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Association of Gastropods-Hydrophytes in Some Ponds of Darbhanga

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ABSTRACT
The degree of association between various macrophytes and gastropods in five ponds of Darbhanga, North Bihar, was studied for March 2018 to February 2019. There existed an inseparable association between them. The variation in population densities and community structure of macrophytes brought about a proportionate variation in gastropod fauna. Ceratophyllum demersum, Hydrilla verticillata, Eichhornia crassipes and Euryale ferox were found to support rich gastropod fauna. Potamogeton crispus was of less concern whereas Typha angustata, Marsilia quadrifolia, Vallisnaria spiralis, Lemna minor and Pistia Stratiotes showed non-significant association with gastropods. Lymnae penguis a pulmonated gastropod showed an exclusive association with Euryale ferox.
KEYWORDS: Gastropods, Hydrophytes, Darbhanga, Euryale ferox, Mithila, Microcystis.

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INTRODUCTION

Hydrophytic vegetation plays most important role to provide substrata for macro-invertebrates especially periphyton and benthos for their normal life activities[1,2].Some workers[3-8] studies the association of insects and gastropods with the plants of *E. ferox*in the ponds of Darbhanga (North Bihar) with additional reference to their pest status coupled with the role of some others as biological control agents. The increase in potential profit was due to proper protection of crop [9].This inter-specific non-parasitic plant-animal association in aquatic environment deserves special attention for various reasons. A few workers[10-12] have paid a little attention on this subject. However, qualitative and quantitative variations between macrophytes and gastropods have not yet been investigated in detail in Indian tropical lentic waters[13-16]. The present study was therefore aimed at evaluating the impact of various hydrophytic vegetation on the distribution and occurrence of gastropod fauna by undertaking five freshwater fish ponds of Darbhanga.

MATERIAL AND METHODS

The ponds selected for study were Ganga sagar,Mirza Talab,Raj Dighi, Majilsa and Harahi.The former four ponds are mesotrophic and less polluted. They do not receive sewage and domestic refuge except surface runoffs during rains. The Harahi is one of the largest ponds in Darbhanga. It receives sewage, domestic refuge and field out wash from a vast adjoining densely populated areas through eight all as all the year-round. It is hypereutrophic and displays a permanent microcystis bloom (Table1).
Monthly collection of gastropod fauna (benthos and periphyton)were made from the littoral areas of all the ponds by modified methods of Welch. An average for five samples was taken for each month and the results were finally expressed as mean monthly gastropod number/m2. Vegetation mapping of all the ponds were also done at regular intervals to understand the distribution pattern of various macrophytes by modified methods of Welch.

Table 1 : Morphometric features of five ponds (Gangasagar, Mirza Talab, Raj Dighi, Majilsa, Harahi) of Darbhanga, North Bihar.

Parameter	Gangasagar	Mirzapur Talab	Raj Dighi	Majilsa	Harahi
Maximum effective length(m)	121.92	140.2	521.2	91.44	365.76
Maximum effective width(m)	121.92	128.01	124.96	67.05	304.8
Maximum surface area(hectare)	1.48	1.79	6.49	0.61	11.12
Maximum shore line (m)	487.68	536.44	1292.35	316.99	134.11
Shore line development [Length/2√ (surface area×π)(m)]	0.28	0.16	0.57	0.33	0.3
Maximum volume of water ($m^3 \times 10^4$)(m^3)	2.25	4.36	18.23	1.48	20.62
Maximum depth(m)	2.74	4.87	5.18	4.88	3.65
Mean depth (m)	1.52	2.43	2.8	2.43	1.85
Mean depth/Maximum depth	0.55	0.49	0.54	0.49	0.5
Maximum depth-surface relation(max depth/√Surface area)	0.02	0.03	0.02	0.06	0.01

Table 2 : Occurrence of gastropod fauna in five ponds (Gangasagar, Mirza Talab, Raj Dighi, Majilsa, Harahi) of Darbhanga, North Bihar.

Gastropod	Gangasagar	Mirzapur Talab	Raj Dighi	Majilsa	Harahi
Cyclophorus indicus	FW	AB	FW	AB	AB
Cyclophorus involves	CN	AB	CN	RR	AB
Pila globosa	RR	RR	RR	RR	AB
Vivipara bengalensis	PL	RR	CN	PL	AB
Melania striatella tuberculata	AB	AB	AB	AB	RR
Lymnae acuminate	CN	AB	RR	FW	AB
Lymnae luteola	CN	AB	RR	FW	AB
Lymnae penguis	FW	AB	AB	AB	AB
Planorbis exustrusi	RR	AB	RR	RR	AB
Anisus convexius culus	FW	AB	FW	FW	AB
Helisoma sp.	RR	AB	FW	FW	AB
Total species number (n)	10	2	9	8	1
Total organisms number (N)	17552	52	12244	15267	20

PL-Plenty CM-Common FW-Few RR-Rare AB-Absent

Table 3: Occurrence of aquatic macrophyte in five ponds (Gangasagar, Mirza Talab, Raj Dighi, Majilsa, Harahi) of Darbhanga of North Bihar.

Macrophyte	Gangasagar	Mirzapur Talab	Raj Dighi	Majilsa	Harahi
Eichhornia crassipes	PL	AB	PL	CM	RR
Potamogeton crispus	FW	RR	FW	FW	AB
Vallisnaria spiralis	AB	PL	AB	AB	AB
Typha angustata	AB	RR	AB	AB	AB
Ceratophyllun demersum	PL	AB	FW	RR	AB
Pistia stratiotes	RR	AB	RR	RR	AB
Lemna minor	FW	RR	FW	RR	AB
Nymphaea lotus	AB	AB	FW	CM	AB
Euryale ferox	PL	AB	AB	AB	AB
Hydrilla verticillate	CM	RR	CM	PL	AB
Marsilia quadrifollia	RR	RR	RR	RR	AB
Colocasia antiquorum	AB	AB	FW	AB	RR
Ipomea aquatic	AB	AB	RR	AB	RR

PL-Plenty CM-Common FW-Few RR-Rare AB-Absent

RESULT AND DISCUSSION

The qualitative and quantitative abundance of gastropod fauna and of hydrophytic flora are given in Tables 2 and 3 respectively. Although many factors such as sediment characters of the soil and physico-chemical parameters of soil and water have been reported to bring about an alteration in population densities and community structure of gastropods, the quality and quantity of hydrophytic vegetation in aquatic ecosystems have also been Observed to play a decisive role in determining respective variations in gastropods. The gastropods depend upon macrophytes in several ways and same work was observed in some workers[4-9].Firstly, the macrophytes supply food materials to the gastropods which primarily feed upon living and dead plant tissues. Secondly, for the gastropods which are nocturnal in habit, the macrophytes cut down intense light of the sun during day by shading water through their various body parts. Thirdly, all parts of a macrophyte act as suitable substrata for their firm adherence. The macrophytes as a whole provide a hiding home to the gastropods that usually need escape from predators. Bushy roots and leaves of the macrophytes furnish an extraordinary environment as a substrate for egg laying and larval development for the gastropods. These clearly indicate that gastropods have to remain in close association with macrophytes for their normal life activities.

Now the question is to find out the degree of association and extent of intimacy that often exists between a particular hydrophytic community and a specific gastropod fauna.

The Mirza Talab pond which was found to have a considerable density of Vallisnaria spiralis and a scarce population of *Marsilia quadrifolia, Typha angustata, Lemna minor, Potamogeton crispus and Hydrilla verticillata* had a rare occurrence of only one gastropod species *(Vivipara bengalensis*). This is because the gastropods were supported by only *Hydrilla verticillata* but the other macrophytes did not show any association with them.

The Gangasagar, as compared to other ponds, had thickest vegetation and the largest number of gastropods in quality and quantity. During October-April, *Ceratophyllum demersum* was thick and denser than *Hydrilla verticillata* and *Eichhornia crassipes*. During May-September, *Euryale ferox* dominated over *Ceratophyllum demersum, Hydrilla verticillata* and *Eichhornia crassipes* which were also abundant. *Potamogeton crispus, Pistia stratiotes, Marsilia quadrifolia* and *Lemna* minor were however few. During October-April all gastropods except *Lymnae penguis* were found well in associationwithCeratophyllum-Hydrilla-Eichhorniavegetation.Althoughentiregastropodpopulation increased many times in May-September than in October-April, a sudden appearance followed by marked increase in the number of *Lymnae penguis* was noticed during the former months. The presence of Euryale ferox and *Lymnae penguis* only in Gangasagar and their complete absence from other ponds indicate an exclusive association of *Lymnae penguis* with *Euryaleferox*.

The Raj Dighi pond, as compared to Gangasagar had less thick vegetation. This was possibly the reason that led to a considerable decline in gastropod fauna in Raj Dighi which showed a common occurrence of *Eichhornia crassipes* and *Hydrilla verticillata* a few *Potamogeton crispus, Ceratophyllum demersum, Lemna minor* and *Nymphaea lotus* and a rare *Marsilia quadrifolia* and *Pistia stratiotes*. Here, it was observed that *Eichhornia-Hydrilla* vegetation supported the maximum gastropod fauna whereas *Potamogeton, Ceratophyllum*, and *Nymphae*a were of little use. *Marsilia. Pistia* and *Lemna* were insignificant for gastropod association. This indicates that gastropods prefer Eichhornia-Hydrilla combination to *Ceratophyllum* and others for comfortable association.

The Majilsa pond displayed dense vegetation of *Hydrilla verticillata, Eichhornia crassipes and Nymphaea lotus*; a few *Potamogeton crispus* and a rare *Pistia stratiote, Lemna minor* and *Ceratoplhyllum demersum*. Among the gastropods all were present except *Cyclophorus indicus* and *Lymnae penguis*. Here, also *Hydrilla-Eichhornia* combination was held responsible for harbouring maximum gastropod fauna, *Nymphaea, Potamogeton* and *Ceratophyllum* were found associated with a few pulmonate gastropods.

The Harahi pond which had a negligible amount of hydrophytic vegetation throughout the year, was alsoreportedtobedevoidofgastropodfaunaexceptarareoccurrenceof*Melaniastriatella.*Theroots of *Eichhornia crassipes* were found harbouring numerous Chironomus larvae instead of gastropods. *Milania striatella* was collected from the mud and not from any plant part. Further, the study in Harahi indicates that thin and sporadic distribution of a few plants of Eichhornia cannot support the life activities of gastropods, rather thick and dense vegetation is a primary requirement for them. The results of the present investigation thus confirmed the findings of [11] who observed that *Eichhornia crassipes* and *Hydrilla verticillata* were the chief macrophytes for supporting gastropods in a pond at Bhagalpur(Bihar).However,theresultsdifferfromthefindingsofSoszkainMikolajskeilake and Pieczynska in Ueinskoe reservoir who found Potamogeton and Typha as the chief macrophytes for gastropod association respectively[10]

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