	0	0	0.1	0	0.003
	Sona	30	7.26	6.7	30.33	1.43	1373.33	1246.6	0.03	0	0	0	0	0