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The interstitial Rotifera of a tropical freshwater peat swamp on Phuket Island, Thailand

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ABSTRACT. We studied the Rotifera inhabiting the psammon of a coastal freshwater peat swamp on Phuket Island, Thailand, in order to provide a first report on interstitial rotifers from tropical regions. The records total 19 species, three of which we describe as new to science. Four species are regional endemics, one is Oriental and two are widespread but very rare. Six taxa are new to Thailand. The results indicate a high endemicity rate, however, the scarcity of information on the distribution of tropical interstitial rotifers, illustrated by the description of one of the new species from Thailand and Bolivia, precludes generalisations at this time.

KEY WORDS: Rotifera, interstitial fauna, zoogeography, taxonomy, Thailand.

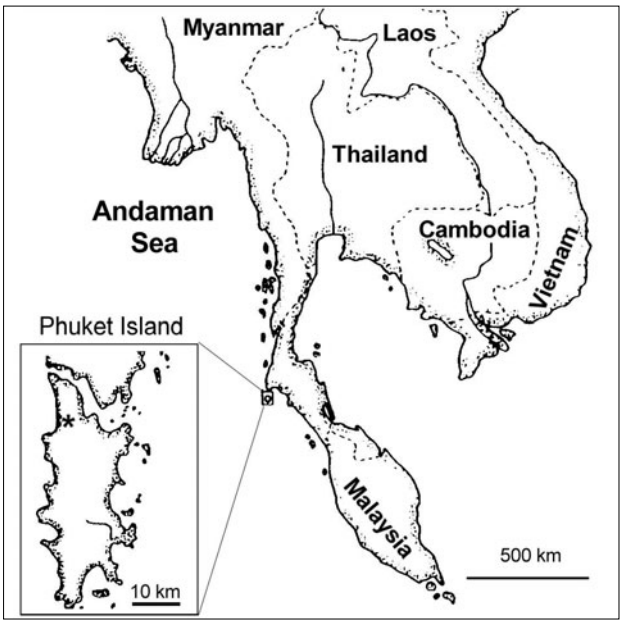
INTRODUCTION

When compared to plankton and even littoral Rotifera, the communities of rotifers inhabiting interstitial environments are rarely studied. The peculiar taxa occurring in the psammon are rare, and/or insufficiently known. Many are presently considered endemic, but it is as yet unclear to what extent this is factual or an artefact of insufficient sampling. Some studies exist on interstitial freshwater and marine European and Northeast American habitats (e.g. WISZNIEWSKI, 1934; REMANE, 1949; PENNAK, 1951; ALTHAUS, 1957a, b; TZSCHASCHEL, 1979, 1980, 1983; TURNER, 1990; SEGERS, 1998; RADWAN & BIELANSKA-GRAJNER, 2001), but hardly any information is available on interstitial rotifers from tropical regions.

In order to contribute to the knowledge of tropical interstitial rotifer communities, we sampled the hygropsammon (see WISZNIEWSKI, 1934) of a coastal freshwater habitat on Phuket Island, Southern Thailand, Mai-Khao peat swamp. The plankton rotifer fauna of this swamp has already been studied by CHITTAPUN et al. (1999).

MATERIAL AND METHODS

Mai-Khao peat swamp is a pristine coastal peat swamp on Phuket Island, Southern Thailand (Map). The swamp water is slightly acidic (pH 5.6-5.9), and brown-coloured



Map. – Situation of the Mai-Khao peat swamp (*) on Phuket Island

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(turbidity 4-18 NTU). The swamp is freshwater, but some influence of the Andaman Sea, from which the swamp is separated by a dike, cannot be excluded. The conductivity is 1.98-2.90 mS.cm^{-1} (CHITTAPUN et al., 1999).

Two samples of hygropsammon were taken on 28 July 1999, by collecting c. 50 cc of sand from the top 0.5 cm of hygropsammon. Fixation was done with formaldehyde (4%). Rotifers were isolated by searching the samples using a Wild M10 dissection microscope, and examined and drawn using an Olympus CH2 microscope with drawing tube. Scanning electron microscopy (SEM) was performed using a JEOL JSM-840 microscope on trophi material processed following SEGERS (1993) and SEGERS & DUMONT (1993). Permanent slides of types are deposited in the collections of the royal Belgian Institute for Natural Sciences, Brussels, Belgium (KBIN), of the department of Biology of Ghent University, Ghent, Belgium (RUG), of Prince of Songkla University, Hat Yai, Thailand (PSU) and of the University of Antwerp, R.U.C.A. campus, Antwerp, Belgium (RUCA). All measurements are in µm.

TAXONOMY

Of the 19 rotifer species found (Table 1), three are new to science, and the trophi morphology of two more species is insufficiently known.

TABLE 1

List of Rotifera in the psammon of Mai-Khao peat swamp

*New to Thailand, †Endemic to Thailand, [1]Oriental endemic
1: single specimen; RR: 1-5 specimens, R: 5-10 specimens, C: >10 specimens.

Brachionus urceolaris (Müller, 1773): 1
Cephalodella innesi Myers, 1924: RR
**C. megalocephala* (Glascott, 1893): R
**C. plicata* Myers, 1924: C
Colurella colurus (Ehrenberg, 1830) f. *compressa* Lucks, 1912: RR
,†Colurella psammophila*** **new species: R**
Colurella obtusa (Gosse, 1886): R
†C. sanoamuangae Chittapun, Pholpunthin & Segers, 1997: C
**Encentrum longidens* Donner, 1943: R
,†Encentrum pornsilpi*** **new species: C**
[1]Lecane acanthinula (Hauer, 1938): RR
L. bulla (Gosse, 1851): C
L. hamata (Stokes, 1896): 1
L. obtusa (Murray, 1913): C
L. pyriformis (Daday, 1905): 1
L. rhytida Harring & Myers, 1926: C
†L. segersi Sanoamuang, 1996: M: C
Lepadella desmeti* **new species: R**
Limnias melicerta Weisze, 1848: 1
Trichocerca tenuior (Gosse, 1886): R

Cephalodella plicata Myers, 1924
(Figs 1-2)

MYERS in HARRING & MYERS (1924) p. 483 figs 28: 3-4; KOCH-ALTHAUS 1963 p. 403 fig. 12a, b; NOGRADY et al. (1995) p. 119-120 fig. 163.

Comment

There are quite a few records of this species from Europe and North America, and one from New Zealand (DE RIDDER & SEGERS, 1997). Of its trophi, of which the original description (reproduced in NOGRADY et al., 1995) lacks

Figs 1-2. – *Cephalodella plicata* Myers, 1924, SEM photographs of trophi. 1: ventral, 2: id., detail. Scale bars: 1µm.

detail, there exists only a single, rather poor illustration (KOCH-ALTHAUS, 1963). We therefore present SEM pictures of this structure (Figs 1, 2). The trophi concur to WULFERT'S (1938) type A, with rounded rectangular basal apophysis without teeth on the inner margins; symmetrical rami with small alulae; rod-shaped manubria with a minute pore approximately medially; and broad fulcrum. Especially the latter feature is noteworthy, as it occurs in only two other species of *Cephalodella* (SEGERS & PHOLPUNTHIN, 1997).

Colurella psammophila new species
(Figs 3-5)

Material: Holotype (RIR 115) and one paratype (RIR 116) in KBIN (IG 2925); three paratypes on one slide in RUG; one paratype in PSU. All collected in the hygropsammon of the type locality, Mai-Khao peat swamp, Phuket Island, Thailand, on 28 July 1999.

Differential diagnosis

Colurella psammophila n. sp. resembles *C. colurus* f. *compressa* (Fig. 6), but has a relatively higher lorica (length: height 1.73-1.85 in *C. psammophila* n. sp. versus 1.9-1.98 in *C. colurus* f. *compressa*), and a shallower ventral sulcus. The outline of its head aperture margin is not an evenly curved outline as in *C. colurus* f. *compressa*, but has a more or less straight dorsal, and ventral part. *C. psammophila* n. sp. could also be mistaken for *C. obtusa,* but this species is smaller, and has shorter toes.

Description

Parthenogenetic female (male unknown): lorica laterally compressed, ventral sulcus shallow. Head aperture margins dorsally and ventrally straight, medially curved. Dorsal margin anteriorly straight, evenly curved from medially onwards. Minute openings to lateral antennas present postero-laterally. Head aperture with deep ventral and dorsal sinuses, dorsal foot aperture without dorsal notch, no lorica extensions lateral to the foot. Foot with three pseudosegments, the distal one approximately 1.5 times as long as the two proximal ones. A sensorial organ present mid-dorsally on the distal foot pseudosegment. Toes equal, straight to weakly curved.

Measurements: lorica length 65-81, height 35-47, width 23. Second foot pseudosegment 5.2-5.7, third foot pseudosegment 6.8-8.9, toe length 30-38.

Distribution and ecology

Colurella psammophila n. sp. is only known from the hygropsammon of the type locality, a pristine freshwater coastal peat swamp on Phuket Island, Thailand. The animal was not found during previous studies of the plankton of the swamp, so it is assumed interstitial. It co-occurred with, amongst others, *C. colurus* f. *compressa* and *C. obtusa*.

Etymology: The name of the new species is an adjective, referring to the species' habitat.

Encentrum (Encentrum) pornsilpi new species
(Figs 9-11, 17-20)

Material: Holotype (RIR 117) and one paratype (RIR 118) in KBIN (IG 29152); one paratype in RUG, one in PSU, one in RUCA. All collected in the hygropsammon of the type locality, Mai-Khao peat swamp, Phuket Island, Thailand, on 28 July 1999.

Differential diagnosis

Encentrum pornsilpi n. sp. is a close relative of *E. marinum* (Dujardin, 1841) and *E. spatiatum* Wulfert, 1936. It differs from *E. marinum* by its slender trophi, trunk without lateral sulci and non-stalked gastric glands, and from *E. spatiatum* by its rounded gastric glands, and absence of ventral body in the trunk.

Description

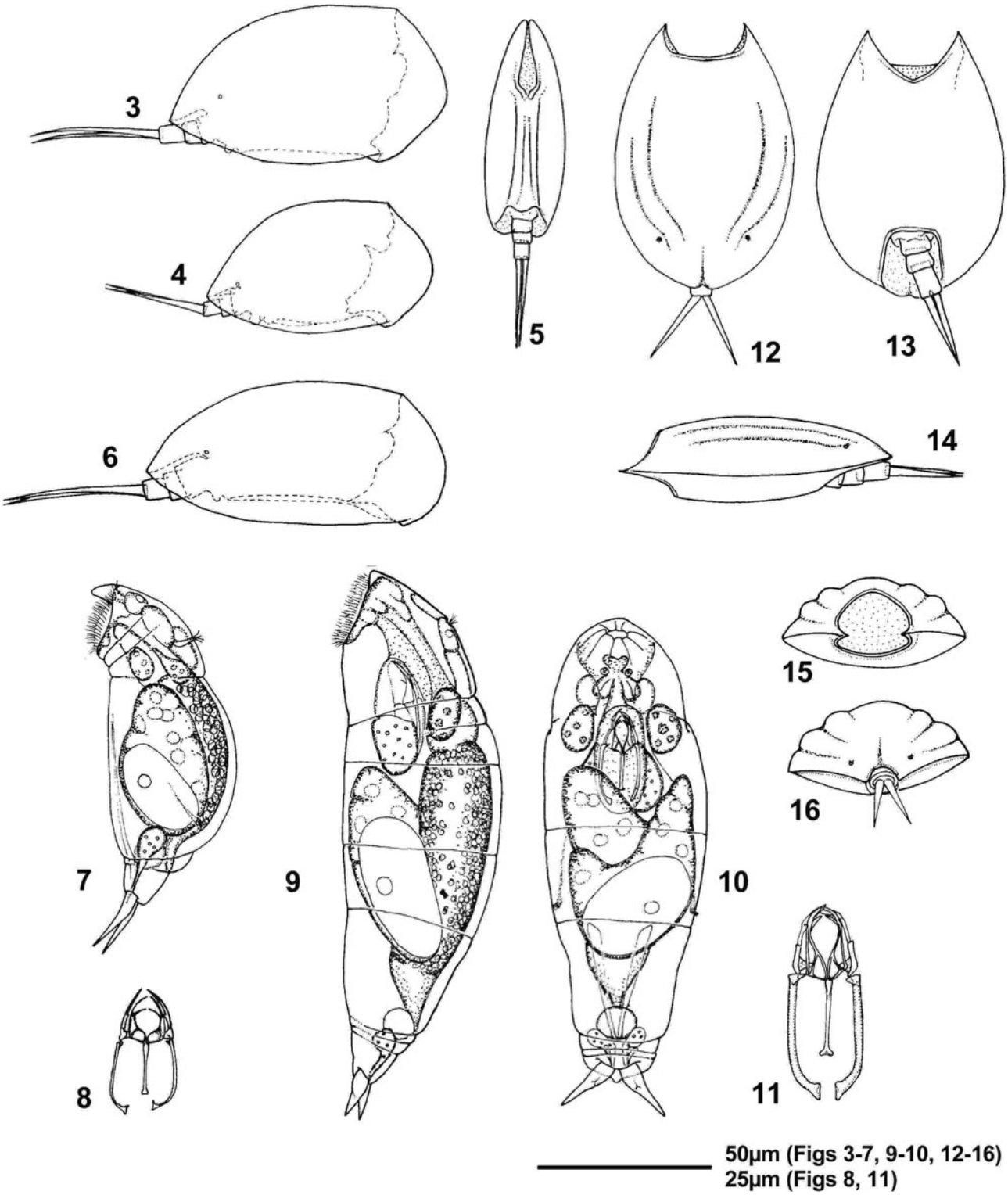
Parthenogenetic female (male unknown): Body elongate, fusiform; cuticle soft, transparent. Head c. 1/3 total length. Rostrum small, short and rounded. Corona slightly oblique, no palps observed. Trunk with weak constrictions. Tail absent. Foot short, conical in lateral view. Toes short, c. 1/8-1/10 total length, bases swollen, slightly decurved ventrally, clearly separated and with papilla between toes. No eyespots, but with two light-refracting globules in the subcerebral glands. Salivary glands terminal. Proventriculus present. Gastric glands large, ovate. Pedal glands clubbed, foot-length.

Trophi small, elongate, slender. Rami longer than wide, outer margin of rami slightly concave laterally, angular posteriorly. Each ramus terminally with single, incurved apical tooth, anterior to this tooth a preuncinal tooth set at right angle to axis; this tooth with a minute medial knob whereupon the ventral uncinal apophysis rests. Fulcrum as long as, or longer than the rami, posterior end with indented basal plate. Unci single-toothed, curved, long and slender. Tooth shaft length small, dorsal and ventral apophyses present. Intramallei long, elongate-triangular in ventral view. Manubria shorter than incus, a triangular expansion proximally, distally strongly incurved and knobbed.

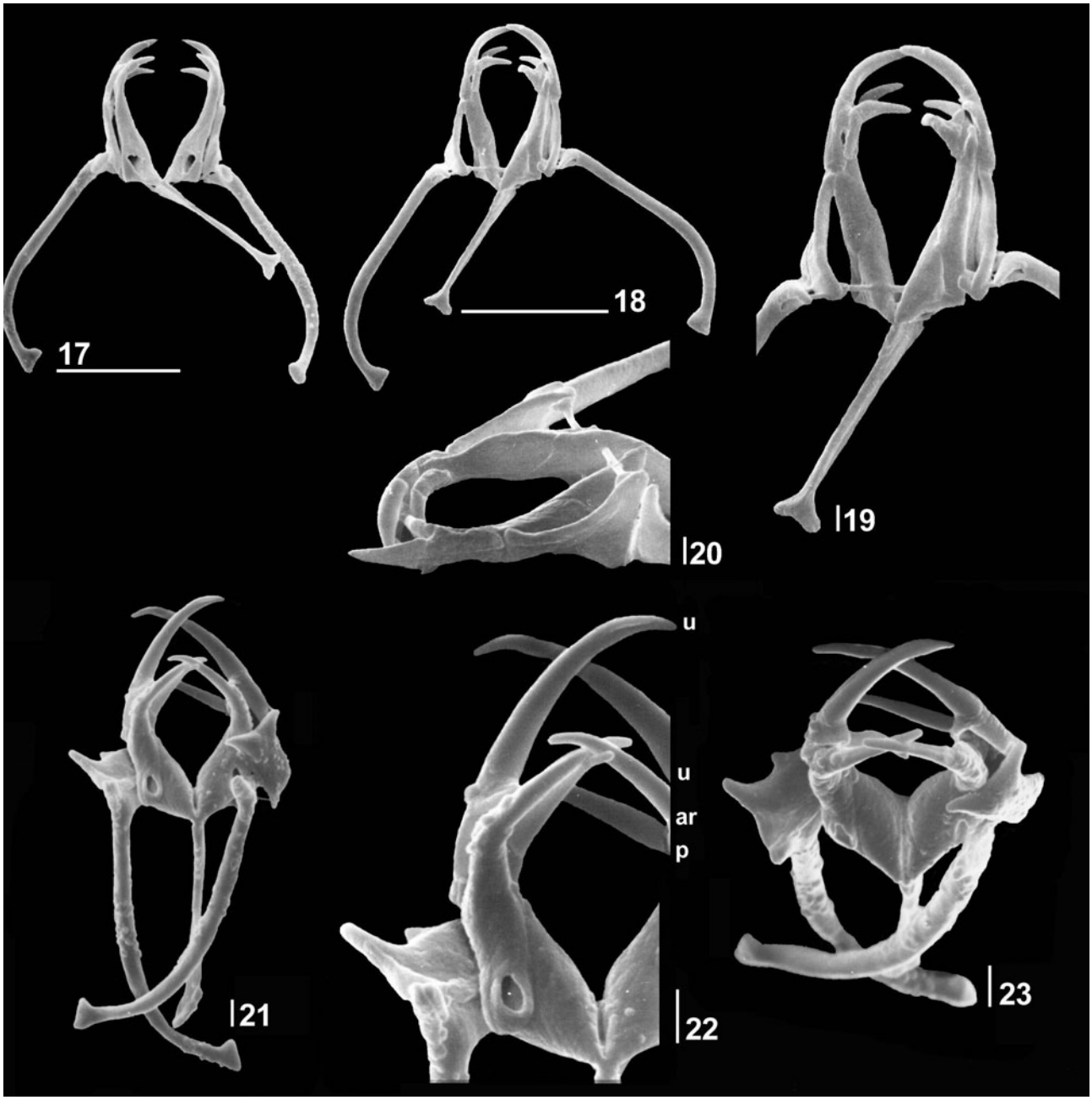
Measurements: Total length 137-160, toe 14-17, trophi 23-27. Ramus 9-10, fulcrum 10-11, uncus 4.4-5.9, intramalleus 5.2-5.5, manubrium 16.3-17.

Distribution and ecology

Encentrum pornsilpi n. sp. is so far known from its type locality only, where it occurred in abundance. It has not been found in the plankton.



Figs 3-5. – *Colurella psammophila* n. sp.. 3-4: lateral (different specimens), 5: ventral (ventral). – Fig. 6. – *Colurella colurus* f. *compressa*. – Figs 7-8. – *Encentrum longidens*. 7: lateral, 8: trophi, ventral. – Figs 9-10. – *Encentrum pornsilpi* n. sp.. 9: lateral, 10: ventral (corona contracted), 11: trophi, ventral. – Figs 12-16. – *Lepadella desmeti* n. sp.. 12: dorsal, 13: ventral, 14: lateral, 15: frontal, 16: caudal.



Figs 17-20. – *Encentrum pornsilpi* n. sp., SEM photographs of trophi. 17: dorsal, 18: ventral, 19: ventral, detail, 20: lateral.
Figs 21-23. – *Encentrum longidens*, SEM photographs of trophi. 21: dorsal, 22: dorsal, detail (p: preuncinal, ar: apical ramus, u: uncus tooth), 23: frontal.
Scale bars: 10µm (Figs 17, 18), 1µm (Figs 19-23).

Etymology: The species is named after Dr. Pornsilp Pholpunthin of PSU, Hat Yai, Thailand, in recognition of his contribution to the knowledge on the Thai rotifer fauna.

***Encentrum longidens* Donner, 1943**
(Figs 7, 8, 21-23)

Donner (1943) p. 70-71 figs 6a-e; De Smet & Pourriot (1997) p. 158 figs 423-427.

Comment

This small *Encentrum* is unmistakable by its general body shape and trophi with long, slender and weakly curved preunci, unci and apical rami teeth, and relatively long fulcrum. To date, the species is known from the type locality in Slovakia only (De Smet & Pourriot, 1997). As the report on the peculiar trophi of this small species is based on light-microscopic observation only and, consequently, lacks detail, we here present SEM photographs of this structure.

Lepadella desmeti new species

(Figs 12-16)

Material: Holotype in KBIN; one paratype in RUG, one in PSU. All collected in the hygropsammon of the type locality, Mai-Khao peat swamp, Phuket Island, Thailand, on 28 July 1999.

Differential diagnosis

The lorica shape of *Lepadella desmeti* n. sp. resembles a small *L. patella* (Müller, 1786), but these two species can be confused only if the ornamentation on the dorsal lorica of *Lepadella desmeti* n. sp. is overlooked. The new species is superficially similar to *L. rhodesiana* Wulfert, 1965. The latter has a relatively broader lorica, different head aperture (dorsal straight or only slightly concave, with punctated collar), and a foot in which the second foot pseudosegment is longest one (WULFERT, 1965).

Description

Parthenogenetic female (male unknown): Lorica stiff, relatively flat. Outline oval, with the greatest width in the posterior third, c. 1.5 times as long as wide. Dorsal plate convex, with two pairs of rounded longitudinal ridges, caudal end indented; a pair of openings to the lateral antenna present postero-laterally. Ventral plate weakly concave. Head aperture dorsally and ventrally concave, dorsally broadly U-shaped, ventrally deeper, V-shaped. No clear collar. Foot aperture squarish, longer than wide, lateral margins slightly diverging to posterior. Foot three pseudosegmented, two broad basal and one elongate and slender distal foot pseudosegment. Toes equal, straight (curved in the holotype, this probably an artefact), evenly narrowing to acutely pointed tips.

Measurements (of Bolivian specimen between brackets): Lorica length 72-78 (78), width 47-54 (48), head aperture width 21-25 (23), ventral sinus depth 15-18 (10), dorsal 6-10 (7), foot aperture width 14-17 (13), length 16-20 (22), toe length 21-25 (22), second foot pseudosegment length 5-6 (5), third 9-12 (9).

Distribution and ecology

Lepadella desmeti n. sp. occurred in low numbers in the interstitial of Mai-Khao peat swamp, but was not found during a previous study of the plankton of the swamp. However, a single specimen of what appears to be this species was recently reported from a plankton sample of a floodplain lake of the Ichilo River, Bolivia (SEGERS et al., 1998) . This indicates that, although the species is psammobiontic, it does occasionally leave the psammon for the plankton, like most other interstitial rotifers. Its present disjunct distribution may be an artefact of insufficient sampling of tropical interstitial habitats.

Etymology: The species is named after Prof. Dr. W.H. De Smet (RUCA, Antwerp), in recognition of his contributions to rotiferology.

ZOOGEOGRAPHY

Apart from the taxa treated above, the psammon rotifer community of Mai-Khao peat swamp contained three taxa of special zoogeographic interest. These are:

- *Colurella sanoamuangae* Chittapun et al., 1997 was only recently described from this peat-swamp, but is also known from a second locality on the Malay Peninsula, Lake Thale Noi (SEGERS & PHOLPUNTHIN, 1997). We found it in large numbers in the psammon, which indicates that it may be interstitial, intruding into the plankton only occasionally. Apparently, the species is endemic to Thailand.
- *Lecane acanthinula* (Hauer, 1938) is Oriental, although its range extends beyond the classical limits of this region (SEGERS, 1996).
- *Lecane segersi* Sanoamuang, 1996 was hitherto known from few specimens found at two localities in Northeast Thailand (SANOAMUANG & SEGERS, 1997), and occurred in high abundance in the psammon of Mai-Khoa peat swamp. Similarly to *C. sanoamuangae,* the species may be interstitial (psammophilous or psammobiontic), and is endemic to Thailand.

Of the 19 monogonont Rotifera found, four are regional endemics, one is an Oriental species (Table 1), and two are more widespread but very rare (*Encentrum longidens, Lepadella desmeti* n. sp.). Six taxa are new to Thailand. The interstitial rotifer fauna of the peat swamp has an endemicity rate of c. 20%. This seems high, notwithstanding that the total number of species on record is quite low (compare with DUMONT, 1983; SEGERS, 1996). However, the scarcity of information on interstitial rotifers, illustrated by the simultaneous description of one of the new species from Thailand and Bolivia, and the second record ever of *Encentrum longidens* after its description from Europe, illustrates that it is premature to generalise at this time.

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