The freshwater medusa *Limnocnida* and associated plankton in the floodplain of the Ayeyarwaddy River, Myanmar

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Abstract

Freshwater medusae of the genus *Limnocnida* were found in a shallow lake in the floodplain of the Ayeyarwaddy River. The medusae are described and identified as a small form of *L. indica*. Single immature specimens were found in two other localities in Myanmar, within the Ayeyarwaddy catchment. These records are an eastward extension of the known range of *Limnocnida*, and indicate that it is probably widespread in the Ayeyarwaddy catchment. The associated phytoplankton and zooplankton are listed, and the zooplankters are compared to those found with *Limnocnida* in a floodplain lake of the River Sokoto in West Africa. In both situations there was a marked preponderance of rotifers and cyclopoid copepods. This indicates that *Limnocnida* influences the zooplankton in a manner similar to that found in various studies on the freshwater medusa *Craspedacusta* in Europe and North America.

Keywords: Associated plankton, freshwater Medusa, Myanmar.

Introduction

In recent years the freshwater medusae of the world have been reviewed by Dumont (1994) and Jankowski (2001). The most important and widespread genera are *Craspedacusta* and *Limnocnida*. The latter genus has a disjunct distribution, with a group of species in Africa and another in the Indian subcontinent. Most of the records from India are from the south and west, but there are also records from the Himalayas, extending up to an altitude of 1400 m (Dumont 1976; Ferro 1979). We have seen no previous records of this genus in Myanmar. Most records of *Limnocnida* do not record the other plankton occurring at the same time. In this paper we record both the net phytoplankton and the zooplankton co-occurring with *Limnocnida* in Myanmar, and compare the zooplankton with that occurring with *Limnocnida* in a riverine backwater in West Africa.

Methods

The lake was circumnavigated in a small boat provided by a local fisherman.
Conductivity and pH were measured with battery-powered meters. Temperature was measured with an electronic probe, previously calibrated against a mercury in glass thermometer. Depth was measured with Hydrobios metre wheel, with the potential, in calm conditions, of measuring to the nearest cm.

Plankton samples were taken with Hydrobios nets with meshes of 250 and 55 μm.

The samples were preserved in 5% formaldehyde, and examined in detail on return to London. Vertical hauls of 1.5 m were repeated four times with the 250 μm mesh net and twice with the 55 μm mesh net. This enabled the estimation of the numbers of zooplankters under 1 m². Total counts of the 250 μm samples were made, but subsamples were taken to estimate numbers in the 55 μm samples.

**The habitat**

Pee Le In (24°11.351N; 97°07.249E) is a shallow lake on the west bank of the Ayeyarwaddy, in Kachin State, about 13 km south-west of Bhamo. It is separated from the river by about 1.5 km of marshy ground, which is innundated during the rainy season. The lake area is slightly under 100 ha. When we sampled the lake on 2 February 2003, the maximum depth measured was 1.93 m. The water temperature was 22°C at the surface, and at 1 m it was 20°C. The conductivity was 120 μS and the pH was 7.9. Most of the lake is open water, but there is a fringe of emergent sedge. Inside the sedge fringe there are small areas of *Eichhornia*, *Blixa*, *Trapa*, *Polygonum*, and the large duckweed *Spirodela*. Fishes are evidently fairly abundant in the lake. There is an elaborate, permanent fish trap in the middle of the lake, and we saw at least 10 different species in the fishermen’s catches.

**Description of the medusa**

The largest specimen had a diameter of 6 mm, with the longest tentacles extending 3 mm beyond the umbrella margin. The mouth is large and circular, and the gonad forms an irregular circle around the manubrium. There are 64 primary tentacles with deeply implanted bases. Between each pair of primaries there are five secondary tentacles, one of which is thinner and shorter than the others. The total number of tentacles is thus 384. A scale-like membrane overlaps the bases of the secondary tentacles (Figures 1, 2). Between successive primary tentacles there are two statocysts, resulting in a statocyst: tentacle ratio of 0.33. The statocysts are spherical, with a diameter of 100–120 μm. The statoliths are also spherical with a diameter varying between 40 and 50 μm.

The nematocysts are oval in shape, 7–10 μm long, with a distinct cnidocil. Finding discharged nematocysts proved to be difficult, but the few found were all microbasic euryteles. The nematocysts are arranged in batteries on the tentacles. Near the bases they are housed in rounded swellings (Figure 3), but near the tips of the tentacles the nematocysts are more numerous and arranged in irregular transverse bands (Figure 4).

A medusa with a diameter of 2 mm lacked a gonad, and had only 40 tentacles, ranging in size from short protuberances to fully formed tentacles over 1 mm in length. Eight statocysts were evident; the largest 80 μm in diameter with a statolith 30 μm in diameter. The statocyst: tentacle ratio was 0.20, which is much smaller than in the larger individuals with gonads. Both the number and the size of the statocysts increase as the medusa grows.

An intermediate specimen, with a diameter of 4 mm, had 20 primary tentacles, and secondary tentacles in groups of five, giving a total of 120 tentacles. The statocysts numbered 40, so that the ratio to tentacles, 0.33, was the same as in the largest specimen.
Figures 1–4. *Limnocnida* from Myanmar. (1) Whole umbrella showing primary tentacles on one quadrant, and all tentacles on another quadrant. (2) Umbrella margin, showing bases of two primary tentacles with associated secondary tentacles and statocysts. (3) Part of the basal region of a tentacle showing groups of nematocysts. (4) Arrangement of nematocysts near the tip of a tentacle.
Associated phytoplankton

The phytoplankton recorded in this section is that retained by a 55μm meshed plankton net. It follows that no account can be given of the smaller forms.

The dominant species retained by the net was *Eudorina elegans* Ehrenberg, a colonial flagellate with overall dimensions up to 85μm. Species present in smaller number were: *Ceratium hirundinella* (O. F. Müller) Dujardin, *Peridinium umbonatum* Stein, *Dinobryon sociale v. americanum* (Brunnthalner) Bachmann, *Closterium* sp., *Pediastrum simplex* Meyen, *Pediastrum duplex* Meyen, *Aulacoseira granulata* (O. F. Müller) Simonsen, and *Spirulina* sp.

Associated zooplankton

Estimates of the numbers of zooplankters under 1 m² are given in Table I. In terms of volume the medusae exceeded all the other zooplankters. The rotifera found in the samples are given in Table II.

Other records of *Limnocnida* in Myanmar

Single immature specimens (ca 2 mm diameter) were found in samples from two other localities, both in sub-basins of the Ayeyarwaddy.

Table I. Numbers of zooplankters under 1 m² in Pee Le In on 2 February 2003.

| Species                      | Number |
|------------------------------|--------|
| Limnocnida medusae           | 46     |
| Rotifera                     | 79,062 |
| Immature Cyclopoida          | 1,696  |
| *Moina micrura* Kurz         | 58     |
| Diaphanosoma excisum Sars    | 16     |
| Heliodiaptomus cinctus (Gurney)| 11     |

Table II. Percentage composition of the Rotifera in the plankton of Pee Le In on 2 February 2003.

| Species                      | %  |
|------------------------------|----|
| Keratella cochlearis (Gosse) | 16 |
| Keratella tecta (Gosse)      | 26 |
| Keratella tropica (Apstein)  | 13 |
| Pompholyx complanata (Gosse) | 18 |
| Synchaeta longipes Gosse     | 15 |
| Trichocerca similis (Wiersejski) | 6 |
| Brachionus angularis (Gosse) | 2  |
| Anuraeopsis coelata (de Beauchamp) | 1 |
| Polyarthra longiremis Carlin | 1  |
| Polyarthra vulgaris Carlin   | 1  |
| Filinia novazeelandiae Shiel and Sanoamuang | 1 |
| Asplanchna giroi de Guerne | +  |
| Asplanchna priodonta Gosse   | +  |
| Testudinella patina (Hermann) | + |
| Trichocerca rutmeri (Donner) | +  |

+, present at less than 1%.
1. Thitson Reservoir (20° 27.452N, 95° 57.666E). Formed by the damming of the Thitson Chaung. Operational in 1961. Sampled 30 January 2001. Phytoplankton dominated by Ceratium hirundinella. Zooplankton dominated by immature cyclopoid copepods. Dominant rotifer: Keratella cochlearis.

2. Kyet Mauk Taung Reservoir (20° 48.569N, 95° 15.520E). Formed by damming two streams: Taungzin and Kyaukpong Chaungs. Operational 1966. Sampled 3 February 2001. Phytoplankton dominated by Ceratium hirundinella. Zooplankton dominated by Ceriodaphnia cornuta. Dominant rotifer: Brachionus angularis.

The capture of single immature specimens indicates that the medusae were very sparse, possibly at the beginning of their cycle. In small numbers they would not have any significant influence on the composition of the zooplankton. This is reflected in the different dominant crustaceans and rotifers found in the two localities.

Discussion

On the basis of the number of tentacles, and the ratio of statocysts to tentacles, the specimens from Pee Le agree with L. indica Annandale, 1911. The arrangement of the secondary tentacles in groups of five, and the presence of two statocysts per group, also agree with L. indica, and contrast with L. nepalensis Dumont, 1976, where the secondary tentacles are in groups of four, with a single statocyst per group.

The specimens from Pee Le are smaller than usual for L. indica, which ranges up to 15 mm in diameter. The present records constitute an eastward extension of the known range of Limnocnida, and indicate that the genus may occur widely in the Ayeyawaddy catchment.

The phytoplankton does not, as far as known, form any part of the food of Limnocnida, but one might expect the presence of medusae to influence indirectly the abundance and composition of the phytoplankton, by preying on zooplankton.

Sharma and Chakrabarti (2000) observed a peak of Dinophyceae when Limnocnida was abundant and crustacean zooplankton was sparse. In enclosure experiments with Craspedacusta, Jankowski and Ratte (2000) found that phytoplankton decreased in control enclosures without medusae, but remained higher in enclosures with medusae.

The phytoplankton in Pee Le was dominated by Eudorina elegans, a relatively large colonial flagellate. Dominance by a large colonial form has also been observed in the presence of Craspedacusta. Green (1998) found an abundance of Errerella bornhemicensis Conrad in the presence of medusae in a backwater of the River Thames in England.

Numerous studies have established that freshwater medusae feed on zooplankton (e.g. Lankester 1880; Boulenger and Flower 1928; Davis 1955; Dodson and Cooper 1983; Jankowski and Ratte 2000). Small cladocerans, such as Bosmina, appear particularly vulnerable. Cyclopoid copepods appear less vulnerable, although Sharma and Chakrabarti (2000) reported a decrease in Mesocyclops during the occurrence of Limnocnida.

A comparison of the general composition of the planktonic Crustacea present in Pee Le with those present in a floodplain lake on the River Sokoto in West Africa (Green 1960, 1962) is given in Table III. In both localities cyclopoid copepods survive better than Calanoida or Cladocera in the presence of Limnocnida. A similar result was obtained in relation to Craspedacusta in a backwater of the River Thames in England (Green 1998). After a week with medusae present the composition of the zooplankton changed so that cyclopoids formed 43% of the total, while Bosmina fell from 80% to 31%. Acker and Muscat (1976) also found a decrease in Bosmina as the numbers of medusae increased. It is clear that both Limnocnida and
Craspedacusta directly influence the numbers and composition of the crustacean zooplankton, and indirectly have similar effects on the phytoplankton.

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