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ECOLOGY OF *TRILOPHUS INTERPUNCTATUS* PUTZ., AN INTERTIDAL CARABID OF ESTUARY

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ABSTRACT

Trilophus interpunctatus Putz. is a predacious and regular inhabitant in the sandy intertidal belts of Sagar Island. This carabid was observed in the field during pre and postmonsoon seasons only. The occurrence of the beetles was controlled by a number of physico-chemical parameters of the environment. Rainfall and moisture were inversely related with the population whereas salinity was directly related. In estuarine conditions, actually the combined effect of these three parameters are responsible for the distribution and abundance of *T. interpunctatus*.

Key-words: *Trilophus* sp., insect, estuary.

Insects are primarily terrestrial or aerial organisms. But still a number of insect species are reported from the marine or estuarine ecosystem (Backlund, 1945; Ormachea, 1986; Jaramillo, 1987) and occupied important position in the trophic level of some part of the intertidal region (Cameron, 1972). Insects are mainly consumed by the fishes (Cheng and Birch, 1978). Among marine insects, coleoptera especially carabidae occupy a significant position and are reported from Atlantic, Mediterranean and Japanese coasts (Glynne - Williams and Hobart, 1952; Sato, 1964; Evans, 1968; Doyen, 1975). Records from tropics is almost nil. A small carabid beetle, *Trilophus interpunctatus* Putz., was observed to occur in some sandy intertidal regions of Hooghly estuary at a regular interval. During the two-year investigation, distribution and population structure of *T. interpunctatus* was carried out in relation to environmental parameters and the results are presented in this communication.

Sagar, the biggest island within the Hooghly estuarine complex was selected for the present investigation. Three sampling areas of one-metre square each were first marked at random on the intertidal region of the south-western side of the island, facing Bay of Bengal (Fig. 1). Five soil samples were collected at random from each sampling area with the help of a corer (5 x 5 x 5 cm) in every fortnight during receding tide. The insects were isolated from the sediment by water floatation technique (Moore, 1964) in the laboratory. Soil-temperature was measured by thermometer and over-drying method was followed for soil-moisture. For measuring soil-salinity,

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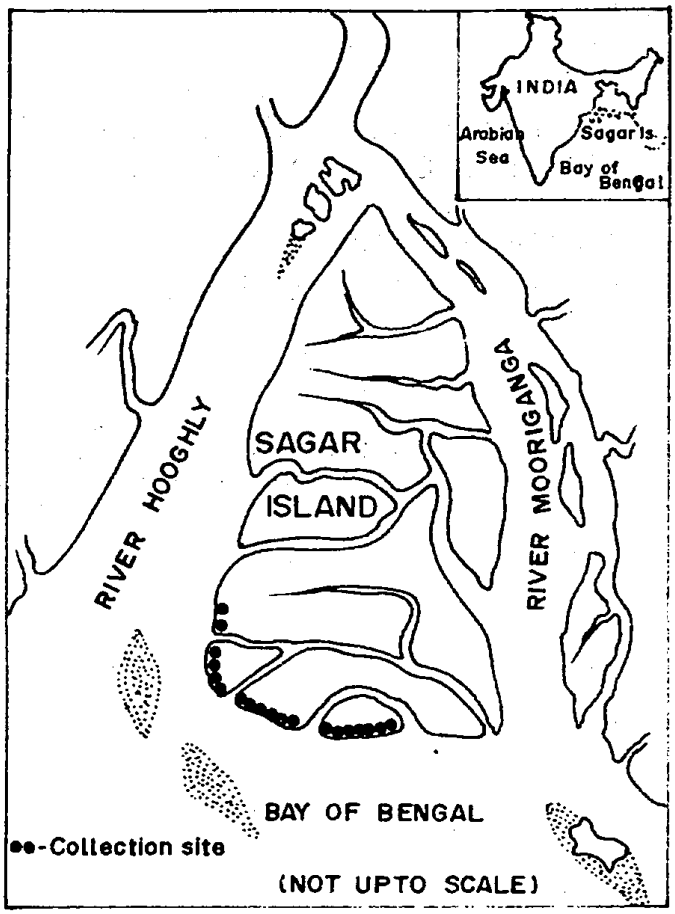

Fig. 1. Map of Sagar Island showing the position of collection site.

firstly, conductivity of the soil was determined from 1:5 soil-water suspension, using a Systronics Conductivity Bridge 305 at 25°C. Then this value was converted into salinity (ppt) by employing the formula as described by Jackson (1973). Rainfall and relative humidity data were collected from Alipore Meteorological Observatory, Calcutta. Statistical procedures were taken from Croxton (1959).

T. interpunctatus was found only during postmonsoon (November - February) and premonsoon (March - June) seasons and were totally absent during southwest monsoon (July - October) period (Fig. 2). The population density of this beetle in different seasons during the period of investigation (November 1983 - October 1985) varied significantly (χ = 8.933; $P<0.05$). Fig. 3 shows the variability of the abiotic parameters over the period of investigation. Furthermore, coefficient of variation (C.V.) results of abiotic parameters indicated that rainfall (C.V. 141.04%), salinity (C.V. 82.20%) and moisture (C.V. 46.23%) were more variable over months in estuarine

condition as compared to temperature (C.V. 11.46%) and relative humidity (C.V. 7.92%). Non-linear correlation coefficients indicated that highly variable factors (rainfall, salinity, moisture) were significantly correlated with population whereas less variable factors (temperature and relative humidity) did not exert any significant influence (Table I). Moisture, salinity and rainfall affected the population individually and in combination too. But the maximum variation in population could only be explained when the combined influence of the three factors were taken into consideration (Table I).

Insects exhibit outstanding success in colonizing terrestrial and freshwater environments but are poorly represented in marine littoral situations due to various

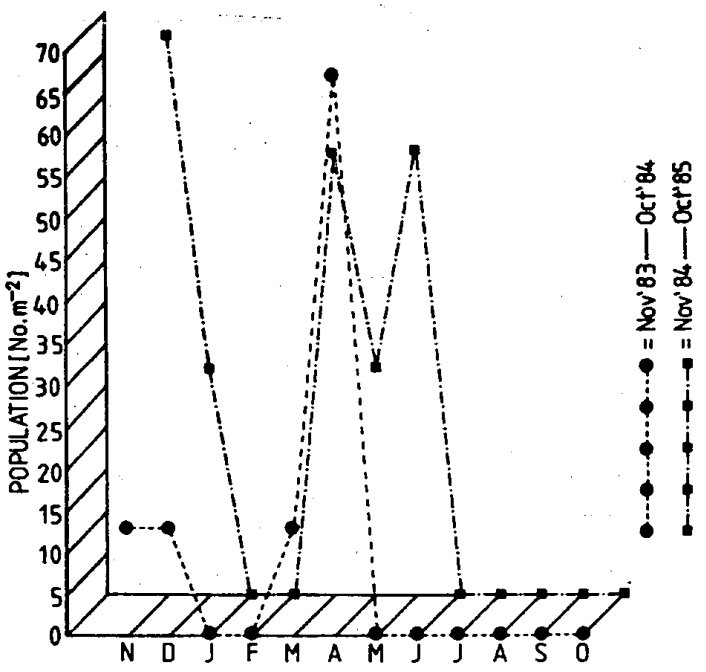

Fig. 2. Fluctuations in the population of *T. interpunctatus* during the period of investigation.

Table I – Result of non-linear correlation coefficients (d.f. 22) and multiple correlation coefficients.

	Temp. (log X_2)	R.H. (log X_3)	Moisture (log X_4)	Salinity (log X_5)	Rainfall (log X_6)
Population (log X_1)	0.118	-0.056	-0.447*	0.494*	-0.645**

$R_{1.45} = 0.518$; $F = 3.844^*$; d.f. 2,21
$R_{1.46} = 0.652$; $F = 7.761^{**}$; d.f. 2,21
$R_{1.56} = 0.649$; $F = 7.635^{**}$; d.f. 2,21
$R_{1.456} = 0.650$; $F = 5.091^{**}$; d.f. 3,20

* = Significant at 5% level, ** = Significant at 1% level

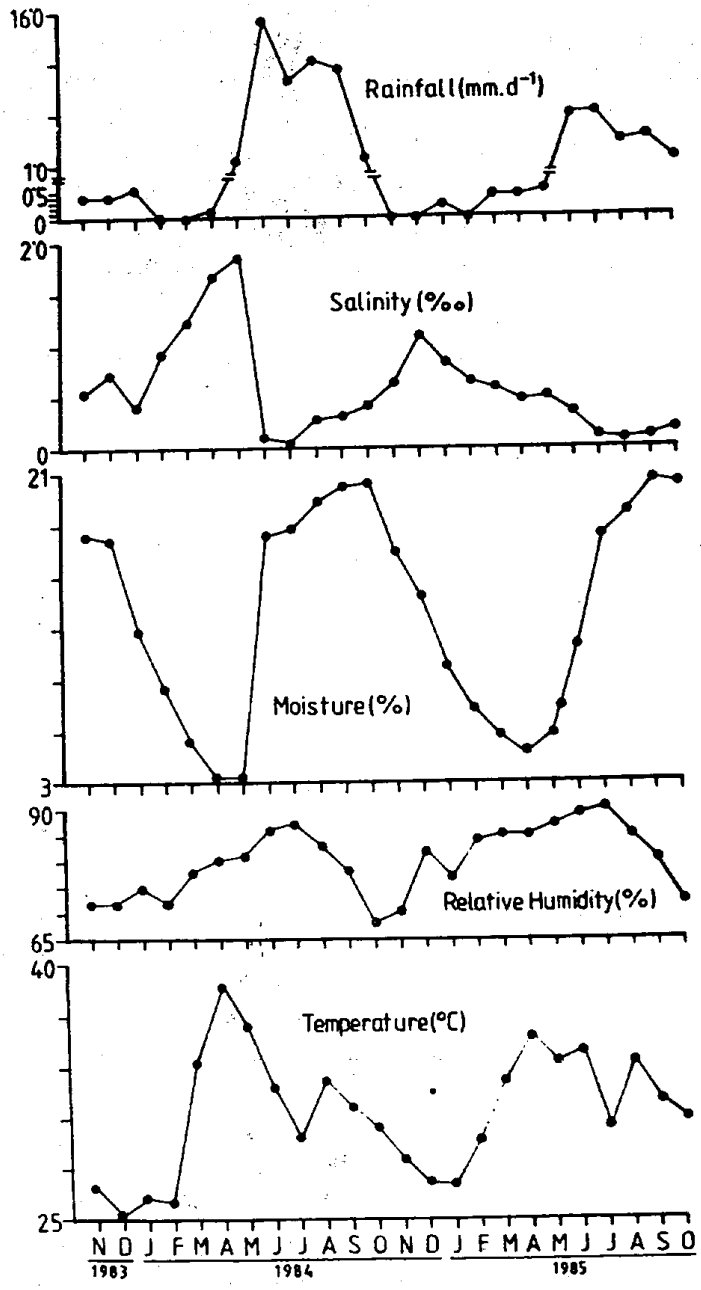

Fig. 3. Monthly variations in environmental parameters at Sagar Island during November, 1983 to October, 1985.

reasons (Cheng, 1976). But few coleoptera form a conspicuous part of the fauna of saline environments (Evans, Ruscoe and Treherne, 1971). Our present intertidal survey surprisingly demonstrated that *T. interpunctatus* forms an accountable part of the fauna of intertidal zone in Sagar Island. Population distribution in open beach

appears to be determined by the nature of the substratum, while density within areas of suitable texture is a function of edaphic factors and food availability. The investigated site was thickly covered by fine sand particles, coming from the sand dunes of landward side, from March onwards due to strong wind action; but it was again eroded at the onset of heavy precipitation (Paul and Bandyopadhyay, 1986). *T. interpunctatus* mostly occurred in premonsoon months and totally absent during monsoon months. The shifting of sands of the beaches destroy the burrow system and adversely affects the population (Griffiths and Griffiths, 1983). Heavy rainfall changed the beach configuration of Sagar Island. The upper loose sandy layer was completely washed out and destroyed the habitat locale of the species concerned. In the present study, rainfall was negatively correlated with population density. The salinity of the natural habitats restrict a good number of enemies and competitors that thrive badly at high salinities (BroLarsen, 1952). *T. interpunctatus* was adapted to high salinity regime, although their prey population was limited. Higher soil moisture was proved non-congenial to this insect which might be due to the fact that water logging for a long time might cause respiratory trouble or breaking down of the burrow that was dug in the loose sandy substratum.

It can be stated that *T. interpunctatus* is adapted for burrowing into the loose sandy substratum during extreme environmental conditions when food availability is minimum. But due to minimum competitive pressure for food and space from other groups, they can totally and successfully utilize the little available food available in the intertidal belt.

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