Population structure analysis of larval rove-beetle in the intertidal zone of Sagar Island, Sunderbans, India

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Abundance of larval rove-beetles under the influence of various physico-chemical parameters was studied in a tidal area during November 1983 to October 1985. The seasonal changing pattern of some environmental components (moisture, pH, salinity) showed profound impact on the fluctuating abundance of the larvae. Monsoon months (July to October) were most congenial period to support maximum number (840 m\(^{-2}\) in October 1984 and 1533 m\(^{-2}\) in October 1985) of larval individuals.

Materials and Methods

Sagar Island, the largest delta of Sunderbans situated nearly 85 km south of Calcutta (21°31'N to 21°53'N and 88°02'E to 88°15'E), is surrounded by large waterbodies, river Hooghly in the north and north-western side and river Mooriganga in the eastern side. The southern part of the island faces the open sea, Bay of Bengal.

The collection site was situated at the confluence of river Hooghly with Bay of Bengal, i.e., in the southern part of the island. The substratum of the collection area was sandy during the period of investigation in all seasons.

Larval populations were sampled from the intertidal sandy beach at fortnightly interval (November 1983 to October 1985) during neap tide period between 0800 and 1000 hrs. There were 3 plots (1 m\(^2\)) each consisting of 5 samples. Each sample consisted of 25 cm\(^2\) area cut neatly to a depth of 5 cm by a corer. Larvae were removed from the soil by simple water floatation technique and placed in 70% alcohol and counted subsequently. Simultaneously with the larval sampling eight environmental parameters, viz, air temperature, soil-temperature, moisture, pH, salinity, organic carbon and available phosphorus and bay water salinity were also measured using standard procedures. Rainfall data of Sagar Island were collected from Regional Meteorological Centre, Alipore. Relation between biotic and abiotic parameters were assessed by correlation coefficients.

Results and Discussion

The seasons here are well recognised: premonsoon (March to June) is the dry season with considerably higher temperature; monsoon (July to October) is accompanied by heavy precipitation; and postmonsoon (November to February) comprises partly the winter season with comparatively lower temperature and less precipitation. The larvae of rove-beetles, an inhabitant of the littoral zone, showed significant seasonal pattern. They were absent during premonsoon whereas monsoon months supported the maximum numbers (Fig. 1). During the first year of investigation (November 1983 to October 1984), the population was nil from January to May 1984 and the
maximum number was 840 m$^{-2}$ in October 1984. In the next year (November 1984 to October 1985), the maximum population was also recorded in October (1533 m$^{-2}$) and they were totally absent from January to June 1985. The environmental factors also exhibited fluctuations (Fig. 2). The air and soil temperatures varied from 26.8$^\circ$ to 34.5$^\circ$C and 25.0$^\circ$ to 37.8$^\circ$C respectively during the period of investigation. Soil moisture and rainfall showed their peaks during the monsoon and the lowest data for the same were recorded during the premonsoon. Just the reverse trend was recorded in case of soil salinity and bay water salinity. Soil $p$H fluctuated from 8 to 8.5 during the study period. The highest and the lowest data recorded for organic carbon and available phosphorus were 0.24% and 0.06% and 4.95 mg.100 g$^{-1}$ and 0.89 mg.100 g$^{-1}$ respectively.

Among the nine abiotic factors studied, 4 exhibited positive correlation with the population and the remaining 5 were negatively correlated, though all were not significant (Table 1). The environmental parameters were also correlated among themselves.

![Fig. 1 - Monthly larval abundance during November 1983 to October 1985](image)

![Fig. 2 - Fluctuations in environmental factors during November 1983 to October 1985](image)

<table>
<thead>
<tr>
<th>A = Larval Abundance (Nov'83 to Oct'84)</th>
<th>B = &quot; &quot; (Nov'84 to Oct'85)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Graph" /></td>
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</tbody>
</table>

**Table 1 - Simple correlation coefficients ($r$) obtained**

<table>
<thead>
<tr>
<th></th>
<th>Air temp.</th>
<th>Soil temp.</th>
<th>Soil moisture</th>
<th>Soil $p$H</th>
<th>Soil salinity</th>
<th>Organic C</th>
<th>Available PO$_4$</th>
<th>Water salinity</th>
<th>Rainfall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>-0.023</td>
<td>0.078</td>
<td>-0.652**</td>
<td>-0.633**</td>
<td>-0.434*</td>
<td>0.223</td>
<td>-0.057</td>
<td>-0.533**</td>
<td>0.359</td>
</tr>
<tr>
<td>Air temp.</td>
<td>0.933**</td>
<td>-0.269</td>
<td>0.044</td>
<td>0.370</td>
<td>-0.419*</td>
<td>-0.700**</td>
<td>0.335</td>
<td>0.178</td>
<td>0.178</td>
</tr>
<tr>
<td>Soil temp.</td>
<td>-0.262</td>
<td>0.047</td>
<td>-0.607**</td>
<td>-0.771**</td>
<td>-0.422*</td>
<td>-0.090</td>
<td>-0.915**</td>
<td>0.621**</td>
<td>0.621**</td>
</tr>
<tr>
<td>Soil moisture</td>
<td>-0.607**</td>
<td>0.393*</td>
<td>-0.308</td>
<td>0.122</td>
<td>-0.490*</td>
<td>-0.081</td>
<td>0.796**</td>
<td>-0.605**</td>
<td>0.176</td>
</tr>
<tr>
<td>Soil $p$H</td>
<td>-0.771**</td>
<td>-0.308</td>
<td>0.122</td>
<td>0.081</td>
<td>0.176</td>
<td>0.017</td>
<td>-0.426*</td>
<td>0.077</td>
<td>-0.021</td>
</tr>
<tr>
<td>Soil salinity</td>
<td>-0.422*</td>
<td>-0.490*</td>
<td>0.176</td>
<td>0.081</td>
<td>0.176</td>
<td>-0.426*</td>
<td>0.077</td>
<td>-0.456*</td>
<td>-0.617**</td>
</tr>
<tr>
<td>Organic C</td>
<td>0.393*</td>
<td>-0.308</td>
<td>0.122</td>
<td>0.081</td>
<td>0.176</td>
<td>0.017</td>
<td>-0.426*</td>
<td>0.077</td>
<td>-0.456*</td>
</tr>
<tr>
<td>Available PO$_4$</td>
<td>-0.771**</td>
<td>-0.490*</td>
<td>0.176</td>
<td>0.081</td>
<td>0.176</td>
<td>0.017</td>
<td>-0.426*</td>
<td>0.077</td>
<td>-0.617**</td>
</tr>
<tr>
<td>Water salinity</td>
<td>-0.302</td>
<td>-0.302</td>
<td>-0.302</td>
<td>-0.302</td>
<td>-0.302</td>
<td>-0.302</td>
<td>-0.302</td>
<td>-0.302</td>
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**= Significant at 1% level  
* = Significant at 5% level
The distribution and abundance of larvae are influenced by various physico-chemical factors of this complex ecosystem. Soil-moisture was significantly correlated with larval population at 1% level of significance. So, it is pertinent to infer that any alteration in the soil microclimate in relation to moisture seems to have a substantial impact on the abundance and distribution of benthic larvae. Salinity, perhaps, is the most variable component of this ecosystem which really exerts perceptible impact on the behaviour of the littoral community. The high and often widely vacillating salinities, both soil and water, had significant negative correlation with the population of larvae. Hence, the viability of salinity as a decisive factor in occurrence and abundance of the larvae in such complex vulnerable ecosystem is unquestionable. Another strong factor was soil pH which also exerted influence on larval distribution; it was negatively correlated. Other parameters measured at the time of investigation were not significantly correlated. Therefore, the present results indicate that some environmental factors could not establish their direct role in population regulation. On the other hand, soil moisture, pH and salinity and water salinity have some positive role in maintaining the rhythm of the population abundance of larval rove-beetle.

Acknowledgement

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References

2. Walsh G B, Entomol Mon Mag, 61 (1925) 137.