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Laboratory observation on the feeding behaviour of two intertidal benthic Nemertine of Subarnarekha estuary, Odisha, India

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A B S T R A C T

The feeding behaviour, food preferences and the role of different extrinsic factors on the feeding rates of benthic Nemertines were studied under laboratory conditions. They showed both micriphagus and macrophus feeding nature. During macrophagy (polychaetes) the use of proboscis is less in comparison to the microphagy (invertebrate eggs and powdered dry fish). There was a positive correlation between the increasing temperature and rate of food intake upto 32^0C. Feeding rate decreased with extremely lower and higher salinity. The result suggested that benthic Nemertines were well adapted with the estuarine environment.

Introduction

Nemertines are known by large proboscis which remains in a large sac known as Rhynchocoel. For the presence of the large proboscis, they are sometimes known as 'proboscis worm' (Waggoners&Collins, 2001). Till now 1500 species have been described and grouped into 250 genera(Gibson, 1995).Nemertine worms are primitively and predominantly marine (Moore, J. 1989).

In intertidal areas predators are an important factor structuring the benthic community (Thiel & Reise, 1993). Nemertines are endobenthic predators and considered as relatively sluggish with low metabolic activity. There is little information on the ecology and feeding behaviour of benthic Nemertine (Gerlach, 1998). Recent investigation suggest that nemertean predators exert a significant impact on the populations of their preferred prey (Wang et al, 2008). Nemertines are predominantly free living in habit and generally regarded as carnivorous or scavengers (Jennings & Gibson, 1969).

Benthic nemerines predates on different types of food organisms of animal source. Active living prey are caught by the proboscis and food materials are ingested

directly without prior proboscis eversion. All the Nemertine collected from Talsari, Odisha, India are Heteronemertines and endobenthic in nature. The feeding behaviour of these specimens are observed in laboratory condition. Several types of food items are used with several change in temperature and salinity of marine water provided to document the food preference and feeding rate etc.

Materials and Methods

Study Sites

The study sites are located at Subarnarekha River mouth, near Talsari, Balasore district, Odisha, India. Benthic Nemertines are abundant allover the intertidal zone. Two study sites(Fig: 1) are selected; one is at Bichitrapur (21.5666754 N & 87.413462 E to 21.575614 N & 87.431505 E) and the second one is at Talsari (21.597822 N & 87.450122 E to 21.601259 N & 87.455645 E). The place receives 156.84cms rainfall throughout the year. During summer the temperature is high and sometimes reaches 40^0C. During winter the mercury stands around 14^0C. The tidal range in the Subarnarekha River is about 3.0 m, and the salinity is lowest during rainy season about 1‰ and highest during winter season 33‰. The sediments consist mainly of muds and a little part is sandy. Small creeks on the tidal flats, which are about 15–40 cm wide and carry about 00 - 2 cm deep water throughout the low tide period.

Collection of Specimens and Fixation

The intertidal part of study site is saturated with luxuriant estuarine flora and fauna. All the Nemertine species are benthic in nature and dominate in soft mud.Specimens are collected by digging soft soil. After collection live specimens are kept in plastic tray containing marine water. specimens are sent to laboratory for further investigation (fig:2).

Some of the specimens are nercotised in 7.5% Magnesium Chloride ($MgCl_2$) dissolved in marine water for 20 minits. After nercotisation specimens are fixed in 9% formalin solution or in 75% alcohol.

Observation of Feeding Behaviour

In the laboratory, Nemrttines are maintained at room temperature (20–25 °C) and kept at a practical salinity of 30‰ for at least 7 days in starved condition (Wang et al,1908). Nemerteans feed on a variety of prey organisms but Heteronemerteans primarily feed on polychaetes, but they have also been observed to feed on bivalves and crustaceans (Thiel and Kruse,2001). In food preference experiments a potential prey is put into a container with a nemertine which had been kept without food for one week, and the reactions of the nemertine and prey are observed (Roe,1970). Several Nemertine species are kept in 500ml beakers and provided with different types of food like polychaetes (fig:4A & B) marine algae and dry fish powder (fig:4C & D). Every time the movement of Specimens, use of proboscis, process of food intake, effect of increasing temperature on feeding behaviour etc is observed.

Histological Staining of Gut

Formalin fixed specimens are used for histological staining. 5 micron thcick sections are prepared(Rotary Microtome Spencer 820) from paraffin blocks. Sections are stained using Crandall's staining method for Nemertine specimens (Schwartz and Norenberg,2005). Slides are observed under light microscope(fig:5B).

Fig.1 Study sites. Study site I : Subarnarekha Estuary, Bichitrapur and Study site II : Talsari, Odisha, India.

Gut Content Analysis

Gut content analysis of available all the specimen is performed. All of them have a simple tubular intestine. Large sized specimens are selected for this purpose. Filtered marine water is taken in a 10ml syringe and the water is pushed through the mouth aparture and collected in a petri dish. The water sample is observed under microscope.

Result and Discussion

Habitats

Nemertines occur in almost all marine habitats from the benthos to the pelagial, from the tropics to the polar seas, and from the shallow intertidal zone to the deep sea (Thiel and Kruse,2001).

Several nemertine species apparently have distinct preferences for microhabitats such as mussel clumps or sea-grass patches on intertidal soft-bottoms (McDermott, 1976). All the benthic Nemertines investigated form burrow under soft mud. They form horizontal and vertical channels under mud. During high tide they come out of the burrow and collect food.

Prey Selection

Different types of foods are offered to the specimens under laboratory condition. The prey items include different types of Polychaetes, invertebrate eggs, marine algae which are common in the Nemertean bed and powdered dry fish. The feeding activity clearly indicates that they prefer food from animal sources.

Fig.2 All the Heteronemertean species collected from soft mud of study areas during low tide

Feeding Rates:

Nemertines under investigation prefer small animal food items over the larger ones. The feeding rate depends on several external and internal factors. If small food items like invertebrate eggs or powdered dry fish is offered, they use the proboscis to capture prey (fig: 3B & C) but in case of larger prey items the use of proboscis is considerably less.

In laboratory condition starved Nemertines attack and quickly engulf the food items. When polychaete worms are offered as food, they slowly move towards the prey item and start engulfing the worm (Fig: 4B). The overall activity of the Nemertines depend on the abundance of prey. With increasing prey density the motile activity and attack rate increases. When invertebrate eggs and powdered dry fish is added, the eversion of proboscis and motile activity increases instantly (fig:4D).

Gut Content Analysis

The gut content analysis of Nenertines is performed as followed by Schubert and Reise,1986. Microscopic observation of gut content showed some invertebrate eggs (fig:6A), body parts of some micro arthropods (fig:6C), undigested and partially digested body parts of polychaetes (fig: 6B & D).

Fig.3 A: Beakers with starved Nemertines; B: Eversion of branched proboscis for capturing food items; C : Eversion of unbranched proboscis for capturing food items

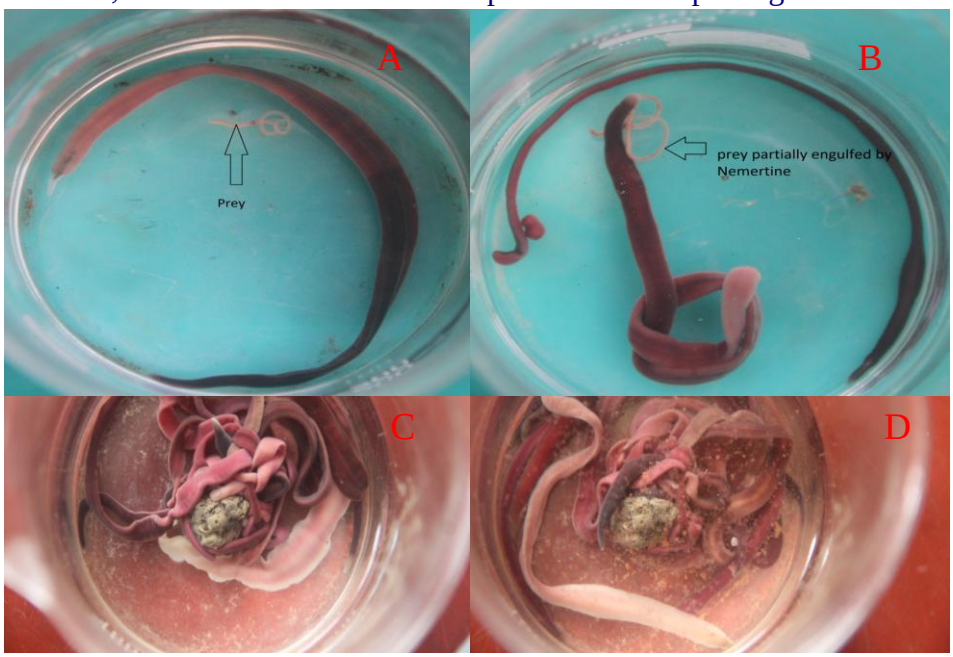

Fig.4 Experiment on feeding habit of Nemertines. A: Polychaete is used as food item; B:Food intake by Nemertine; C: Sluggish Nemertines before adding food; D: Increased motile activity after adding dry fish powder as food.

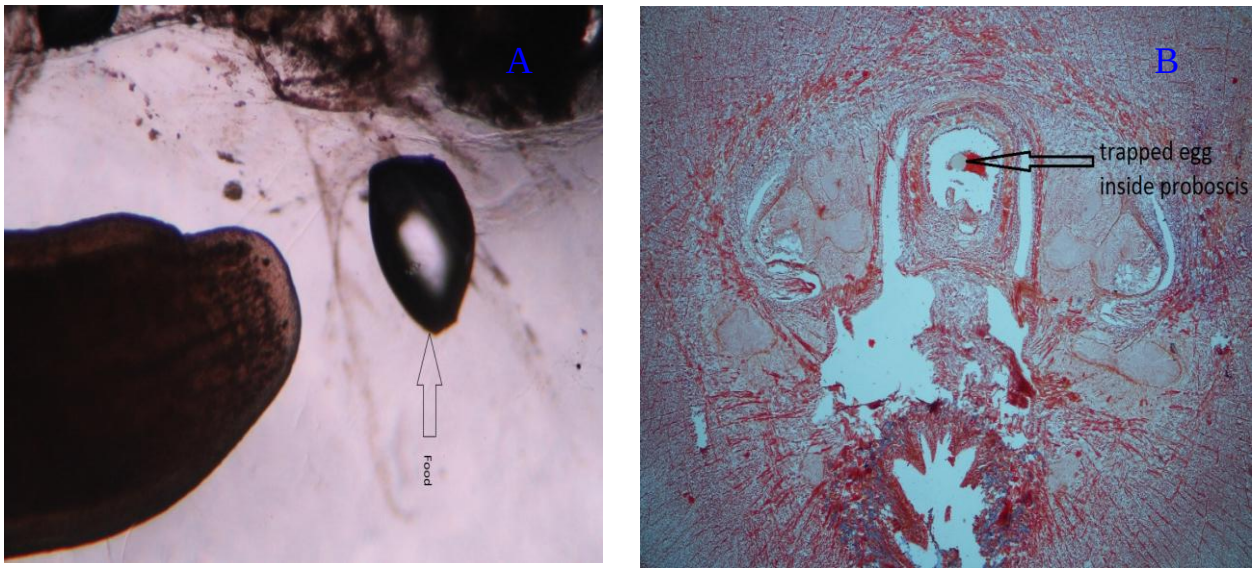

Fig.5 A: Nemertine rapidly migrating towards food items; B: T.S of Nemertine showing trapped food inside proboscis

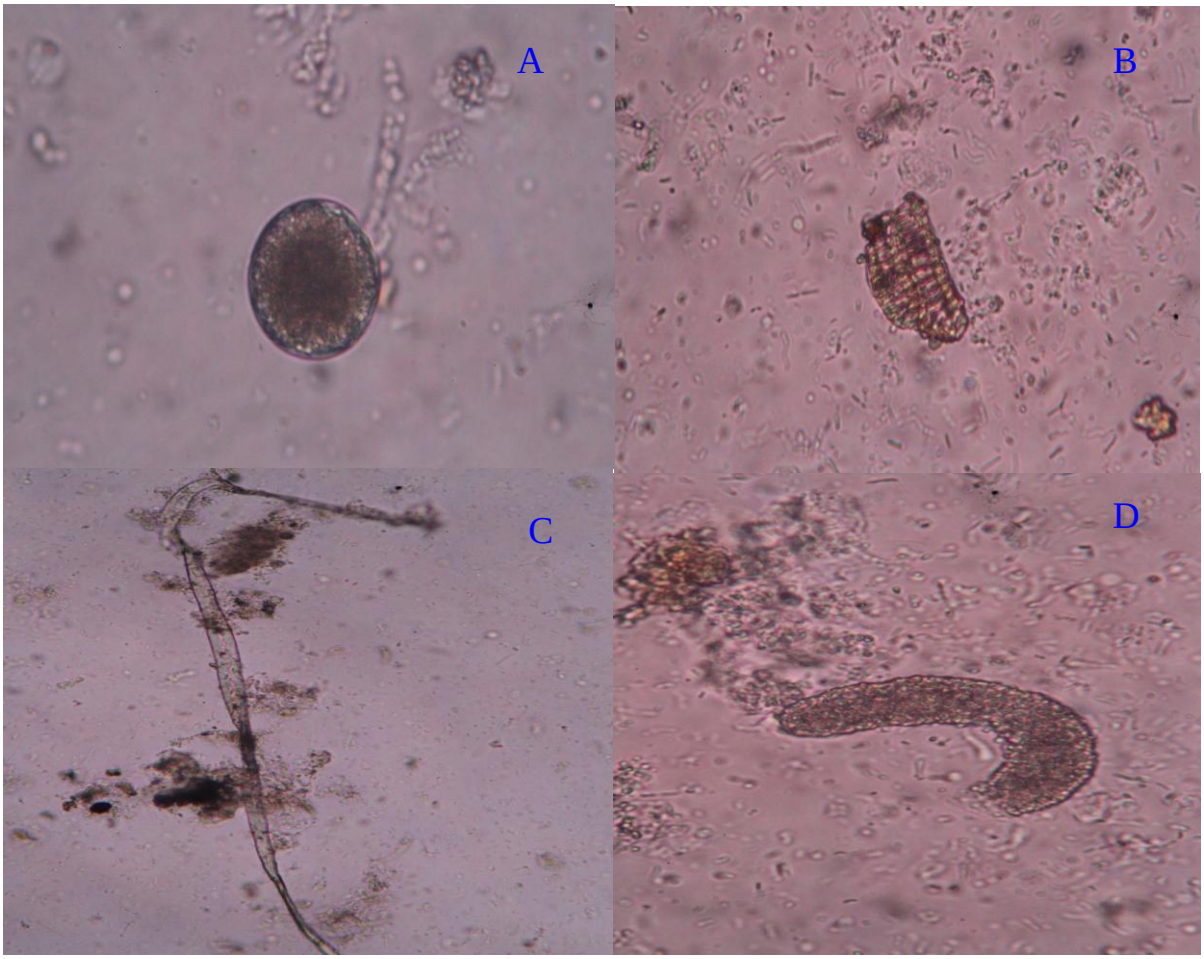

Fig.6 Gut Content analysis under compound microscope. A: invertebrate egg; B&D: Partially digested body parts of polychaetes; C: Undigested leg of micro Arthropodes

Direct knowledge about the feeding behaviour of Nemertine is poor because all the specimen under investigation are infauna.This study indicates that benthic Nemertines have a wide range of food habits but they mainly rely on polychaetes, soil nematodes, micro arthropods, eggs of different invertebrates etc. But the presence of some marine algae in the gut reveals the omnivorous nature. The presence of proboscis in Nemertines plays a significant role in food capturing. The proboscis is lined with conical gland cells that secrete a sticky mucus-like substance upon contact with a prey, which can nutralises the small prey item (Roe,1970). Histological staining of sections of formalin fixed Nemertines revealed the presence of food particles inside the proboscis indicates the role of proboscis in food capturing. Nemertines are top consumers in the tidal mudflats and plays a key role in the benthic esturine ecosystem.

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