# ECOLOGY OF *CAMPTOCERAS LINEATUM* BLANFORD (PULMONATA: BASOMMATOPHORA) STUDIED IN DEEPAR WETLAND OF ASSAM, INDIA AND A NOTE ON ITS EMBRYONIC DEVELOPMENT

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**ABSTRACT**

*Camptoceras lineatum* Blanford is a small freshwater gastropod mollusc in the family Planorbidae. During a limnological investigation in Deepar wetland of Assam, India, the species was recorded for the first time from this region. Some of the ecological aspects of the species studied during June to November, 2005 are presented here. The animal was cultured e*x situ* and some notes on its embryonic development is presented.

**KEYWORDS**

*Camptoceras lineatum*, Deepar wetland, embryonic development, mollusc

The available fauna reports on freshwater mollusca in India reveal a total of 200 species of gastropods and bivalves of which only 47 species are reported as very common (Subba Rao, 1989). This freshwater group colonizes in every possible habitat like pools, ponds, lakes, rivers, and streams and is dominant over benthic communities of all freshwater ecosystems. Besides, there are some species under a few genera which are uncommon and difficult to discover. *Camptoceras* is one of such interesting genus, with four Indian species all are reported as uncommon (Subba Rao, 1989). Information also indicates that the Indian leading molluscan collection centre, ZSI, has no recent collection of two of the species *C. lineatum* and *C. subspinosum* until this report. However, earlier, both the species were reported by Annandale and Prasad (1920) from Manipur and Kashmir, respectively.

The majority of freshwater molluscs are yet to be explored ecologically and biologically. A perusal of Indian literature reveals that the biological studies on this phylum is confined to only a few viviparid, thiarid and pilid species (Muley, 1977; Prashad, 1925; Ramamoorthi, 1955). In Assam, there is dearth of references on the autecological studies on aquatic malacofauna; Bhattacharyya (1977) studied on a land mollusc which is of autecological nature. Besides, Goswami (1985), Lahon (1986), and Goswami *et al.* (1999) have reported some of the freshwater molluscs from the region during their synecological studies on wetlands.

During a limnological investigation in Deepar wetland of Assam, India, the species *C. lineatum* has been recorded for the first time from this region. Its species status was confirmed by ZSI Kolkata (Vide Z.S.I. Lot No Moll-1149, I.R. No-11/05). Some of the ecological aspects of the species at its occurring zone in the wetland were studied during June to November, 2005. The animal was cultured in the Limnological Laboratory of the Zoology Department of Gauhati University where its *ex situ* development was observed.

## STUDY AREA

Deepar wetland is a perennial water body and a Ramsar site (91°38'-91°40'E & 26°6'-26°8'N) near Guwahati, Assam, India (Fig. 1). The main wetland has three major parts, the Barbeel, Kharbari and the Chanabeel. Barbeel has the regular recharge of water received from a perennial stream known as Basistha through an offshoot of river Mora Bharalu (Source: ARSAC, Guwahati). However, the Kharbari and Chanabeel have more or less stagnant water in winter season. But, during monsoon, recurrent flushing in these two sites is observed due to a connection with River Bramhaputra through the Khanajan inlet/outlet canal. The receiving part of Khanajan canal at Kharbari area is swampier from which place the *Camptoceras lineatum* samples were collected during June-November 2005 (Fig. 2).

## METHODOLOGY

Underwater vegetations and decomposed materials were collected randomly with the help of an indigenously designed quadrate sampler of 25 x 25cm iron bar. Collected materials were washed thoroughly in a plastic container, supernatant debris was removed carefully. Then the settled remnant along with the fauna was repeatedly washed using clean water on a cotton mesh filter to remove fine debris. Collected materials were identified at the limnology laboratory of Department of Zoology, Gauhati University and micro-structural and biological studies.

Three batches, each of ten individuals were cultured in general laboratory conditions for three months, from June to September, 2005 in one-litre beaker providing cleaned water and a few twigs of submerged macrophytes of *Hydrilla verticillata*, *Ceratophyllum demersum*, *Vallisneria spiralis* and *Utricularia flexuosa* along with small amount of under water decomposed plants collected from the natural habitat. These were examined thoroughly with the help of a dissection microscope before introducing in the culture. The water and plant materials are renewed weekly. Rest of the sample is preserved in 70% alcohol. The micro-structural views of the animal were photographed with the help of a CCD camera.

Same procedure was followed for studying the *ex situ* embryonic development of *C. lineatum* from June to September

[W] See Images in the web supplement at www.zoosprint.org

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2005.

Living and preserved samples were compared with the text description and figures provided by Gude (1914), Annandale & Prashad (1918, 1920, 1921), Walker (1919) and Subba Rao (1989). Shell samples were also sent to ZSI Kolkata for confirmation of the species status.

Water and soil samples for the physico-chemical studies were collected respectively as per the recommendation of State Public Health laboratory and State Soil Survey Laboratory of Assam and analyzed there. The gaseous as well as the physical parameters were analyzed in the field following American Public Health Association (1976). Plant samples were identified following Biswas & Calder (1984).


***Figure 1. Location map of Deepar wetland***

**Systematic enumeration of *C. lineatum***

The systematic enumeration of the species was prepared based on the classification put forward by Annandale & Prasad (1920).

Phylum: Mollusca
Class: Gastropoda
Sub-class: Pulmonata
Order: Basommatophora
Family: Planorbidae
Subfamily: Bullininae
*Camptoceras lineatum*, Blanford

**Species characteristics**

*C. lineatum* is a small mollusc, measuring 4.2-4.5mm in length. The animal has sinistral shell sculptured with spiral lines with subspinose rows. Shells dark brown, bear 2½ whorls (Image 1[w]). Suture is distinct. Shell aperture is oval and a bit sub oblique (Image 2[w]), foot is short and eyes are at the base of its tentacles.

**OBSERVATIONS**

*C. lineatum* occurs at the littoral areas of northern shoreline near *Khanajan* canal of the wetland along with selective vegetations. The bottom soil texture at its occurring zone is clayey-loam. They are never observed on sandy soils of main

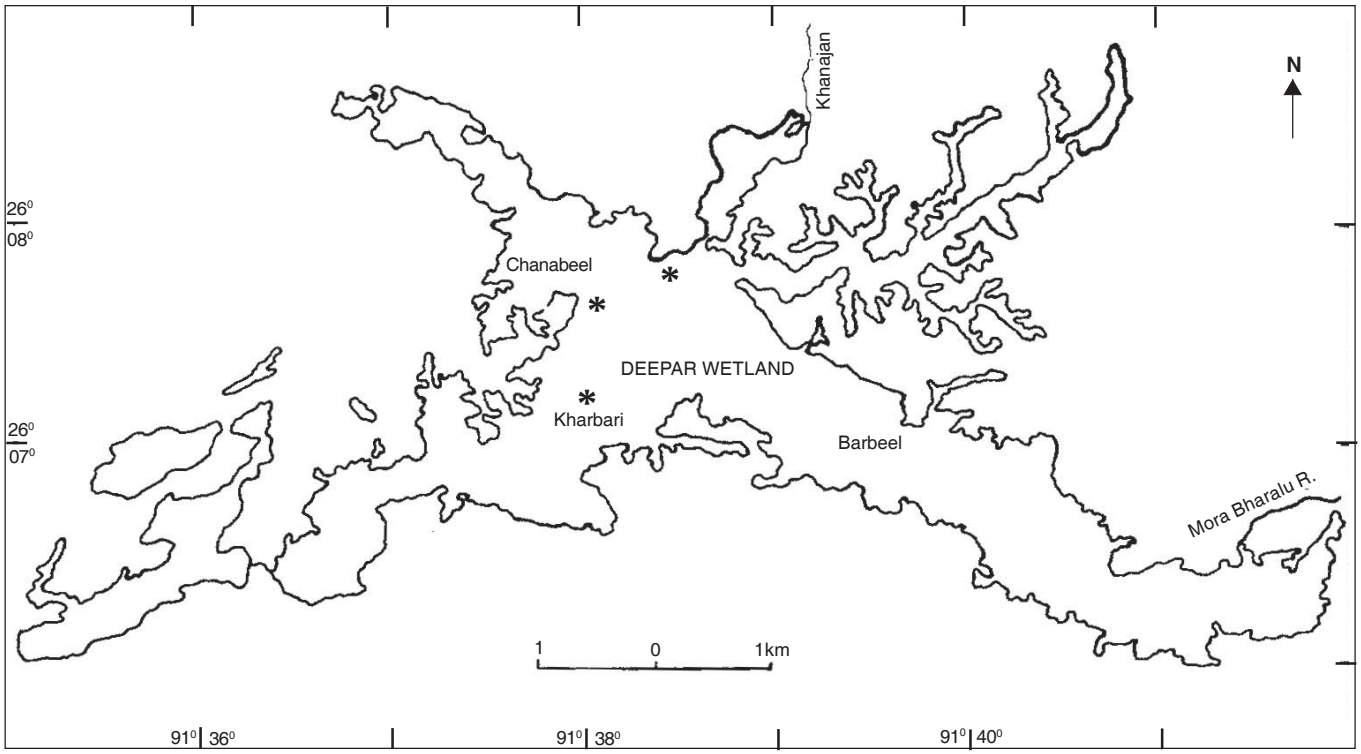


***Figure 2. Map of Deepar wetland showing the habitat of* Camptoceras lineatum *(*) (Source: ARSAC, Guwahati)***

***Table 1. Population density of Camptoceras lineatum (n.m$^{-2}$) on different macrophytic stands studied in Deepar wetland during June-November, 2005.***

| Name of the macrophytic stand | Average density (n.m$^{-2}$) | Relative Density (%) | SD | Maximum density(n.m$^{-2}$) | Minimum density(n.m$^{-2}$) |
|---|---|---|---|---|---|
| *Hydrilla verticillata* | 45 | 32.6 | 10 | 63 | 35 |
| *Ceratophyllum demersum* | 21 | 15.2 | 10 | 36 | 12 |
| *Utricularia flexuosa* | 25 | 18.1 | 5 | 32 | 17 |
| *Vallisneria spiralis* | 12 | 8.7 | 6 | 17 | 5 |
| *Potamogeton octundrus* | 11 | 8.0 | 4 | 19 | 7 |
| *Panicum auritum* | 24 | 17.4 | 25 | 65 | 3 |

***Table 2. Studies on the water parameters at the habitat of Camptoceras lineatum in Deepar wetland during June-November 2005 (N/D= Not detectable)***

| Parameters | Min | Max | Average | STDEV |
|---|---|---|---|---|
| Appearance | - | - | Turbid | - |
| Temparature º C | 27.5 | 32.3 | 29.5 | 3.2 |
| pH | 6.7 | 6.9 | 6.8 | 0.09 |
| DO (mg/l) | 5.9 | 6.9 | 6.3 | 0.35 |
| B.O.D. (mg/l) | 1.00 | 6.00 | 2.50 | 0 |
| Carbon-di-oxide as $CO_2$ mg/l | 3.1 | 4.9 | 4.3 | .99 |
| Total Suspended Solid (mg/l) | 45 | 55 | 52.5 | 2.75 |
| Total hardness as $CaCO_3$ (mg/l) | 40 | 44 | 41.7 | 0 |
| M. Alkalinity as $CaCO_3$ (mg/l) | 34 | 42 | 39.7 | 5.66 |
| Calcium as $CaCO_3$ (mg/l) | 10 | 30 | 12.4 | 2.60 |
| Magnesium as Mg (mg/l) | 2.88 | 5.28 | 3.9 | 0.87 |
| Chloride as Cl (mg/l) | 6 | 8 | 6.50 | 0 |
| Fluoride as F (mg/l) | 0.03 | 0.035 | 0.03 | 0 |
| Amonical Nitrogen as $NH_3$ (mg/l) | 0.02 | 0.4 | 0.3 | 0.06 |
| Nitrite Nitrogen as N | N/D | N/D | Trace | - |
| Nitrate Nitrogen as N | Nil | 1.4 | 1 | 0.66 |
| sulphate as $SO_4$ (mg/l) | 7 | 14 | 11.2 | 4.95 |
| Phosphate as P (mg/l) | 0.2 | 0.3 | 0.24 | 0.04 |
| Dissolved Organic Matters (mg/l) | 10 | 16 | 14 | 0.82 |
| conductance (micro mho/cm) | 80 | 130 | 112.3 | 7.59 |

*Khanajan* canal. The species was collected from up to the depth of 4m of *Kharbari* area near *Khanajan.*

There are about 28 different macrophytes recorded from the habitat of *C. lineatum* in Deepar wetland. However, the species is considered as enmeshed fauna specifically found in submerged aquatic plants such as *Hydrilla verticillata*, *Vallisneria spiralis*, *Potamogeton octundrus*, *Ceratophyllum demersum*, *Utricularia flexuosa* and underwater part of *Panicum auritum*. Their population density per square meter area (n.m$^{-2}$) on different macrophytic stand was estimated (Table 1). It was observed that the population density of C. *lineatum* was highest on *Hydrilla verticillata* stand (Average 45 $\pm$ 10 n.m$^{-2}$) and lowest on *Potamogeton octundrus* stand (Average 11 $\pm$ 4 n.m$^{-2}$) (Table 1).

The physico-chemical status of water studied from the habitat of *C. lineatum* in Deepar wetland has been shown in Table 2. The study reveals that average water temperature in the habitat of the species is 29.5$^0$C $\pm$ 3.2$^0$C; and the water pH is slightly acidic ranging from 6.7 to 6.9. Other parameters like dissolved oxygen (DO), biological oxygen demand (BOD), total suspended solids (TSS), total hardness (TH), total alkalinity (TA), chloride (Cl), fluoride (F), phosphate ($PO_4$), nitrogen (N) parameters, and specific conductance are in tolerance limit (Table 2).

The studied soil chemical parameters in the habitat of the animal are tabulated in Table 3. It is observed that the soil is more acidic (Average: 4.7 $\pm$ 0.36) than the water cover in its habitat. Moreover, the soil potassium level was high (above 340kg/acre) in the studied area. These parameters are congenial for macrophytic growth.

***Table 3. Soil parameters of Deepar wetland studied during June-November 2005***

| S. No. | Soil parameters | Average | Maximum | Minimum |
|---|---|---|---|---|
| 1 | pH | 4.7 | 5.7 | 4.3 |
| 2 | Organic Carbon (%) | 3.42 | 5.08 | 1.27 |
| 3 | $P_2O_5$ (Kg/Acre) | 1.675 | 5.692 | 0.242 |
| 4 | $K_2O$ (Kg/Acre) | High | Above 340 | - |
| 5 | Texure | Clay loam | - | - |

### *Ex situ* embryonic development in *C. lineatum*:

It was observed that after one day of their collection the mollusc started laying eggs over *Hydrilla* and *Vallisneria* leaves. The animal used both the surfaces of the leaf for egg laying. There were 8 +/- 2 eggs in a cluster that looked like a gelatinous dome over the leaf. Diameter of each egg mass was roughly 1mm. Egg shells were gelatinous, hexagonal, and transparent (Image 3$^w$). The embryo was initially yellow in colour. However, after two days of its development the colour became gradually faint and fairly transparent. The one-day embryo was ciliated, highly active and having the capacity to move actively in all the directions within the egg shell. However, the movement slowed down after two days and the body started differentiating. The development of shell, eyes and mouth inside the egg shell could be distinguished in a three-day embryo. The animal hatched within five days to young immature form (Image 4$^w$). At this stage only 1½ whorl on its shell was externally distinguished. Juveniles studied in the laboratory conditions took 20 to 25 days to attain adulthood. After hatching the animals started feeding actively. Both juveniles and the adults consumed only the slimy periphytonic layer of the plant surface and decomposed vegetations. However, in laboratory conditions, only 6.25% of the hatched individuals survived to attain their adult stage.

## Discussion

Deepar wetland supports more than 17 freshwater malaco-fauna comprising both gastropods and bivalve molluscs. *C. lineatum* is the smallest of all gastropod molluscs so far reported from the freshwater habitats of Assam, which also constitute the first occurrence record in the region. There has been a great deal of taxonomic ambiguity and misunderstanding in reporting two species of *Camptoceras*, one Japanese species *C. hirasei* by Walker (1919) and the other one *C. subspinosum*, a

new species allied to *C. lineatum* from Kashmir by Annandale & Prashad (1920).

The occurrence of *C. lineatum* in a sluggish water channel of Loktak Lake in Manipur (Annandale & Prashad, 1920) and in Nazirpur, Shushong, Mymensingh District, of Bangladesh (Gude, 1914; Annandale & Prashad, 1921; Subba Rao, 1989) has already been confirmed. The dearth of reference in respect of the occurrence of the species in rest of India is recorded and the present finding justifies its spatial distribution throughout northeastern India.

In Deepar wetland, *C. lineatum* was recorded from standing water habitat only. Annandale & Prashad (1920) did not record the detailed habitat ecology of the species during their studies. Their findings of the animal on grass-stems of a channel of Loktok lake in Manipur were probably due the migration of the animal from their original habitat along with running water.

In general all the oviparous freshwater gastropod molluscs, during their development, exhibit rotational movement inside the egg capsule and there is no report on free-living larval forms in the group (Nagabhushanam & Sarojini, 1985; Subba Rao, 1989; Tonapi, 1980). The pro larva of *C. lineatum* in the present finding demonstrates highly active movement inside the egg capsule, which corroborate the earlier finding.

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