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Taxonomy and distribution of meiobenthic intertidal foraminifera in the coastal tract of Midnapore (East), West Bengal, India

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A B S T R A C T

Taxonomy and distribution of recent meiobenthic intertidal foraminifera in the coastal tract of Midnapore District have been studied for a period of two years (March, 2009- February, 2011). A total of 44 meiobenthic foraminiferal species belonging to 22 genera, 17 families, 14 super families and 7 orders has been recorded from the intertidal belts of this coastal environment. Faunal assemblages revealed a dominance of the order Rotaliida (20 species) followed by the order Miliolida (9 species), order Lituolida (7 species), Lagenida (3 species), Trochamminida (2 species), Buliminida (2 species) and order Textulariida (1 species). *Asterorotalia trispinosa, A. multispinosa, A. dentata, Ammonia beccarii, A. tepida, Miliammina fusca, Quinqueloculina seminulum, Trochammina inflata, Ammobaculites agglutinans, Elphidium hispidulum,* and *E. crispum* were found to be the most abundant foraminifera recorded from different study sites during different seasons.

Introduction

Studies on recent benthic foraminifera along the intertidal beach sediments of India were very few. Occurances of recent benthic foraminifera along the west coast of India has been reported by Bhalla et. al., 1980a; Antony, 1980; Bhalla et. al., 1980b; Setty et. al., 1984; Nigam, et.al., 2000 and Katz et.al., 2010. Such studies along the east coast of India in general and along the West Bengal coast, in particular were absolutely rare (Ghosh, 1966; Majumdar et. al., 1996, 1999; Majumdar, 2004). Murray, 2006 had reported intertidal recent benthic foraminifera from the West Bengal coast. The present investigation has attemped to deal with the qualititive and quantitative studies on recent benthic foraminifera along the intertidal zone of Midnapore (East) coast, India.

Seasonal samplings of benthic foraminifera were made from three selected intertidal zones of the coastal tract of Midnapore (longitudinal extension $87^0$20' E to $88^0$5' E and latitudinal extension $21^0$30' N to $22^0$2' N), namely study site – I (Junput), II (Sankarpur) and III (Talsari) from March 2009 to February 2011 (Figure 1).

The three study sites along the coastal tract of Midnapore District were selected considering their contrasting ecological conditions. The study site I (S-I) is a mudflat with least mangrove vegetation and some degree of riverine influence; study site II (S-II) is a sandflat having moderate presence of mangrove vegetation in the viscinity of fishing harbor and tourist resort and Study site III (S-III) is an intertidal belt having both mudflat and sand flat with a mangrove patch and a considererable influence of river Subarnarekha. The mangrove vegetation in the study sites includes *Avicennia officinalis, A. alba, A. marina, Acanthus ilicifolius, Ipomoea pes-caprae, Salicornia brachiata, Suaeda maritima, Ceriops decandra, Sonneratia apetala, Aegiceras corniculatum, Spinifex littoreus, Porteresia coarctata, Casuarina equisetifolia* etc.

Materials and Methods

Sediment samples were collected randomly from each study site by means of a indigenous PVC sampler. The top one cm. was separated from each sample and fauna were preserved in a 10% buffered formaline solution. The samples were removed and mixed thoroughly to prepare a composite sample. Finally one fifth of this composite sample (100 cm^3) was taken for routine foraminiferal analysis following wet sieving and flotation technique (Schroder et. al., 1987, Saraswat et. al., 2004; Ernst et, al., 2006; Sabean et. al., 2009).

Result

Out of the 44 meiobenthic intertidal foraminifera faunal assemblages revealed a distinct dominance of the order Rotaliida (65%) (presented by 20 species, 8 genera, 6families and 5 super families) followed by order Lituolida (15%) (7 species, 5 genera, 4 families and 3 super families), order Miliolida (14%) (9 species, 3 genera, 2 families and 1 super family), order Trochamminida (4%) (2 species, 2 genera, 1 family and 1 super family), order Lagenida (1%) (3 species, 2 genera, 2 families and 2 super families), order Buliminida (1%) (2 species, 1 genera, 1 family and 1 super family) and order Textulariida (0%) (1 species, 1 genera, 1 family and 1 super family) from the coastal tract of Midnapore (Table -1&2).

Discussion

Quality and stability of substratum, salinity, nutrients, turbidity, turbulance etc. play vital role in controling the abundance and distribution of recent benthic foraminifera. Relative abundance is an important community parameter particularly when seasonal fluctuations are concerned and also in ascertaining dominance of the species in a community. Some species are strictly opportunistic and occur in great abundance when conditions are highly favorable, and become scarce when conditions are unfavorable. Such species show considerable temporal variation in relative abundance. In contrast to these the species which are neither very common nor very rare show little variation in relative abundance.

A taxonomic checklist of the recorded foraminiferal species following taxonomic scheme of Loeblich and Tappan, 1988 (30) is given hereunder:

TAXONOMIC CHECK LIST

Order	:	LITUOLIDA
Super family	:	RZEHAKINACEA (Cushman,1933)
Family	:	RZEHAKINIDAE (Cushman, 1933)
Genus	:	Miliamina (Heron- Allen and Earland, 1930)
Specimen	:	*Miliamina fusca* (Brady)
Super family	:	HORMOSINACEA (Haeckel, 1894)
Family	:	REOPHACIDAE
Genus	:	Reophax (Rhumbler, 1895)
Specimen	:	*Reophax dentaliniformes* (Brady)
Super family	:	LITUOLACEA (de Blainville, 1827.)
Family	:	HAPLOPHRAGMOIDIDAE
Genus	:	Cribrostomoides
Specimen	:	*Cribrostomoides jeffreysi* (Williamson)
Genus	:	Haplophragmoides (Cushman, 1910)
Specimen	:	*Haplophragmoides canariensis* (d' Orbigny)
Family	:	LITUOLIDAE (de Blainville, 1827)
Genus	:	Ammobaculites (Cushman, 1910)
Specimen	:	*Ammobaculites agglutinans* (d' Orbigny)
		A.americanus (Cushman)
		A.exiquus (Cushman and Bronimann)
Order	:	TROCHAMMINIDA (Schwager, 1877)
Super family	:	TROCHAMMINACEA (Schwager, 1877)
Family	:	TROCHAMMINIDAE (Schwager, 1877)
Genus	:	Arenoparrella (Anderson, 1951)
Specimen	:	*Arenoparrella mexicana* (Kornfeid)
Genus	:	Trochammina (Parker and Jones, 1859)
Specimen	:	*Trochommina inflata* (Montagu)
Order	:	TEXTULARIIDA
Super family	:	TEXTULARIACEA
Family	:	TEXTULARIIDAE (Ehrenberg, 1838)
Genus	:	Textularia (De france, 1824)
Specimen	:	*Textularia agglutinans* (d'Orbigny)
Order	:	MILIOLIDA (Delage and Herouard, 1896)
Super family	:	MILIOLACEA (Ehernberg, 1839)
Family	:	SPIROLOCULINIDAE (Weisner, 1920)
Genus	:	Spiroloculina (d'Orbigny, 1826)
Specimen	:	*Spiroloculina depressa* (d'Orbigny)
		S. indica (Cushman and Todd).
Family	:	HAUERINIDAE (Schwager, 1876)
Genus	:	Quinqueloculina (d'Orbigny, 1826)

Specimen	:	*Quinqueloculina lamarckiana* (d'Orbigny)
		Q. seminulum
		Q. vulgaris (d'Orbigny)
		Q. venuata
Genus	:	Triloculina (d'Orbigny, 1826)
Specimen	:	*Triloculina brevidentata* (Cushman)
		T. insignis (Brady)
		T. trigonula (Lamarck)
Order	:	LAGENIDA (Delage and Herouard, 1896)
Super family	:	NODOSARIACEA (Ehrenberg, 1838)
Family	:	LAGENIDAE (Reuss, 1862)
Genus	:	Lagena (Walker and Jacob, 1798)
Specimen	:	*Lagena perlucida* (Montagu)
		L. interrupta (Montagu)
Super family	:	POLYMORPHINACEA
Family	:	GLANDULINIDAE
Genus	:	Glandulina
Specimen	:	*Glandulina laevigata*
Order	:	BULIMINIDA (Glaessner, 1937)
Super family	:	BOLIVINACEA (Glaessner, 1937)
Family	:	BOLIVINIDAE (Glaessner, 1937)
Genus	:	Bolivina (d'Orbigny, 1839)
Specimen	:	*Bolivina seminude* (Cushman)
		B.striatula (Cushman)
Order	:	ROTALIIDA
Super family	:	DISCORBACEA
Family	:	BAGGINIDAE (Cushman, 1927)
Genus	:	Cancris (de Montfort, 1808)
Specimen	:	*Cancris auriculus* (Fichtel and Moll)
Super family	:	PLANORBULINACEA
Family	:	CIBICIDIDAE
Genus	:	Cibicidoides (de Montfort, 1808)
Specimen	:	*Cibicidoides wuellerstorfi*
Super family	:	NONIONACEA (Schultze, 1854)
Family	:	NONIONIDAE (Schultze, 1854)
Genus	:	Nonion
Specimen	:	*Nonion scaphum*
		N. boueanum
Genus	:	Nonionella (Volshinova, 1958)
Specimen	:	*Nonionelln labradorica* (Dawson)
		N. turgida (Williamson)
		N. grateloupi
Super family	:	CHILOSTOMELLACEA (Brady, 1881)
Family	:	GAVELINELLIDAE (Hofker, 1956)
Genus	:	Hanzawaia (Asano, 1944)

Specimen	:	*Hanzawaia concentrica* (Cushman).
Super family	:	ROTALIACEA (Delage and Herouard, 1896)
Family	:	ROTALIIDAE
Genus	:	Ammonia (Brunnich, 1772)
Specimen	:	*Ammonia beccarii* (Linne)
		A.tepida (Cushman)
Genus	:	Asterorotalia (Hofker, 1950)
Specimen	:	*Asterorotalia dentate* (Parker and Jones)
		A.inflate (Millett)
		A.multispinosa (Nakumara)
		A.trispinosa (Thalmann)
Family	:	ELPHIDIIDAE (Galloway, 1933)
Genus	:	Elphidium (de Montfort, 1808)
Specimen	:	*Elphidium advenum* (Cushman)
		E. crispum
		E. discoidale Var. multiloculum (Cushman and Ellisor)
		E. hispidulum (Cushman)
		E. incertum (Williamson)
		E. somaense (Takayanagi)

The study area was under considerable influence of river Hoogly. As a whole, the area represent high energy, turbulant, marginal marine nearshore environment. Forams with robust test and or with adaptive structures like presence of spines, marginal keels etc. can with stand such environmental inhospitability with fair drgree of success.

Of the three study sites, study site- I & study site-II were more exposed to high engrgy, turbulant, conditions in comparision to study site-III. Which infact was a relatively sheltered, low energy environment with a marsh-margrove-lagoonal set up.

In study site – I, *Asterorotalia multispinosa* and *Asterorotalia trispinosa* showed maximum relative abundances 28.36% and 20.11%. Robust test and presence of spines in their test help them to overcome the turbulant environment. *Quinqueloculina seminulum* with a relative abundance of 5.87% also managed to thrive well in such an environment because of their strong test. *Asterorotalia trispinosa, Asterorotalia multispinosa* and *A. dentata* with respective relative abundance of 21.74%, 16.21% and 12.20% constituted a major proportion of faunal assamblages in study site- II. The highly adaptive, eurihaline, *Quinqueloculina seminulum* and *Ammonia beccarii* with relative abundance of 5.55% each also able to tackle this wave dominated, high energy, turbulant environment.

Though 38 species of benthic foraminifera were obtained from study site – II a large majority of them were found to be empty tests of dead foram, a product of postmortam transfer of many of the open marine form as reported from 10-20km offshore by Majumdar et. al.,1999 from Digha shelf.

In study site- III, 23 species of benthic foraminifera were observed through

Asterorotalia trispinosa showed the highest relative abundance (21.48%), many of them were dead, empty tests. Miliammina fusca with a relative abundance of 14.86% dominated the area 33% of species found in this area were representatives of hypohaline marsh mangrove environment which infact was well coroborated with the actual setup. Forams like Lagenids, Nonionellids may well be the product of thanatocoenoses. Ingeneral, the study area was dominated by euryhaline marginal marine shallow water forams capable of withstanding high energy, relatively less saline habitat. Percentage and ratio of entire and broken tests revealed that there was less breakeg in study site- III in comparision to study site- I &II because of reduced surf and current content in comparision to study site – II & III which were directly exposed to shifting substratum under high wave action. Churning action of the substratum by the navigable boats, fishing trawlers in study site- I & II may well be an additional factor for such high rate of brakeg. This fact was also corroborrated from the entire broken test ratio of the prevailing ostracoda fauna from the study area.

Seasonal variations amoung the three seasons in terms of temperature, salinity variations, tidal effect, current action, stability of the substratum have a significant effect on diversity and density of benthic foraminifera in the area. Monsoon being the most hostile while postmonsoon beaing the most feavarable seasons for foraminiferal abundances in this intertidal zones of the study area. This finding is well coroborated with similar such findings for recent benthic foraminifera from Digha, Sundarban, Mahanadi coastal shelf by Majumdar, 2004.

Conclusions

Forty four recent benthic foraminiferal species have been identified and studied quantitatively with regard to their percentage occurrence from intertidal samples collected from three study sites along the Midnapore (East) coast.

Asterorotalia trispinosa, A. multispinosa, A. dentata, Ammonia beccarii, A. tepida, Miliammina fusca, Quinqueloculina seminulum, Trochammina inflata, Ammobaculites agglutinans, Elphidium hispidulum, and *E. crispum* have been found to be the most abundant species of Midnapore (East) coast. *Asterorotalia, Ammonia, Elphidium, Triloculina, Quniquilina, Miliammina* and *Ammobaculites* were the most dominant genera.

Foraminiferal species displayed maximum number in the study site – II followed by S-I and S- III.

The foraminiferal faunal assemblages have been observed to be dominated by the family of Rotaliidae followed by Elphidiidae, Hauerinidae, Rzehakinidae and Lituolidae.

The percentage of agglutinated forms was low in study site – II, but increased in study site – I & III. In general, porcelaneous tests were relatively high in the study site – I as compared with other two sites. Hyaline types dominated the fauna in the areas of three study sites, but relatively high in study site – II.

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