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Sediment–ostracode relationship in the Bimili backwater and the Balacheruvu tidal stream

C ANNAPURNA and D V RAMA SARMA
Zoology Department, Andhra University, Waltair 530 003, India

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Abstract. Based on the collections of benthic ostracodes during January–December 1977 from two selected marginal water bodies, namely Bimili backwater and Balacheruvu tidal stream on the east coast of India, the quantitative variations in the ostracode fauna have been studied in relation to the sedimentological characteristics like sand, silt and clay and organic matter content.

Keywords. Marginal water bodies ; sedimentological characteristics ; organic matter in sediment ; ostracode assemblages.

1. Introduction

Studies on sediment–ostracode relationship are rare and whatever is available are mainly concerned with the distribution of dead fauna. Moreover, information on the distribution, sedimentological and ecological relationship of living benthic ostracodes has been published either in taxonomic papers or in publications principally concerned with the ecology of other groups. The studies of Remane (1933), Klie (1936), Elofson (1941), Smidt (1951), Wieser (1959, 1960), Kornicker (1964), Kornicker and Wise (1960), Puri *et al* (1964), McIntyre (1964), Engel and Swain (1967), Williams (1969), King and Kornicker (1970), Joy and Clark (1977) and Athersuch (1979) have shown that the nature of the substratum and organic matter content play a vital role in controlling the biota in the habitat.

Malkin (1954) and Swain (1955) did not find any pronounced correlation between the distribution of ostracodes and character of the substratum. Kornicker (1958) found that the correlation was disappointing in the Bimili area, Great Bahama Bank, while Benson (1959) found that sediment had a marked influence on some of biofacies in Estero de Puncta Banda.

In the present investigation an attempt has been made to establish a possible relationship between the ostracode fauna and the sediments in two selected bodies of water, Bimili backwater and Balacheruvu tidal stream.

2. Areas of investigation

Bimili backwater : The area covered is an extensive shallow backwater about 4·5 sq. km towards the north of Bheemunipatnam (Long. 83° 28′ E ; Lat. 17°

54′ N). Three nearly equidistant stations (I to III) are located for collection of samples (figure 1).

Balacheruvu tidal stream : This meandering stream opens into Bay of Bengal 15 km (by coast line) south of Visakhapatnam (Long. 83° 15′ E; Lat. 17° 39′ N). Three stations (I to III) are located in the course of the stream for the collection of samples (figure 2).

3. Material and methods

Collections were made at monthly intervals for one year (January–December 1977) at six fixed stations, three in the Bimili backwater and three in the Balacheruvu tidal stream. For quantification of ostracodes, collections were made using a device developed by Phleger (1960) and the density of ostracode fauna was expressed as number per 10 cm^2.

To study sediment composition and its organic matter, sediment was collected by pushing a PVC corer of 4·5 cm diameter. Sand, silt and clay fractions in the sediment were estimated by the pipette method of Krumbein and Pettijohn (1938). Organic matter was estimated by the method of Gaudette *et al* (1974).

4. Results

Seasonal variations in fauna in relation to sedimentological parameters are shown in figures 3 and 4. In the Bimili backwater, the organic matter content ranged from 0·32 to 4·12%. In general, higher values were recorded in July which marks the end of hot weather season and the establishment of the south-west monsoon season when drainage from the land was high. In addition, the contribution of organic matter by the decaying algae which grows densely on the western margin of the backwater is significantly high.

In the Balacheruvu stream, the organic matter content ranged from 0·34 to 3·56%. Higher values of organic matter were observed at station II compared to the values at stations I and III.

Sediment analyses show that sand was dominant over the silt and clay fractions at all the stations in the Bimili backwater and the Balacheruvu stream. Hence sediments of Bimili and Balacheruvu may be categorised as sandy areas following the categorisation of Folk (1968).

At station I in the Bimili backwater ostracodes were present in greater numbers from March through September than during the remainder of the year. Except for a peak in May, the abundance of ostracodes at station II did not vary markedly during the year. At station III ostracodes were encountered in considerable numbers in January, and from May to July.

In the Balacheruvu tidal stream ostracodes were encountered in considerable numbers in January, February and December collections. At station II, ostracodes were present from August to December in higher numbers compared to other months. Except for a peak number in January, the abundance of ostracodes at station III did not vary markedly during the year.

At stations I and II of Bimili and Balacheruvu the maximum in the seasonal abundance of live ostracodes coincided with the highest organic matter content. Slight deviation from this trend was seen at station III in both areas.

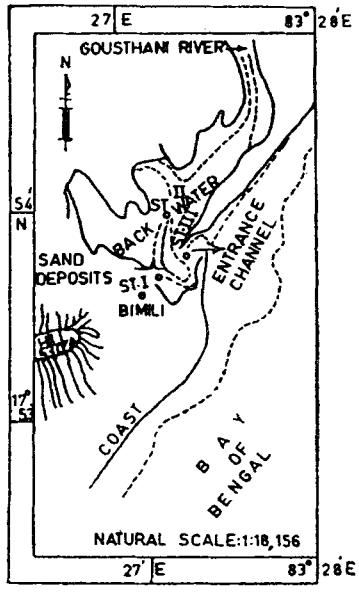

Figure 1. Location map of Bimili backwater.

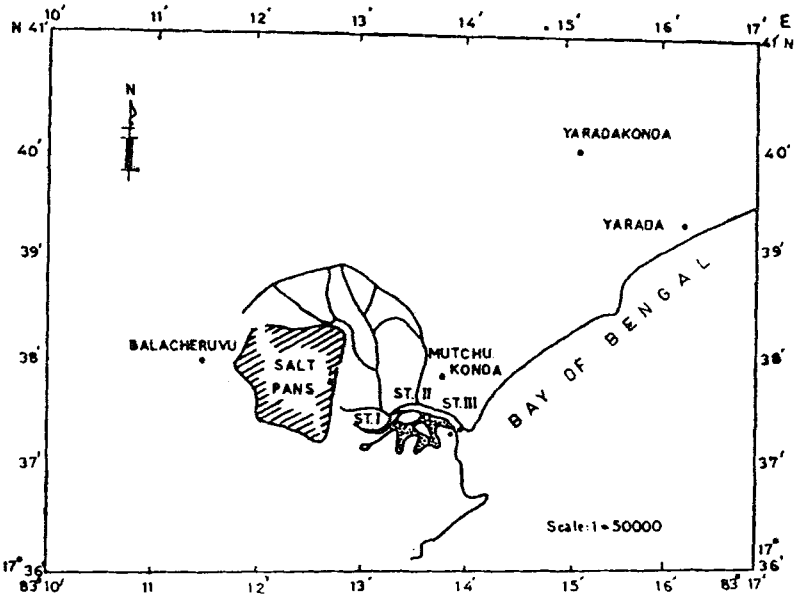

Figure 2. Location map of Balacheruvu tidal stream.

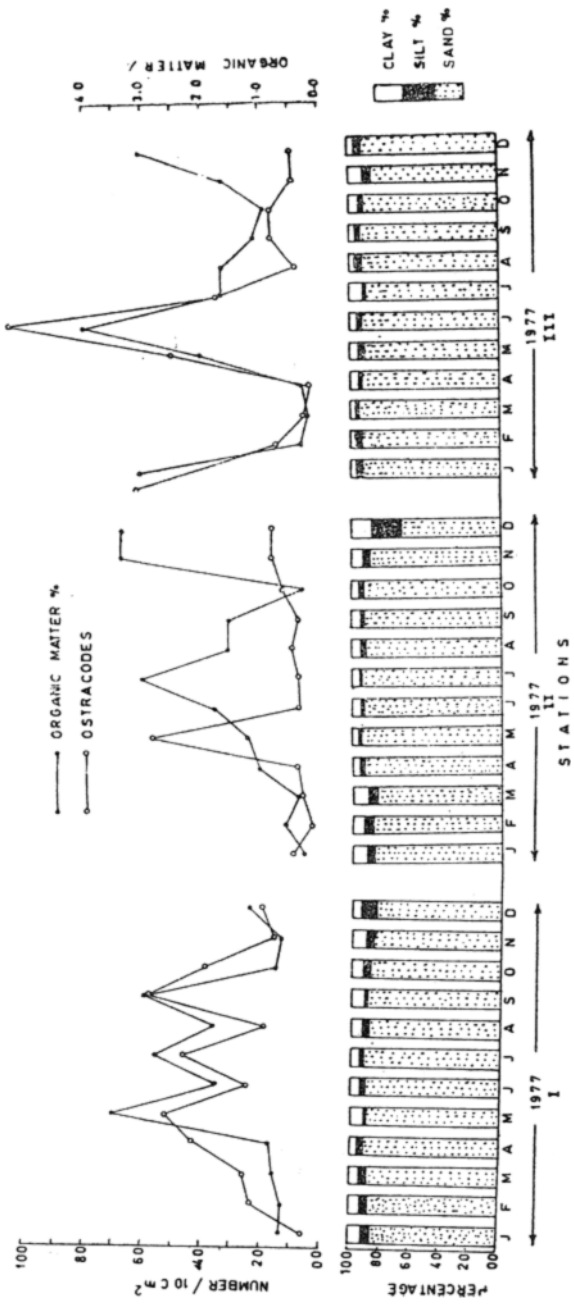

Figure 3. Monthly variations in organic matter, sand, silt and clay percentages in the sediments and ostracode fauna in the Bimili backwater.

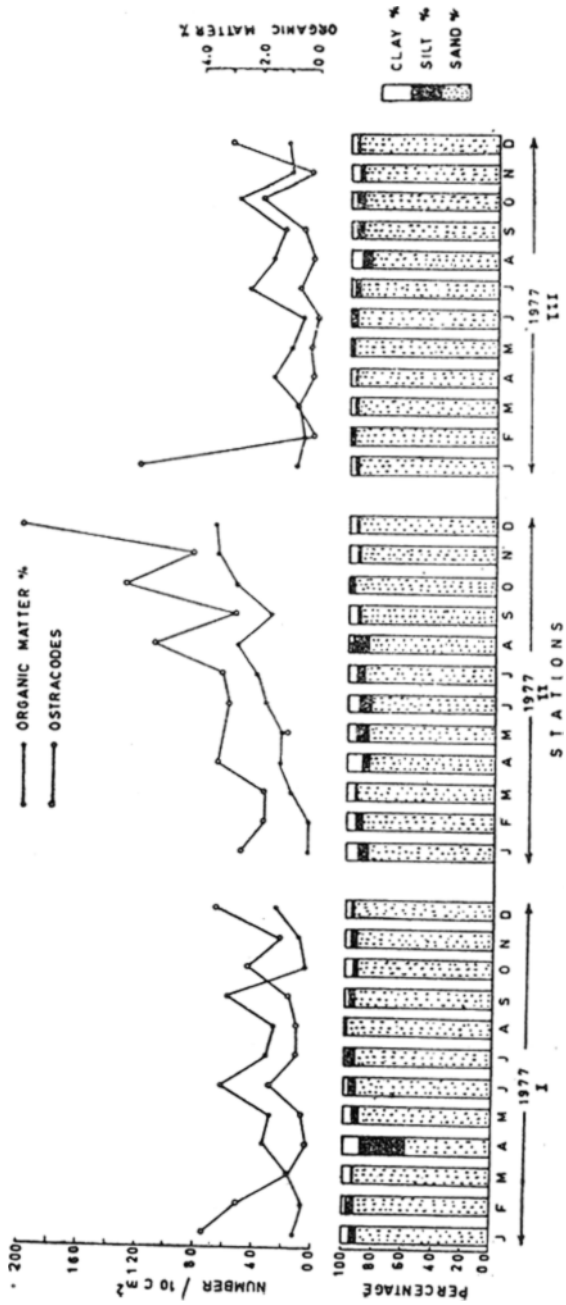

Figure 4. Monthly variations in organic matter, sand, silt and clay percentages in the sediments and ostracode fauna in the Balacheruvu tidal stream.

The sand, silt and clay fractions at the six stations during different months, when viewed in the background of total numbers of ostracodes, clearly indicate that ostracode abundance increased as the sand and clay content increased and silt content decreased. At station I in the Balacheruvu stream, the sand content was below 60% and silt above 10% in April and a fall in the ostracode numbers coincides.

Relatively higher numbers of ostracodes were encountered at station III of Bimili and station II of Balacheruvu, compared to the other stations. It is interesting to note that sediments at the above stations hold a higher sand and clay fraction and relatively high percentage of organic matter content.

5. Discussion

Throughout the survey conducted in Balacheruvu and Bimili backwater, samples contained faecal pellets in large quantities which the ostracodes seem to nibble indicating that the pellets form a sizable source of food. The fact that faecal pellets serve as the food source for the ostracode fauna is well established (King and Kornicker 1970).

The ostracode abundance in the areas of study increased with the availability of organic matter. The ostracode abundance varying with availability of food was observed by Swain (1955), Engel and Swain (1967) and Joy and Clark (1977).

A close examination of the pattern of distribution of ostracodes in relation to the sediment composition reveals that ostracodes prefer areas high in sand and clay fraction rather than silty areas. Thus Balacheruvu and Bimili sustain ostracodes in considerable numbers. This observation agrees with those made elsewhere in similar localities by Klie (1936), Elofson (1941), Smidt (1951), Benson (1959), Wieser (1959, 1960), McIntyre (1964) and Williams (1969).

High density of ostracodes observed in the shallow backwater and the tida stream is due to the high rate of photosynthesis of diatoms in the sediments. This observation agrees with those made elsewhere in similar localities by Hagermann (1967).

The stability structure of the sediment exerts a strong influence on the marine ostracodes in the selection of a suitable substratum. While the smooth-shelled forms prefer fine-grained muds, the rough and more ornate ostracodes prefer coarse or calcareous sediments. Such terms like endopelose (silt and clay burrowers), epipelose (silt and clay wanderers) and epipsammon (sand surface crawlers) have been suggested by Remane (1933) and Elofson (1941) for ostracode assemblages typical of certain bottom sediments which emphasize the control of the substrate over the character of associated assemblages.

In the present study smooth-shelled forms like *Phlyctenophora* occurred in sand-dominated areas but not in muddy areas. Forms such as *Tanella, Loxoconcha, Paijenborchellina* and *Atjehella* which are sculptured and heavily ornamented were encountered in considerable abundance in the sandy areas. *Palmenella* which is the characteristic genus of station III of Bimili backwater is known to be epipelitic (Remane 1938).

The foregoing account suggests that substratum plays a major role in the distribution of ostracodes both qualitatively and quantitatively. Regions of sandy sediments containing high percentage of organic matter content were more densely populated.

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