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RESEARCH ARTICLE

OCCURRENCE, DENSITY AND SEASONAL VARIATIONS OF MACROBRACHIUM DAYANUM IN A WETLAND ECOSYSTEM OF TRIPURA IN RELATION TO PHYSICO-CHEMICAL FACTORS

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ABSTRACT

The present paper makes a record for the occurrence of a freshwater prawn *Macrobrachium dayanum* in a wetland ecosystem of Tripura during March 2016 to February 2018. During two year study period, prawn population followed a definite rhythm of seasonal variations showing highest density(76 u/m^3) in the winter and lowest (18 u/m^3) during summer. Numerical abundance of *Macrobrachium dayanum* was observed in and around the peripheral root area of *Eichhornia crassipes*. Notable physico-chemical factors of the studied wetland were also observed and their degree of influence over the seasonal abundance of prawns was noted. The simple correlation coefficient shows that water temperature has negative and significant correlation(r = - 9431, P<0.01) with the abundance of total prawns. However, stepwise multiple regression analysis depicted that water temperature (P<0.01), pH (P<0.05), dissolved oxygen (P<0.05), dissolved organic matter (P<0.01) and phosphate phosphorus (P<0.01) have significant correlation with the abundance of total prawns.

Key words: Macrobrachium dayanum, Prawn Density, Seasonal variations, Physico-chemical factors, wetland ecosystem, Tripura.

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INTRODUCTION

In recent years, attention has been paid on prawns in aquaculture because of their greater value in domestic as well as international market (New, 1990). So, studies of those fauna become important in aquaculture point of view (Pillay, 1993). In order to identify them properly, taxonomical description of the said fauna is prerequisite (Kurian and Sebastian, 1986). By voracious predation, they greatly influence the structural dynamics of the ecosystem which supports the density as well as diversity of different phytoplankton and zooplankton (Wickins, 1976; Sandifer and Smith 1976; Christensen, 1996). Restricted distribution of prawn species in lentic water habitat may be attributed to varying biological features such as aquatic vegetation and species-specific food items (Tripathi, 1992; Qureshi, 1994; Chakrabarti 2010). So, knowledge of their ecological niche conditions is also needed to get a clear idea regarding their nature of distribution (FAO 1985). For understanding the seasonal dynamics of an organism, a population or a community, knowledge of both the organism and its environment is required (Chakrabarti 2009). The seasonal density of *Macrobrachium dayanum* is largely determined by the interactions and seasonal cycles of physico-chemical parameters in the lentic ecosystem (Jayalakshmi and Natarajan, 1986). Although specific physico-chemical factors may exert greater impact on their abundance, some parameters might affect their growth and survival (Maria, 1997).

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A look into the existing literature explicitly reveals that a number of works on prawn ecology were carried out in different aquatic ecosystem like pond and lake but wetland ecosystem did not receive due attention till to-date (Gopal and Mashing, 1990; Wetzel *et al.,* 1994). In the present study, an attempt was undertaken to observe the taxonomical characteristics, density as well as seasonal variations of *Macrobrachium dayanum* and the degree of influence of physico-chemical factors on the occurrence and abundance *Macrobrachium dayanum* in a wetland ecosystem of Tripura.

MATERIALS AND METHODS

The present study was carried out in a freshwater wetland located at Melaghar (Latitude $23^0$50'15"N and Longitude $91^0$15'45"E), Sepahijala district of Tripura during a period of March 2016 to February 2018. The wetland is irregular shaped, the surface area of which is about 3.2 hectare. The mean depth of the wetland varied from 76 cm in winter to 168 cm in the monsoon. The wetland is communicated with one side with Gomoti River. The northern part of the wetland is densely infested with *Eichhornia crassipes***.** The littoral zone of the wetland also harbours some species of macrophytes such as *Salvinia, Nelumbo, Lemna minor and Utricularia*. The description of the studied prawn is based on 208 samples which were studied in live conditions. The prawns were collected from the root area of *Eichhornia crassipes* by a special net sampler at weekly intervals during early morning

hours. To identify the studied prawn up to species level, the works of Hothuis (1980), Kurian and Sebastian (1986) and Jalihal *et al*. (1988) were consulted. To get a clear idea regarding the influence of physico-chemical factors on the occurrence as well as abundance of prawn species, some physico-chemical factors (such as water temperature, p^H , transparency) were determined in situ and the remaining parameters(such as dissolved oxygen, free carbon dioxide, bicarbonate, dissolved organic matter, silicate, chlorinity, salinity, phosphate phosphorus and nitrate nitrogen) have been analysed in the laboratory following the standard methods of APHA(1988). Statistical analysis such as correlation coefficient, stepwise multiple regression were performed to find out the degree of relationship between the physico-chemical parameters and prawn density of the studied wetland.

RESULTS AND DISCUSSION

The identified prawn species collected from the wetland was *Macrobrachium* dayanum (Figure 1 and 2). It belongs to family palaemonidae, genus *Macrobrachium* Bate, 1868 and species *Macrobrachium dayanum* Henderson1893.

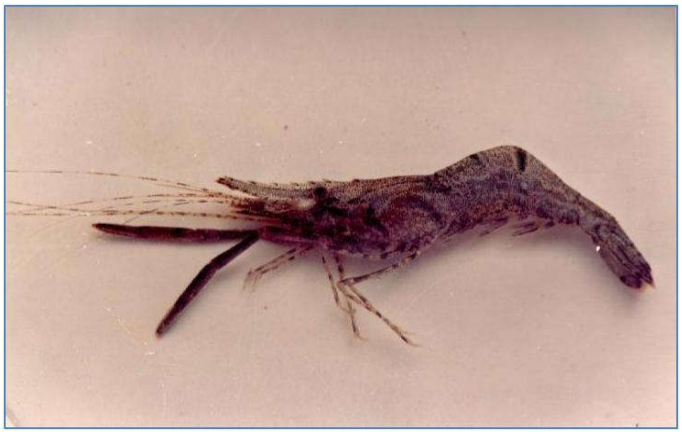

Figure 1. *Macrobrachium dayanum*(Male)

Figure 2. *Macrobrachium dayanum* (Female)

The taxonomical description of the identified prawn species viz., *Macrobrachium dayanum* is rostrum curved upwards, rostral formula 9/6 (dorsal/ventral) in most cases and 8-9/5-6 in some rare individuals; arrangement of dorsally placed rostrum teeth are not uniform; 5th walking legs are of the same length as the fourth; 2nd chelae of adult male equal or sub equal in shape; fingers of the 2nd chelae are grooved longitudinally and velvety hairs are inserted within the groove; the walking legs as well as dorsal body surface with brown stripe; Eggs of adult females are brownish in colour and small sized (less than 0.70 mm. Body length (male): 4.9-7.8 cm; Body length (female): 4.5-6.4 cm; Body width (proximal side):0.7-1.2 cm; Body width (distal side): 0.2-0.4 cm; Length of the 2nd walking leg: 2.3-4.0 cm. *Macrobrachium dayanum* exhibited highest density (76 u/m^3) in the winter (November to February) and lowest (18 u/m^3) in the sum mer (March to May) in both the study periods (Figure 3).

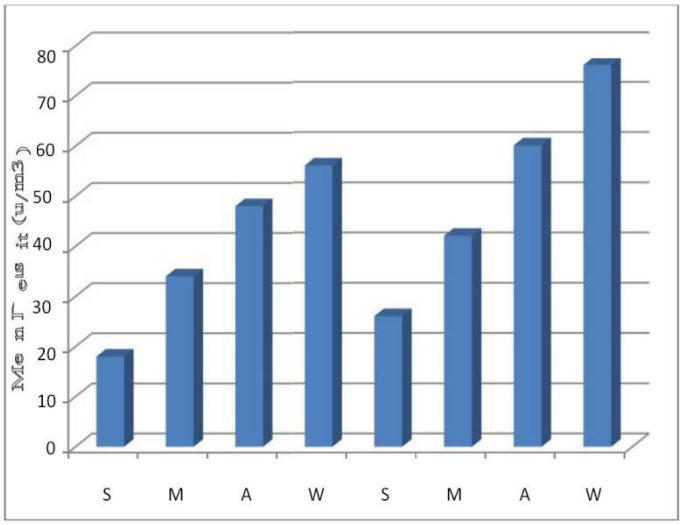

Figure 3. Seasonal variations in the mean density (u/m^3) of *Macrobrachium dayanum* in the studied wetland from March 2016 to February 2018

Several researchers (Wickins, 1976; Jalihal *et al.,* 1998; Chakrabarti, 2002) opined that during summer, when water bodies start shrinking, the prawn population become scarce in catches as a result of destruction of marginal macrophytes. Qureshi (1994) reported that the lower abundance of prawns in the vegetation free area was due to the sunlight factor. Chakrabarti(2010) opined that lower concentration of dissolved organic matter as well as low availability of live food biota during summer season will be the reason for low density of *Macrobrachium dayanum* in the studied wetland. Highest density of *Macrobrachium dayanum* during winter season may be due to favourable conditions like abundant live food biota in addition to optimal range of some physico-chemical factors like temperature, pH, dissolved oxygen etc., as reported earlier by several researchers (Strauss *et al.,* 1991; Nair and Salin, 2012; Kingdom *et al.,* 2013).

The present observation shows that the prawn population are comparatively more abundant under the macrophytes than those of the exposed littoral areas of the studied wetland ecosystem. Researchers (Jalihal *et al.,* 1988; Rao and Janaki Ram, 1992; Chakrabarti, 2010) opined that the occurrence as well as abundance of prawn population is dependent upon the degree of availability of food algae and the metabolic products of the macrophytes. So, the availability of prawn population in higher density in and around the macrophytes than those of the exposed littoral zones in the studied wetland indicates that the periphery of macrophytes forms a suitable ecological niche condition. Amongst physico-chemical factors (Table 1) water temperature exerts significant impact on the relative abundance of prawns (Marcela, 2011). In the present observation, maximum density that of *Macrobrachium dayanum* is encountered at a temperature range of 24-26^{0}C. Strauss *et al*. (1991) reported that p^H is one of the important influential factors on the occurrence as well as abundance of prawns. In the present study, higher numerical abundance of

Macrobrachium dayanum has been noticed in the p^H range of 6.4-7.2. Oxygen seemed to be an important limiting factor on the occurrence as well as abundance of the prawn species (Ukagwu *et al.,* 2017). However, in the present observation, higher numerical abundance of *Macrobrachium dayanum* was recorded in wide range of oxygen concentration (6.8-7.0ppm). The dissolved organic matter has been found to be important for the growth of live food biota (Jhingran, 1993). The phytoplanktonic algae which serve as food to the prawns is known to be strongly correlated with phosphate content of water (Chakrabarti, 2010). In the present observation, the highest density of prawns was noticed in the phosphate phosphorus range of 0.4-0.5ppm. The simple correlation coefficient shows that water temperature has negative and significant correlation($r = - 9431$, $P<0.01$) with the abundance of total prawns. However, stepwise multiple regression analysis depicted that water temperature ($P<0.01$), pH ($P<0.05$), dissolved oxygen ($P<0.05$), dissolved organic matter ($P<0.01$) and phosphate phosphorus($P<0.01$) have significant correlation with the abundance of total prawns though bicarbonate alkalinity and transparency did not depict any significant correlation (Table 2).

Table 1. Physico-chemical factors of the studied wetland

Physico-chemical factors	Range	Mean
Water Temperature (^{0}C)	11-31	23
Transparency (cm)	6.0-17	11.36
P^H	6.4-7.6	6.8
Bicarbonate alkalinity (ppm	54.0-132	86.31
Dissolved oxygen (ppm)	6.2- 8.6	6.47
Free carbon dioxide (ppm	2.0-4.0	2.31
Dissolved organic matter (ppm)	8.2-17.8	13.64
Silicate (ppm)	4.0-12.4	7.06
Chlorinity(ppm)	12-26	17.13
Salinity (ppt)	0.01-0.03	0.02
Phosphate phosphorus (ppm)	0.4-0.6	0.52
Nitrate nitrogen (ppm)	0.4-0.7	0.54

Table 2. Stepwise multiple regression analysis

Variables in regression	Reg. Coeff	S.F.	F	Beta Coeff.
Water Temperature	-47.033	4.132	111.057	-0.813**
$_pH$	0.027	0.031	0.756	0.153*
Dissolved oxygen	-15.375	6.139	7.633	- 0.317*
Bicarbonate alkalinity	0.051	0.013	5.134	0.537
Transparency	3.131	2.649	1.373	0.651
Dissolved organic matter	76.379	8.153	23.925	0.375**
Phosphate phosphorus	-21.073	8.533	6.191	-0.173 **

Asterisks indicate values are significant at $P<0.01$(**) and $P<0.05$(*)

Conclusion

Thus, the present observation infers that the occurrence as well as abundance of *Macrobrachium dayanum* may vary with seasons due to the dynamic nature of the aquatic ecosystem and might be also due to optimal condition in the physico-chemical factors of the freshwater lentic ecosystem.

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