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A report on mesopelagic foraminiferal species of *Hastigerinelladigitata* from the neritic waters of Andaman Island

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Abstract

The neritic water of Port Blair Island was sampled to delineate the Planktonic foraminiferal distribution. Zooplankton samples collected each month and observed under the microscope. While a mesopelagic foraminiferal species *Hastigerinelladigitata* was encountered during the south west monsoon. The identified species is deep dweller and generally abundant in cooler water. So the deeper water species dwelling in surface waters of neritic environment, it may be the regional hydrographical conditions i.e. the heavy wind towards the leeward and the current system might have brought to the near shore surface water from the shallow depth around 100 m. As well as it is a significant report to trace the changes of hydrographical activities and eco provenance of planktonic foraminifera on the neritic waters of this Island. The continuous monitoring of the species occurrences and the observation of oceanographic parameters and analysis of water mass tracers may give better idea of the eco provenance of planktonic foraminifera, which are highly useful to demarcate the water masses and its sources. In addition this species also identified as first time for the Andaman and Nicobar Islands.

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Introduction

Foraminifera are eukaryotic super group Rhizaria with amoeboid structure and skeleton bearing Protist (Caron *et al.*, 2012; Sierra *et al.*, 2013). They are separated into two types depending on their life strategy, namely, the benthic and the planktonic foraminifera. The planktonic foraminifera, in particular, belong to the foraminifera class Globobulimina, the order Rotaliida and the suborder Globigerinina (Pawlowski *et al.*, 2013). Currently 46 valid species of planktonic foraminifera are recorded in the World Oceans they are classified under 5 different groups depending on their morphological characters, Such as macro perforatespinose, macro perforatenonspinose, micro perforatenonspinose, monolamellar and serially arranged chambers (Weiner 2014). In India 30 planktonic species (Rao *et al.*, 1991) have been recorded from the Arabian Sea and 19 species are reported from Bay of Bengal (Setty 1978). The status and distribution of planktonic foraminifera in the Andaman and Nicobar Islands (ANI) has not been studied in detail. In the past, few attempts had been made to document the distribution of planktonic foraminifera (Rajashekhar 1985;

Rajashekhar 1989; Rajashekhar 1990; Rajashekhar 1992; Srinivasan 1968; Srinivasan 1977; Srinivasan 1984; Srinivasan 1996) in the ANI in view of paleoecology and stratigraphy. A total 21 planktonic foraminifera (Frerichs 1971) have been recorded from the surface sediments of ANI. However, studies on living form of foraminifera were not attempted by any authors in this water.

The present study in the waters of Andaman Islands suggested that the live planktonic specimens of *Hastigerinelladigitata*, collected from Burmanallah, South Andaman (Fig.1) was not reported previously from the ANI, Hence, it is reported herein for the first time from the Andaman Islands, India. A detailed description along with colour plate and relevant notes are also provided for further collection and identification of this species elsewhere.

Materials and methods

To study and understand the seasonal distribution of planktonic foraminifera, the samples were collected during September 2015 from the study area Burmanallah (Fig.1).

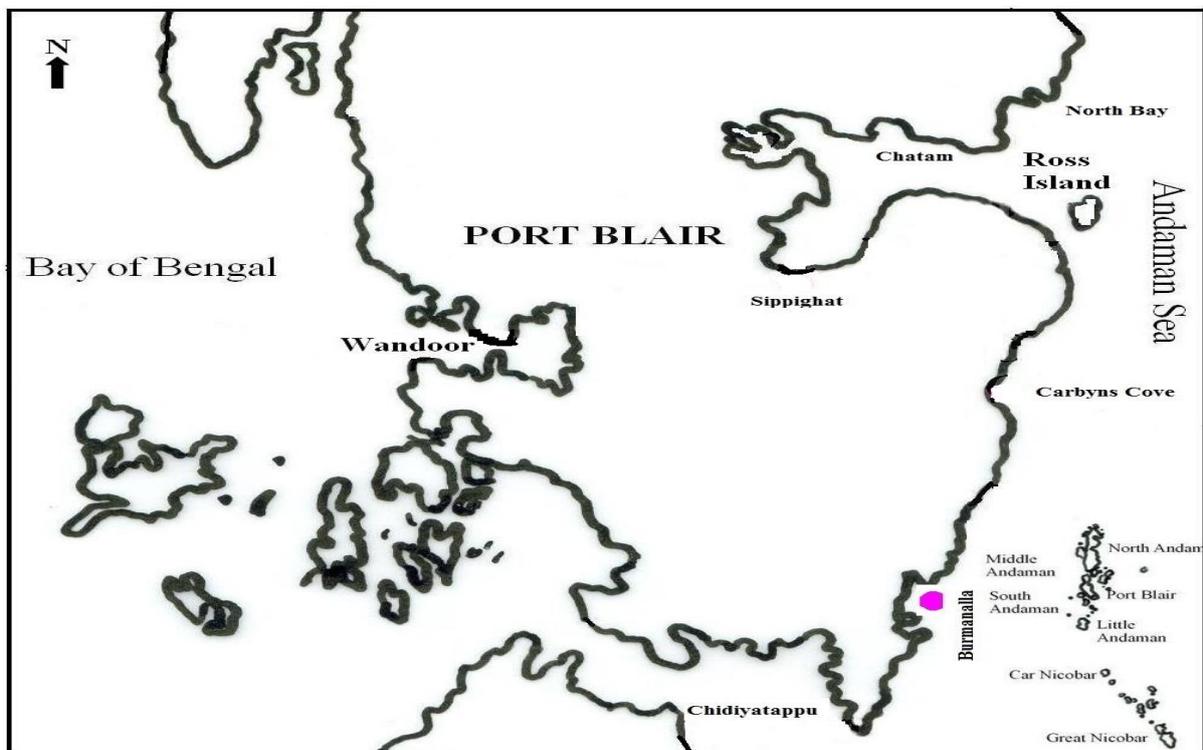


Fig. 1. Location of the study area.

Depth of the seafloor measured approximately 25m and the sampling location was just half a kilometer away from the shore. A horizontal surface plankton net 50 µm mesh sized was deployed to collect the plankton samples by using motorized dinghy. The dinghy was operated slowly in 3Km speed/hr up to 10 minutes. Collected samples were transferred to 1 liter plastic bottle and preserved with 4 % of formaldehyde solution. Then the samples brought to the laboratory and allowed to settling down where the supernatant were filtered carefully. The zooplankton samples separated from the phytoplankton by using 150 µm meshes sized plankton cup filter. Zooplankton samples were used for the study of planktonic foraminiferal distribution and available live tests were separated under the Leica – M205C stereoscopic microscope. The separated animal made photographs by using Leica MC170 HD camera as wet specimen and then the specimen were dried and mounted in a micro paleontological slide. The physico-chemical parameters of surface water, such as temperature, salinity and pH were measured by using digital Quanta Hydrolab (USA) probe. Seawater samples were also collected using Niskin water sampler and analyzed in the laboratory for nitrite, nitrate, reactive silicate and inorganic phosphate.

Results

The studied physiochemical parameters for this water are as follows: temperature (29.5°C), salinity (32.0 PSU) pH (8.2), nitrite (Not Detected), nitrate (0.028 µm), reactive silicate (Not Detected) and total phosphate (Not Detected). The studied planktonic samples suggested that only one planktonic foraminiferan from the genus *Hastigerinella* was availed in three numbers.

Systematic position

The classification follows Loeblich and Tappan (1987)
Order FORAMINIFERIDA Eichwald, 1830.

Suborder Globigerinina Delage and Herouard, 1896
Family Hastigerinidae Bolli Loeblich and Tappan, 1958.

Genus *Hastigerinella* Cushman, 1937
Hastigerinelladigitata (Rhumbler, 1911) (Plate 1 AC).

Diagnostic and taxonomic remarks

Hastigerinelladigitata represented its early chambers in globular or round shape (Plate 1) and arranged streptospirally; later chambers are digitate. Chambers are noted to increase in size with growth. Six chambers are visible per whorl, eight to ten triradiate spines are arranged each chamber. The cytoplasmic bubbles are clearly visible in the live specimens. It has a monolamellar wall structure and micro perforated test. The size measured from the smallest chambers to largest size, respectively 28.16 µm and 453.5 µm. The number of *Hastigerinelladigitata* species collected from this sample was three numbers. The collected zooplankton soup consisted mainly of copepods.

Discussion

The Family Hastigerinidae showing their uniqueness in their own morpho characters. They are monolamellar test wall, possession of cytoplasmic bubble capsule and triradiate spines with lateral hooks (Aldredge and Jones, 1973; Hemleben *et al.*, 1989 and Hull *et al.*, 2011). The monolamellar fragile shells of the Hastigerinidae are hardly preserved in the sediments. This species comprise a dense spine network for capturing active prey as reported by Hemleben *et al.*, (1989). Brummer *et al.*, (1987) reported that adult stages start at the size range of 170 to 250 µm. Similarly, Fisher *et al.*, (2003) noticed that the maximum size of the planktonic foraminifera falls between 250 to 450 µm diameters. Gansen *et al.*, (2010) also reported that the size range of planktonic foraminifera support the above recorded size ranges. Hemleben and others (1989) reported that the maximum size range of *Hastigerinelladigitata* and the sister species *Hastigerinella pelagica* were the largest size range reported among the planktonic foraminifers i.e. 1mm. The present available species chamber's size falls between 28.16 to 453.5 µm of tests suggested that the species is just reach to the adult stage. Further, as it

was also identified these species had carnivorous feeding habit which was evident from the maximum number of copepods available in the zooplankton soup.

Since the species could not preserved in the sediment owing to its delicate texture, the origin of this group are not entirely clear (Aurahs *et al.*, 2009). According

to Hemleben *et al.*, (1989) this species *Hastigerinelladigitata* is a rare deep-dwelling form. This species occupies a narrow depth horizon of 60 m around a median depth of 360 m, immediately above the core of the regional oxygen minimum zone. Also generally they are more abundant in cooler waters on seasonal and inter annual timescales i.e. around 7.2 to 7.8°C (Hull *et al.*, 2011).

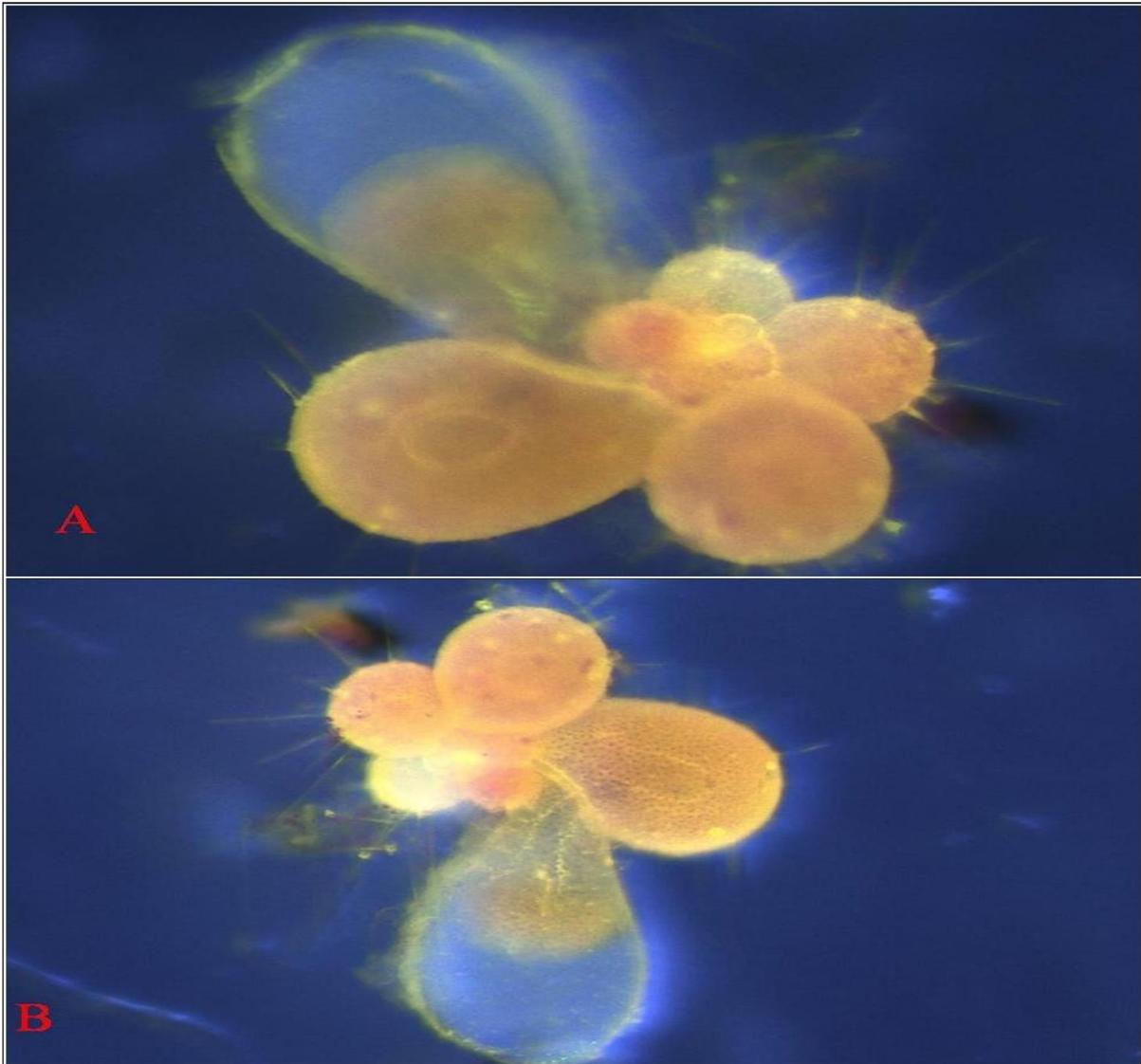


Fig. 2. A Wet specimen of *Hastigerinelladigitata* (Spiral side), B *Hastigerinelladigitata* (Inverted position) of spiral side.

In addition to this, stable isotope studies indicate that most fossil digitate species lived in deep-water habitats below the thermocline and are hypothesized to have lived near or in oxygen minimum zones (Coxall *et al.*, 2007). In the present study, the species were obtained from the surface plankton sample. This

species occurred only in the rainy season of (September - SW monsoon) the coastal waters (temperature-29.5°C; salinity-32.0PSU; and pH-8.2) among the analyzed three periods of samples (summer, SW monsoon and NE monsoon). According to Suwannathastsa *et al.*, (2012a, b) the

Ekman pumping and wind driven current move the coastal current towards southward direction. This process may have brought the shallow deep of around 100 m water mass with the *Hastigerinelladigitata* to the surface and moving towards the southward along the coast where these species encountered with the surface waters during this study. Even though this study did not provide much stronger evidence but the meager notification and record may prompt the future research on this aspects.

Conclusion

The present study had been reported that the distribution of the species *Hastigerinelladigitata* in surface water of the near shore area, which is a strange phenomenon on their distribution. Since, the presence of this species were observed in the monsoon period, it is suggested that heavy wind towards the leeward and the current system might have brought to the near shore surface water from the shallow depth around 100 m.

This present observation may ascertain the distribution of this species in this part of the ocean and also the ecological importance of Andaman waters. Moreover, the species may also be a potential indicator for the environment changes in marine realm. Based on the literature available so far for the planktonic foraminifera with reference to Indian origin, no reports of this species were mentioned earlier, marking this as first time report from this Andaman Island as well as the Indian waters.

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