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Research Article

BIOINDICATORS OF RIVER YAMUNA AT AGRA

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ABSTRACT
Benthic macro invertebrates are aquatic macro fauna visible to unaided eyes .Due to their sensitivity to the environmental changes , they are used as bio indicators for pollution and health of a water body. For study, six sites were selected on the bank of 23 km stretch of River *viz.* Hathi Ghat (Site-I), Mantola (Site-II), Taj Tannery (Site-III), Garhi Mahavan (Site-IV), Dayalbagh (Site-V) and Pohia Ghat (Site-VI) An attempt was made for the assessment of benthic macro-invertebrates (bio indicators for pollution)of river Yamuna at Agra .On the basis of the occurrence of their families ,it could be interpreted that , Mantola and Hathi Ghat sites indicated heavy pollution. Taj tannery area and Garhi Mahavan sites were moderately polluted while Pohia ghat and Dayalbagh sites were least polluted .The families which were encountered at the most were, Chironomidae ,Hydrophilidae and Noteridae ; Lestidae Nepidae showed lesser distribution while Pleidae, Hygrobidae and Hydrobiidae species were least in number.

Key Words. *Benthic macro invertebrates,families ,Yamuna river.*

INTRODUCTION

The macro- invertebrates are popular as pollution indicators (Hallawell, 1986). Benthic marco-invertebrates are best indicator for bioassessment (Kumar ,2003). They are aquatic macro- fauna inhabiting the bottom substratum. They give sensitive response to toxic effluents and pollution ,therefore are studied for evaluation of water quality as biological components (bio indicators) of the aquatic ecosystem. They are aquatic macro fauna having sedentary and long life span ,inhabiting the different substratum of river, stream, lake and other water bodies, for atleast a part of their life cycle and are visible to unaided eyes. Having developed taxonomy , can be easily identified. Most of these macro-invertebrates, share their biological life in fresh water, while their adults fly over for miles in search of suitable habitat for reproduction and laying eggs.(Mustow 1996 ;Akolkar *et al.* 1999;Muhammed Zaheer Khan,2006 ;Khanna and Vats,2006;Singh and Ahmad,2006;Prasum *et.al.*2006). In 1966, order 'Hemiptera' was discovered by Hungerford during the bio assessment of water(Hungerford,1966). The present study is an attempt for assessment of the benthic macro invertebrates of River Yamuna at Agra .

MATERIALS AND METHODS

For studying benthic macro invertebrates of River Yamuna at Agra ,six study sites,*viz;* Hathi Ghat (Site-I), Mantola (Site-II), Taj Tannery (Site-III), Garhi Mahavan (Site-IV), Dayalbagh (Site-V) and Pohia Ghat (Site-VI) were selected on the banks of river Yamuna. Benthic macro- invertebrates were studied for evaluation of water quality as biological components of the aquatic ecosystem. They were selected as bio-indicators,as they give sensitive response to toxic effluents and pollution.They are visible to unaided eyes, have developed taxonomy , can be retained on the sieve (.6mm)and can be easily identified. They were identified upto family level.

RESULTS AND DISCUSSION

Benthic macro- invertebrates were studied for evaluation of water quality as biological components of the aquatic ecosystem. They were selected as bio- indicators,as they give sensitive response to toxic effluents and pollution .Most of these macro-invertebrates particularly insect larvae, which are aquatic, share their biological life in fresh water, while their adults fly over for miles together in search of suitable fresh water

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A - DAYAL BAGH TANNERY AREA.
B - POIYA GHAT.
C - HATHI GHAT.
D - MANTOLA NALA.
E - TAJ TANNERY AREA.
F - GARHI MAHAVAN

environment for reproduction, breeding and laying eggs in suitable habitats and establish biological communities. (Mustow 1996; Akolkar *et al.* 1999;Muhammed Zaheer Khan,2006 ;Khanna and Vats,2006;Singh and Ahmad,2006; Prasum *et.al.*2006).

Table 1: Occurrence of benthic macro- invertebrate families encountered in River Yamuna at Agra Autumn. 2006

Taxonomic Group	Families	Hathighat Site-I	Mantola Site-II	Taj Tannery Site-III	Garhi Mahavan Site-IV	Dayalbagh Site-V	Pohia Ghat Site-VI
Odonata	Lestidae	-	-	+	+	+	+
	Gomphidae	+	+	-	-	-	+
	Aeschinidae	+	-	-	+	-	-
Hemiptera	Nepidae	+	+	-	-	+	+
	Aphelocheiridae	+	-	-	-	-	-
	Naucoridae	-	-	-	+	-	-
	Notenectidae	+	-	-	+	+	-
	Pleidae	-	-	-	-	-	+
	Belastomatidae	+	-	-	+	-	-
	Corixidae	-	-	-	-	-	+
Diptera	Syrphidae	-	-	-	+	+	+
	Chironomidae	+	+	+	+	+	+
Coleoptera	Hydrobidae	-	+	-	-	-	+
	Dytislidae	-	-	-	-	+	-
	Hydrophilidae	+	-	+	+	+	+
	Noteridae	+	+	+	+	+	+
Mollusca	Lymnalidae	-	-	-	+	+	-
	Physidae	-	-	+	-	-	-
	Planorbidae	-	-	+	-	+	+
	Hydrobiidae	-	-	-	-	-	-

Site-I:
Gomphidae and Aeschinidae families of order Odonata was found at this site. Amongst Hemipteran families , Nepidae, Aphelocheiridae , ,Notenectidae,Naucoridae,Pelidae and Blastomatidae were noted. Other families observed at this site were , Chironomidae of order Diptera; Hygrobidae, Dytiscidae, Hydrophilidae and Noteridae of order Coleoptera and Lymnalidae, Physidae and Hydrobiidae of order Mollusca were observed.Various anthropogenic activities like cattle wading, open defecation, factory effluents discharge are observed at this site, which affect the habitat and occurance of benthic macro invertebrates.

Site-II:
Odonatan family Gomphidae was found. Nepidae represented Hemipteran Order. Chironomidae as Dipteran family; Hydrobiodae, Hydrophilidae, and Noteridae as Coleopteran families were noted. This site was most polluted.Therefore,tolerant benthic families like Chironomidae ,Noteridae survived at this

site. Factories effluent of bad odour merges here. Amongst anthropogenic activities cattle wading,cattle grazing,open defecation etc. prevails here.

Site-III :

Amongst Odonata,Lestidae and Gomphidae were observed. Aphelocheiridae ,Corixidae and Nepidae, were present as Hemipteran families. Chironomidae as Dipteran family was universally present; Hydrophilidae and Noteridae as Coleopteran families; Physidae and Planorbidae as Molluscan familily could be observed at this site.

Site-IV:

Lestidae, Gomphidae and Aeschinidae families of order Odonata were found.Amongst the families of Hemiptera, Nepidae, Naucoridae, Notenectidae and Belastomatidae were found here. Dipteran families Syrphidae and Chironomidae were present Families Hydrophilidae, Noteridae of Order Coleoptera ;Family Lymaelidae of Mollusca were also observed**.**

Table 2: Occurrence of benthic macro- invertebrate families encountered in River Yamuna at Agra .winter. 2006

Taxonomic Group	Families	Hathighat Site-I	Mantola Site-II	Taj Tannery Site-III	Garhi Mahavan Site-IV	Dayalbagh Site-V	Pohia Ghat Site-VI
Odonata	Lestidae	-	-	+	+	+	+
	Gomphidae	-	-	+	+	+	+
	Aeschinidae	-	-	-	+	-	-
Hemiptera	Nepidae	-	+	+	+	+	+
	Aphelocheiridae	-	-	-	-	-	-
	Naucoridae	-	-	-	-	-	-
	Notenectidae	+	-	-	-	-	+
	Pleidae	-	-	-	-	-	-
	Belastomatidae	+	-	-	+	-	-
	Corixidae	-	-	+	-	-	+
Diptera	Syrphidae	-	-	-	+	+	+
	Chironomidae	-	+	+	+	+	+
Coleoptera	Hydrobidae	+	+	-	-	-	+
	Dytislidae	-	-	-	-	+	-
	Hydrophilidae	+	+	+	+	+	+
	Noteridae	+	+	+	+	+	-
Mollusca	Lymnalidae	-	-	+	+	+	-
	Physidae	+	-	-	-	-	-
	Planorbidae	-	-	-	-	+	+
	Hydrobiidae	-	-	-	-	-	-

Site-V:
Amongst Odonata families, Lestidae and Gomphidae were observed. Amongst Hemiptera Nepidae and Notenectidae were observed.Amongst Dipteran families Syrphidae and Chironomidae were present. Coleopteran families were Dytislidae ,Hydrophilidae and Noteridae.Families Lymnalidae and Planorbidae of Mollusca were also encountered.

Table 3: Occurrence of benthic macro- invertebrate families encountered in River Yamuna at Agra .Summer. 2007

Taxonomic Group	Families	Hathi ghat Site-I	Mantola Site-II	Taj Tannery Site-III	Garhi Mahavan Site-IV	Dayalbagh Site-V	Pohia Ghat Site-VI
Odonata	Lestidae	-	-	+	+	+	+
	Gomphidae	-	-	+	-	-	-
	Aeschinidae	-	-	-	-	-	-
Hemiptera	Nepidae	-	+	+	+	+	+
	Aphelocheiridae	+	-	+	-	-	-
	Naucoridae	+	-	-	-	-	-
	Notenectidae	+	-	-	-	-	+
	Pleidae	-	-	-	-	-	-
	Belastomatidae	+	-	-	+	-	-
	Corixidae	-	-	+	-	-	+
Diptera	Syrphidae	-	-	-	+	-	+
	Chironomidae	+	+	+	+	+	+
Coleoptera	Hydrobidae	+	+	-	-	-	+
	Dytislidae	+	-	-	-	+	-
	Hydrophilidae	+	+	+	+	+	+
	Noteridae	+	+	+	+	+	-
Mollusca	Lymnalidae	-	-	+	+	+	-
	Physidae	-	-	-	-	+	+
	Planorbidae	-	-	-	-	+	+
	Hydrobiidae	+	-	+	-	-	-

Site-VI:
Odonatan families were ,Lestidae and Gomphidae.Hemipteran families were Nepidae , Pleidae ,Notenectidae and Corixidae; families Hydrobidae, Hydrophilidae and Noteridae of Coleoptera; families Syrphidae and Chionomidae of Diptera and families Lymnalidae and Planorbidae of Mollusca were present at this site
Benthic macro- invertebrates are the best suitable for water quality evaluation among the other living systems present in aquatic ecosystems(CPCB, 1999,2001,2002 ;Kumar ,2003). The macro- invertebrates are 'pollution indicators' which gives an index of health of water body and level of pollution there. (Hallawell, 1986; Prasum *et.al.*2006; Fishar and Williams ,2007). Benthic Macro- invertebrates are sensitive to environmental changes and factory/industrial and agricultural waste material and pollution. Taxonomical key is useful for biological water quality determination.(Hungerford,1966;Trivedi and De

Zwart,1995). Biological assessment of river Kapila indicated water pollution. (Somashekar and Ramaswamy, 1984)

Table 4: Occurrence of benthic macro- invertebrate families encountered in River Yamuna at Agra Rainy. 2007

Taxonomic Group	Families	Hathighat Site-I	Mantola Site-II	Taj Tannery Site-III	Garhi Mahavan Site-IV	Dayalbagh Site-V	Pohia Ghat Site-VI
Odonata	Lestidae	-	-	-	-	+	+
	Gomphidae	-	+	-	-	-	-
	Aeschinidae	-	-	-	-	-	-
Hemiptera	Nepidae	+	+	+	+	+	+
	Aphelocheiridae	-	-	-	-	-	-
	Naucoridae	-	-	-	-	-	-
	Notenectidae	-	-	-	-	-	+
	Pleidae	-	-	-	-	-	-
	Belastomatidae	+	-	-	+	-	-
	Corixidae	-	-	+	-	-	+
Diptera	Syrphidae	-	-	-	+	-	+
	Chironomidae	+	+	+	+	+	-
Coleoptera	Hydrobidae	+	+	-	-	-	+
	Dytislidae	+	-	-	-	+	-
	Hydrophilidae	+	-	+	+	+	+
	Noteridae	-	+	+	+	+	-
Mollusca	Lymnalidae	-	-	+	+	+	+
	Physidae	+	-	-	-	-	-
	Planorbidae	+	-	-	-	+	+
	Hydrobiidae	+	-	-	-	-	-

Aquatic Diversity in Jharkhand with references to Macro- zoobenthos shows variation with pollution. (Kumar and Bohra ,2005). Bioassessment of water quality of river Yamuna using benthic macro-invertebrates indicated pollution(Mukhopadhayay ,2002 ;Kumar,2003).Analysis of various taxonomic groups of macro invertebrates at selected places of River Hindon in Uttar Pradesh gives a definite picture of pollution and water health of the river.(Prasum *et.al.*2006).The present study was an attempt for observing presence of families of various taxonomical groups of macrobenthic invertebrates, at six selected sites of River Yamuna at Agra .

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