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STUDIES ON *LINGULA ANATINA* (BRACHIOPODA: INARTICULATA) IN SUBARNAREKHA ESTUARY, ODISHA WITH SPECIAL REFERENCE TO HABITAT AND POPULATION

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INTRODUCTION

Lingula is the oldest living genus belongs to the phylum Brachiopoda commonly known as 'Lamp shell'. It is flourished from Cambrian times to the present (MacGINITIE and MacGINITIE, 1968) and come down to the ages with little changes. Among the 150 extant species family Lingulidae, it is considered to be the most primitive and has only 12 species (living) belong to 2 genera (Emig, 1997). Genus *Lingula* is distributed in Asia, Australia, Europe and Africa while the other genus *Glottidia* confined only in the continents of America.

Soota and Reddy (1976) reported on the genus *Lingula* from Talsari, the western most part of the Subarnarekha estuary and the detailed taxonomical account and their habitats were not investigated. During the Faunistic survey in Subarnarekha Estuary (2006-2010), a vast bed of *Lingula anatina* Lamarck, 1801 were noticed. The present attempt is to investigate on the taxonomical account, habitat and population of *Lingula anatina*.

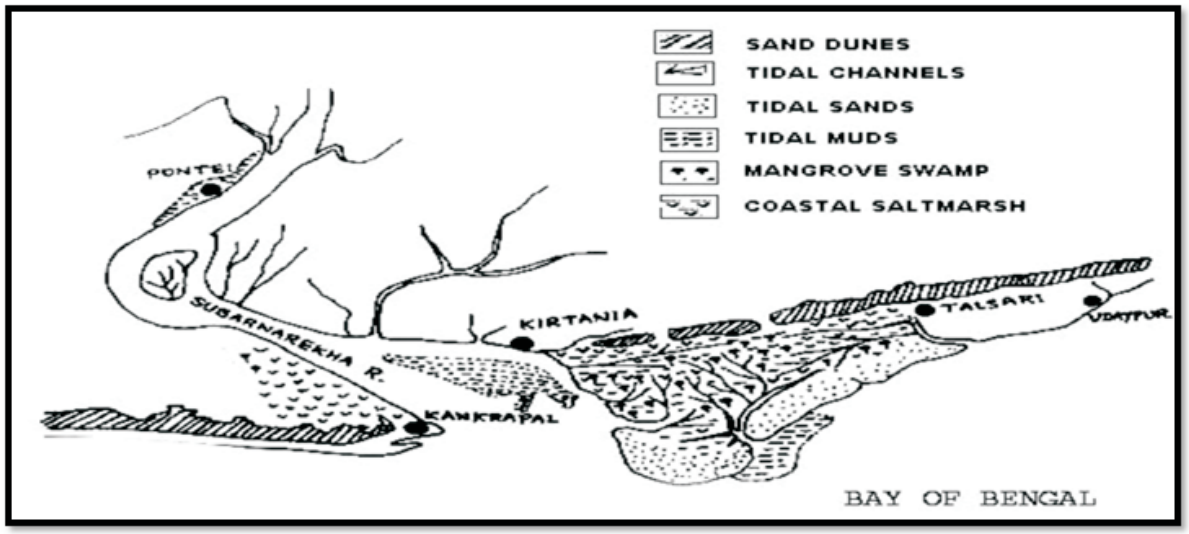
MATERIAL AND METHOD

The Subarnarekha is one of the major rivers of eastern coast of India. It originates from the Ranchi plateau of Jharkhand state and flows over 477 km distance covering three states of India and forming an estuary complex composed of mangrove trees, bushes, salt marshes, mudflats and sandy beaches at the extreme north eastern part of Odisha (Latitude 21° 34´- 21° 37´ and Longitude 87° 20´- 87° 27´), which opens into Bay of Bengal.

A long mudflat (19 km) besides the narrow creeks, surrounded by mangrove bushes and salt marshes in between Talsari to Kirtania are overwhelming habitats, which makes a sheltered bed for this species (Map. 1).

For taxonomical identification Specimens were collected from the mud by using a shovel and spade for especially bigger specimens. After collection, the specimens were washed and anesthetized by using magnesium chloride in estuarine water. A small chip of wood used to be placed in between two valves of the shell of these specimens before preservation in 90% alcohol; this will allow effective penetration of preservatives into the soft body parts of the specimens.

The observation and collection of specimens for this study were made in different seasons during the period of 2006-2010. Surveys were made in low tidal conditions. Littoral fauna were collected during low tide from the mud flat area along the *Lingula* habitat. During sample collection and observation, type of the substrate, abundance, habit and habitats of individual species were noted, population of brachiopods are estimated by calculating their number and nest holes in 1 square meter area by using a plastic frame of 1 meter X 1 meter.



Map 1. : Different habitat of Subarnarekha estuary showing the mangrove zonation as habitat of *Lingula anatina*

TAXONOMICAL ACCOUNT

Phylum BRACHIOPODA Dumerill, 1806
Class LINGULATA
Order LINGULIDA Waagen, 1885
Family LINGULIDAE Menke, 1828
Genus *Lingula* Bruguiere, 1797

Lingula anatina Lamarck 1801

Lingula anatina Lamarck 1801, p. 140, pl. 1-6.

***Material examined*:** 16 ex; Loc: India, Orissa, Dist: Balasore, Subarnarekha Estuary, Talsari, Date: 05. vi. 2006; Coll: A. Misra and party, Regd. No. MP 1/5.; 13 ex., Loc: India, Orissa, Dist: Balasore, Subarnarekha Estuary, Kirtania, Date: 13. X. 2007, A. Misra and party; Regd. No. MP 2/5.; 11 ex; Loc: India, Orissa, Dist: Balasore, Subarnarekha Estuary, Talsari, Date: 19. iii. 2008; Coll: A. Misra and party, Regd. No. MP 3/5.

***Diagnosis*:** Shells shape oblong; sub parallel lateral margins; anterior margin slightly convex to straight with a median projection; smooth external valve surface but distinct growth lines. Colour greenish (from translucent green to dark green), sometimes slightly brownish along the lateral and posterior margins (Fig.1). Deltoidial regions acute: dorsal valve with triangular beak with straight to slightly concave profile; ventral valve with a pedicle groove without visible growth lines, discontinuous with the internal side of the valve. The general muscle disposition is elongate. On the ventral face, the left perimial line is strongly curved below the median internal oblique muscle, anterior internal oblique muscles (near the anterior oblique muscle) and posterior internal oblique muscles are well separated.

***Distribution*: India:** East coast: Subarnarekha Estuary (Orissa); Kankinda Bay and Krishna Estuary (Andhra Pradesh); Parangipettai Beach (TamilNadu). West Coast:- Karwar (Karnataka) Konkan Coast (Maharashtra); Beyt Island, Okha (Gujarat); Mayabandar, Phoenix Bay and Port Blair (Andaman).

Elsewhere: Australia, Japan, China, Philippines.

HABITAT

In Subarnarekha estuary, the habitat of *Lingula anatina* occurs in either side of the tidal creeks, substrata are generally soft muddy area, but sometimes black soil (decomposed) and sand mixed mud were preferred for living. Juvenile's bed was found in fine soft mud only. The Lingulids beds are only 2-8 mts in width. Both the banks of the creeks covered by patchy mangroves and mudflats highly exposed during low tide, the area is inundated by sea water at a depth of 0.5 to 1.2 mts during high tide.

Figs : 1. *Lingula anatina*(adult). **2.** Habitat of *Lingula anatina* at Subarnarekha estuary. **3.** Juvenile bed of *L. anatina*. **4.** Nest hole of *lingula anatina* with one adult form in its hole

OCCURRENCE AND POPULATION DENSITY

The occurrences of the Lingulids were predominant in the scanty zones of mangrove forest of the Subarnarekha estuary (Fig. 2). Due to presence of suitable habitat and lack of disturbance in this estuary a vast belt of 19 km long and several meters width of Lingulids habitat is nowhere reported in our country. The mean population were measured 640-720/ m^2 on the soft mud just beside the narrow creeks and 900-1200/ m^2, at a distance of 4-8/ m^2 from the creek and on silty sand. Juveniles are found in pre and post monsoon with a population of 2300-2700/ m^2 (Fig.3). Juvenile beds are found only in the soft, blackish mud. Some macro benthic fauna (Table-1) were recorded from the same habitat, to relate ecological relationship with

Table-1. : List of Macrofauna found in the Lingula bed

Sr. No.	Group	Species
1.	CNIDARIA	*Pelocoetes exul* Annandale, 1915
2.		*Edwardsia jonesii* Seshaiya & Cuttress, 1971
3.		*Virgularia sp.*
4.	POLYCHAETA	*Euclymene annandalei* Southern, 1921
5.		*Phyllodoce malmgreni* Gravier,1900
6.		*Loimia medusa* (Savigny, 1818)
7.		*Diopatra cuprea* (Bosc, 1802)
8.		*Parheteromastus tenuis*
9.		*Dendronereides heteropoda* Southern,1921
10.	SIPUNCULIDA	*Phasolosoma arcuatum* (Gray)
11.	BIVALVIA	*Glauconome sculpta Sowerby, 1894*
12.		*Laternula truncata* (Lamarck, 1818)

Lingula anatina. Based on the burrows opening the bedding can be described the type of genus lives in the habitat. Here in the study *Lingula anatina* Lamarck 1801 bed was observed which has elliptical opening based on the animal morphological pattern. Slit or oblique openings of their nest hole are distinguished the *Lingulid* bed from the bivalve, as the latter has a rounded burrow openings (Fig.4).

DISCUSSION

Live beds of *Lingula sp*. reported from Balapur Bay of Beyt Island from Gujrat coast (Hornell, 1909); Maharshtra coast (Awati & Kshirsagar, 1935 & 1957); Vellar river mouth of Tamilnadu (Rama Moorthy *et. al.,* 1973); mudflats of Kakinada Bay (Radhakrishna and Ganapathi,1969); Digha Mohana, West Bengal and Talsari, Orissa (Soota and Reddy,1976); Karwar waters of Karnataka (Veena & Nayak, 2004) and recently from Krishna estuary, Andhra Pradesh (Rao, 2009). Beside this some stray report on the dry shell collection also available (Patil, 1953; Soota & Reddy, 1976 and Rao, 2009). The studies on the habitat and population of these primitive animals were not quiet explored.

Thus, this investigation shows the detailed study on *Lingula anatina,* which mainly prefers the silty sand substrata near the estuarine mouth. The discontinuous, sporadic and patchy distribution of this species also indicates that the species is a rare faunal elements of the coastal areas of India (Rao, 2009). Lesley cherns, (1979) found two common species in the Lower Leintwardine Beds, *Lingula lewisii* and *Lingula lata* which occur commonly in such associations, have distributions indicative of such an environment and occurrence resembles an indicator of very nearshore environments, particularly when found in monospecific assemblages which was coincided with the the huge population of *Lingula anatina* occurrence in Subarnarekha estuary.

Subarnarekha estuary, merely rich in biological resources (Mitra *et. al.,* 2009) recently facing some disturbance by the fishing activity of local people and tourist trampling which should be restricted to some extent to conserve and restore this ecosystem.

SUMMARY

Lingula anatina belongs to phylum Brachiopoda is a rare and primitive animal occurs in Indian coast and estuaries as patchy distribution. Here it is reported from the Subarnarekha estuary of Orissa with the other invertebrate fauna occurs in the same habitat of this species. The habitat of *Lingula anatina* of Subarnarekha estuary is the widest (19 km long)

in India. The population of the *Lingula* and other fauna are also measured and polychaetes found the dominant species. As the habitat of *Lingula anatina* is situated in the estuaries mudflat where a freshwater discharge is opens in the estuaries, this condition should be maintained and conservation of the habitat may be needed to conserve this species.

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