

Primary Research Paper

Loxosomatoides sirindhornae, new species, a freshwater kamptozoan from Thailand (Entoprocta)

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Abstract

A new species of freshwater kamptozoan (Entoprocta) is described from the Mae Klong and Prachin Buri Rivers in central Thailand. This brings to two the number of known entoproct species occurring in fresh water. The new species, *Loxosomatoides sirindhornae*, grows as stolonate colonies; each diminutive zooid has a muscular, unsegmented stalk, and an obliquely oriented calyx. A well-formed hibernaculum originates from a short, lateral stolon at the base of certain zooids. The calyx bears a rigid shield with a conspicuous aboral carina extending along the entire length. Colonies have been found only in fully freshwater habitats and appear not to tolerate salinities higher than 1.0 ppt.

Introduction

This paper introduces a new species of freshwater entoproct (Phylum Entoprocta Nitsche, 1870 = Kamptozoa Cori, 1929). It is only the second recognized freshwater species in this otherwise mostly marine group. The invertebrate Phylum Entoprocta, with about 150 described species, is well represented in marine fouling communities, with a handful of species occurring in brackish habitats. All are suspension feeders, mostly small and inconspicuous, growing on firm substrata or in association with larger invertebrates (Nielsen, 1989).

The only other freshwater species, *Urnatella gracilis* Leidy, 1851 was initially reported from the Schuylkill River near Philadelphia and was subsequently confirmed in other parts of eastern North America. In Europe, the species was first documented in 1938 from the Meuse River in Belgium (Damas, 1939), later appearing to spread throughout Europe and in the USSR (Emschermann, 1972). *Urnatella* has also been

reported from South America (Bonetto & Cordi-viola, 1963; Mañé-Garzon, 1964), Africa (Wiebach, 1965), southern India (Seshaiya, 1947) and most recently from Japan (Oda, 1982). The pattern of reports gives the impression that the species is expanding its range rather than being the target of delayed discovery. Apparent morphological variations have prompted the proposal of two additional species (*U. dnjestriensis* Zambriborshch, 1958) in the USSR and *U. indica* (Seshaiya, 1947) in southern India), but Nielsen (1989) considers both of these to be synonymous with *U. gracilis*.

Materials and methods

Colonies were collected on submerged substrata including nylon rope, rotten bamboo, and the shells of living zebra mussels, *Dreissena polymorpha* (Pallas, 1771). In the laboratory they were kept alive for several weeks in a round, 15-liter glass container with pond water changed daily and swirled slowly by a simple airlift pump. Zooids

growing on mussel shells survived somewhat longer when living mussel tissue was removed and the shells were fastened medial side down to glass Petri plates using thermal glue. The Petri plates were suspended upside down in a thriving 50-gallon aquarium containing large goldfish (*Carassius auratus* L.) as described by Wood (1996).

To test for tolerance to salinity, I prepared a stock solution of sea salt (Instant Ocean™, Mentor, Ohio) in pond water with a concentration of 3 ppt as measured by a hydrometer. Using calculated dilutions, I initially exposed colonies to 0.3 ppt for 10 min, then increased the concentration at 10-min intervals with gentle mixing, finally reaching 1.0 ppt after 4 h. Several species of phylactolaemate bryozoans were included in the test water for comparative observations.

Measurements of zooids and hibernaculae were taken by ocular micrometer on dissection and compound microscopes.

For electron microscopy specimens were initially fixed in alcohol and later freeze dried; then sputter coated with gold palladium alloy and examined with a Philips 500 scanning electron microscope.

Diagnosis

The calyx shield bears a conspicuous, longitudinal crease, or carina, which extends along its entire length. A unilocular hibernaculum develops as an irregularly shaped, localized enlargement at the tip of a short stolon immediately adjacent to the zooid base. This structure takes on a roughly hemispherical or low conical shape with a well defined circular plug at its apex from which a new zooid will eventually emerge.

Description

Colonies of zooids are joined in linear series by slender stolons adherent to firm substrata throughout their length, each zooid capable of radiating 1–4 new stolons from the base (Fig. 1). The stalk is roughly cylindrical and muscular throughout its length, tapering slightly from base to apex (Figs. 1 and 2). When straightened, the stalk length of the largest zooids does not exceed 0.45 mm, and in most zooids the stalk is slightly shorter than this. The stalk-calyx junction is wide,

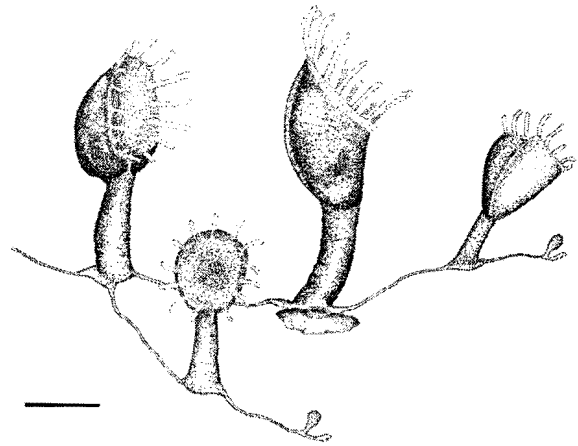


Figure 1. Colony of *Sirindhornella cristata* showing hibernaculum and zooids in various stages of development. Scale bar = 0.30 mm.

unconstricted, and lacking a star-cell complex. The calyx orients obliquely to the stalk, the oral side facing the general direction of the next youngest zooid in linear series. The conspicuous aboral shield bears a medial ridge or carina throughout its length, which is especially pronounced in larger zooids. Also in full grown zooids both the stalk and shield are minutely roughened with small protuberances easily visible in clean specimens at 30× magnification (Fig. 2). In most specimens the semi-opaque shield, together with adhering debris, obscures internal structures. The largest calyces measure 0.4 mm in length. The atrium is surrounded by 12–16 colorless tentacles. Stolons are relatively slender, about 30 μm in diameter, yet strong enough to be dislodged intact from hard substrata. Septa within the stolons have so far been observed only at the proximal side of a hibernaculum. Hibernaculae develop as irregularly shaped, localized enlargements at the tips of short, lateral stolons immediately adjacent to zooid bases (Figs. 1 and 4a). The wall of each hibernaculum thickens and darkens, and a spreading basement cuticle adheres the entire structure to the substratum. The finished hibernaculum is a low, isolated mound, roughly conical or hemispherical, measuring about 300 by 180 μm (Fig. 3). A central indentation at its apex is ringed by a raised margin that defines a circular orifice about 75 μm in diameter (Figs. 1, 3, and 4a). The orifice appears plugged with a granular material. From this orifice a small zooid eventually emerges to generate a new colony (Fig. 4b).

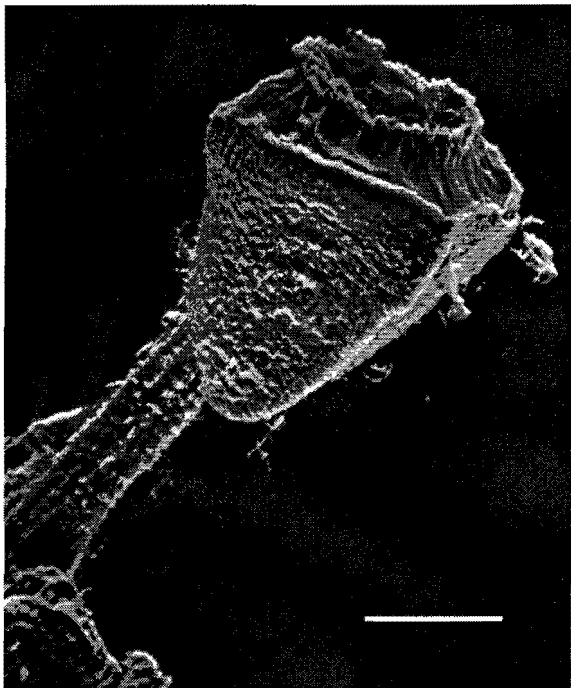


Figure 2. Scanning electron micrograph of a single zooid of *Sirindhornella cristata* showing natural rough external texture. Alcohol fixative has deformed the soft tissues. Scale bar = 250 μm .

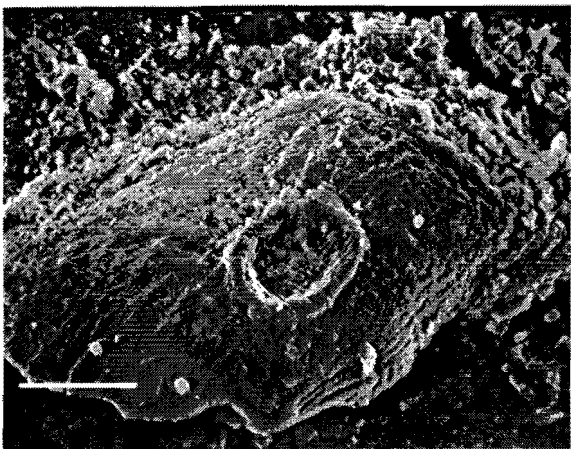


Figure 3. Scanning electron micrograph of a single hibernaculum of *Sirindhornella cristata*. Scale bar = 70 μm .

Etymology

The specific epithet honors Her Royal Highness Princess Maha Chakri Sirindhorn, who maintains a strong interest in the biological diversity of Thailand.

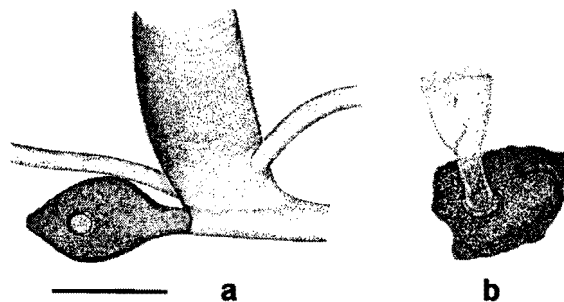


Figure 4. Hibernaculae in *Loxosomatoides sirindhornae* drawn from living material. Scale bar = 0.24 mm. (a) Developing hibernaculum, showing its spatial relationship and attachment to the parental zooid. (b) New zooid recently emerged from a hibernaculum.

Type material

Type specimens are composed of several colonies or colony fragments attached to strands of nylon rope collected 6 March 2004 from the Mae Khlong River at the city of Kanchanaburi, Kanchanaburi Province in west central Thailand, 13°59'74" N, 99°32'34" E. The holotype is deposited at the Chulalongkorn University Zoology Museum (Bangkok). Paratype specimens include No. NHM 2005.1.4.1 at the Natural History Museum (London) and No. USNM 1071739 at the Museum of Natural History (Smithsonian, Washington, DC).

Discussion

The unsegmented and unbranched stalk, small stature, and aboral shield are among the features distinguishing this species from *Urnatella gracilis*, the only other entoproct known from fresh water. *Urnatella* is currently placed in the Family Barentsiidae on the basis of its segmented stalk with alternating muscular and nonmuscular segments (Nielsen, 1989). This stalk may grow up to 5 mm long, often with lateral budding from younger segments which produces a tuft of multiple zooids sharing the same basal plate. Certain segments, including the basal plate, may function as hibernaculae. All this contrasts sharply with the new Thai species, where the unsegmented stalk rarely exceeds 0.45 mm and never produces lateral buds nor harbors hibernaculae.

Instead, the stolonate colonies of zooids with their unsegmented, muscular stalks place the Thai

species securely in the Family Pedicellinidae (Johnston, 1847 *sensu* Emscherman, 1972). Other genera of this group include *Pedicellina* Sars 1835, *Myosoma* Robertson 1900, and *Loxosomatoides* Annandale 1908. The latter two genera are very similar, characterized by strong stalk musculature and an obliquely oriented calyx. Differences among their six combined species are tabulated and discussed by Wasson et al., (2000). *Myosoma* species are marine, while at least three of the four *Loxosomatoides* species occur in brackish water. One of these, *L. colonialis* Annandale 1908, is reported to form a two-chambered hibernaculum (Wasson et al., 2000) but no description has yet been published. However, *L. laevis* Annandale 1915, produces a monolocular hibernaculum well described and illustrated by Annandale (1915). Resembling a prostrate calyx, the bud lies with the stalk emerging from one end, the combined unit adhering to the substratum throughout its length by means of a "thin, horny membrane." These features bear some resemblance to early stages of the hibernaculum in *L. sirindhornae*, although Annandale's drawing suggests a longer and less specialized structure.

In general, the differences between *Loxosomatoides* and *Myosoma* are not entirely clear and may not, in fact, be taxonomically significant (Wasson et al., 2000). However, under the current scheme, in which certain *Loxosomatoides* species have hibernaculae and a brackish habitat, it seems reasonable for now to place the new freshwater species here. Future revisional studies of these genera will certainly be appropriate when additional information becomes available.

Loxosomatoides sirindhornae has been collected so far from two rivers that flow south into the Gulf of Thailand near Bangkok: the Mae Khlong River to the west and the Prachin Buri River to the east. No surveys have yet been made on the Chao Praya River, which lies between these two. On the Mae Khlong River the known species range extends from Ban Mai Wang Khanai Bridge at Tha Muang north to Srinakharin Reservoir, a distance of more than 90 river kilometers. The largest population was found at the city of Kanchanaburi (13°59'74 N, 99°32'34 E), where colonies grew abundantly on synthetic rope trailing in the water from floating guest houses, restaurants, and fish culture frames. Other substrata included partly rotted planks,

bamboo, and rocks. On the Prachin Buri River *L. sirindhornae* was found only at the town of Prachin Buri in Prachin Buri Province (14°03'14" N, 101°22'24" E) on old bamboo substrata. All collections were made during the months of November, 2002 and March and August, 2003, and it is likely that the species occurs throughout the year. Water temperatures were 29–32 °C, and conductivity was measured at 206–234 mmhos.

Loxosomatoides sirindhornae appears to be a true freshwater species with little tolerance for brackish salinities. No colonies were found in lower reaches of either river where there are still tidal incursions of brackish water from the Gulf of Thailand. In a series of triplicate tests I compared the salt tolerance of the entoproct colonies with three species of freshwater (phylactolaemate) bryozoans: *Lophopodella carteri* Hyatt, *Plumatella bombayensis* Annandale, and *Plumatella vorstmani* Toriumi. At 0.3 ppt salinity all colonies behaved normally, except *Lophopodella*, which had its tentacles bent slightly at the tips. A small amount of saline solution was slowly mixed in every 10 min, so that after 2 h the total salinity had reached 0.6 ppt. At that point the cilia on the tentacles of all species beat irregularly or else became immobile, making feeding ineffective. The phylactolaemates were dead at 0.7 ppt, and the kamptozoans were completely unresponsive at 1.0 ppt. It appears from these trials that while *L. sirindhornae* may be more hardy than the three phylactolaemate bryozoans, it has little tolerance for even low salinities.

Certainly none of the invertebrate species occurring naturally with *L. sirindhornae* suggest an even a slightly brackish habitat, including the phylactolaemate bryozoans *Plumatella bombayensis*, and *Internectella bulgarica* Gruncharova, and the gymnolaemate, *Hislopia malayensis* Annandale.

With *Loxosomatoides sirindhornae* it is apparent that at least two entoproct families, Barentsididae and Pedicellinidae, have ventured independently into fresh water habitats. *Urnatella* is widespread and well known, possibly due to its relatively large size (about 10 times larger than the Thai species) and its occurrence in regions where freshwater communities have been well studied. It is possible that additional field work will show *Loxosomatoides sirindhornae*, like *Urnatella*, to be a frequent member of freshwater communities with a significant geographic range in tropical Asia.

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