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NOTES ON THE TAXONOMY AND DISTRIBUTION OF THE INTERSTITIAL ROTIFERA FROM A DUNE POOL

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Abstract. A preliminary study of the interstitial Rotifera from a dune pool at the Belgian coast yielded several rare and insufficiently known species, namely *Colurella salina* Althaus, *Encentrum villosum* Harring & Myers and *Lecane psammophila* (Wiszniewski). Brief accounts are presented on these and on *Colurella hindenburgi* Steinecke (new synonym: *C. geophila* Donner) and *Trichocerca taurocephala* (Hauer). Of the twenty-five morphotaxa recorded, nine, all of which are psammobionts, are new to the Belgian fauna. Since, the rotifers inhabiting the psammon have not been studied sufficiently, their contribution to species diversity in freshwater habitats is not recognised.

Key words: psammon Rotifera, taxonomy, distribution, new records.

INTRODUCTION

Rotifera inhabiting the psammon of stagnant waters have been studied only rarely since the 1930s, when WISZNIEWSKI (1934a, b, 1935, 1936) and NEISWESTNOWA-SHADINA (1935) in Europe, and MYERS (1936) in North America conducted extensive researches on the rotifer fauna living in the interstices of sand grains. More recently, interstitial rotifers of marine and brackish water habitats have been studied by ALTHAUS (1957a) and TZSCHASCHEL (1979, 1980), while SCHMID-ARAYA (1995a, 1995b) worked on rotifers in river bed sediments and TURNER (1990, 1993, 1995) and TURNER & PALMER (1996) published contributions on interstitial rotifers of both fresh and saline waters in North America (For a review see SCHMID-ARAYA, in press). These studies revealed that the rotifer fauna of the psammon habitat consists of a diverse taxocoenosis which includes a number of specialised taxa (TURNER & DISTLER, 1995).

Interstitial rotifers of dune pools have not been studied so far. In this paper results are presented of a preliminary study of such rotifers, sampled from the hygropsammon (*sensu* WISZNIEWSKI, 1934c) of a dune pool («Eendeput») in the nature reserve «De Fonteintjes» in Zeebrugge, Belgium. The rotifer content of these samples, and some comments regarding the occurrence of interstitial rotifers are presented here.

MATERIAL AND METHODS

The samples studied consist of ca. 50 cc of sand of the top 0.5 cm hygropsammon of the «Eendeput», a dune pool in the nature reserve «De Fonteintjes», Zeebrugge, Belgium. They were collected on 22 April and 12 July 1997, and fixed in formaldehyde (4%). Animals were selected under a Wild M10 dissection microscope, and examined and drawn using an Olympus CH2 research microscope with drawing tube. Permanent slides containing reference specimens are deposited in the collection of the Laboratory of Animal Ecology, University of Gent. Scanning electron microscopy was carried out using a JEOL JSM-840 microscope on trophi material processed following SEGERS (1993) and SEGERS & DUMONT (1993).

TAXONOMY

A list of the Rotifera identified from the psammon samples is given in Table 1. Of the 25 morphotaxa found, nine are new to the Belgian fauna (see DE RIDDER, 1989, 1992). Some of these, treated below, are particularly noteworthy on account of their rarity, or require taxonomic treatment.

TABLE 1

List of Rotifera from the psammon of De Eendeput, Fonteintjes Nature reserve, Zeebrugge, Belgium

*: new to the Belgian fauna; 1: 22 April 1997; 2: 12 July 1997; a: abundant (>20 specimens), c: common (6-20 specimens), r: rare (2-5 specimens), s: single specimen.

Asplanchna girodi (De Guerne, 1850): 2c
Colurella adriatica Ehrenberg, 1831: 1r (fig. 1)
**C.* cf. *anodonta* Carlin, 1939: 1s (figs 2-4)
C. colurus (Ehrenberg, 1830): 1c, 2c (figs 5-7)
C. hindenburgi Steinecke, 1917: 1r, 2c (figs 8-10)
**C. salina* Althaus, 1957: 1c (figs 11-12)
**C. sinistra* Carlin, 1939: 1s (fig. 13)
Cephalodella catellina (Müller, 1786): 2c
C. exigua (Gosse, 1886): 1a
C. gibba (Ehrenberg, 1832: 1c
**C. gibba microdactyla* Koch-Althaus, 1963: 2c
C. gracilis (Ehrenberg, 1832): 1s
**C. megalocephala* (Glascott, 1893): 1s, 2r
**C. sterea* (Gosse, 1887): 2r
**Encentrum villosum* Harring & Myers, 1928: 1c, 2r (fig. 27-28)
Euchlanis dilatata Ehrenberg, 1832: 2r
Keratella cochlearis (Gosse, 1851)(incl. f. *tecta* (Gosse, 1851)): 2a
Lecane closterocerca (Schmarda, 1859): 1r, 2a
L. lunaris (Ehrenberg, 1832): 2s
**L. psammophila* (Wiszniewski, 1932): 1a, 2a (figs 14-16)
Lepadella patella (Müller, 1773): 2r
Lindia torulosa Dujardin, 1841: 2r
Pompholyx sulcata Hudson, 1885: 2a
**Trichocerca taurocephala* (Hauer, 1931): 1a, 2a (figs 17-21, 29-31)
T. tenuior (Gosse, 1886): 1r

Family Colurellidae

Of the four genera belonging to Colurellidae, the taxonomy and, consequently, identification of members of *Colurella* Bory de St. Vincent, 1824 is by far the most difficult. This is because of their generally similar body (lorica) morphology and high intraspecific variability. Specimens of *Colurella* species are rarely found, and in many published records are mistakenly identified. As a contribution to the knowledge of the genus, illustrations of all members of *Colurella* encountered during this survey are given.

Colurella hindenburgi Steinecke, 1917
(Figs 8-10)

Synonyms: *C. gastracantha* Hauer, 1924
C. hindenburgi gastracantha: Wiszniewski (1953)
C. hindenburgi f. *gastracantha*: Koste (1978)
C. geophila Donner, 1951 (new synonym)
C. geophila hallensis Althaus, 1957
C. geophila f. *hallensis*: Koste (1978)

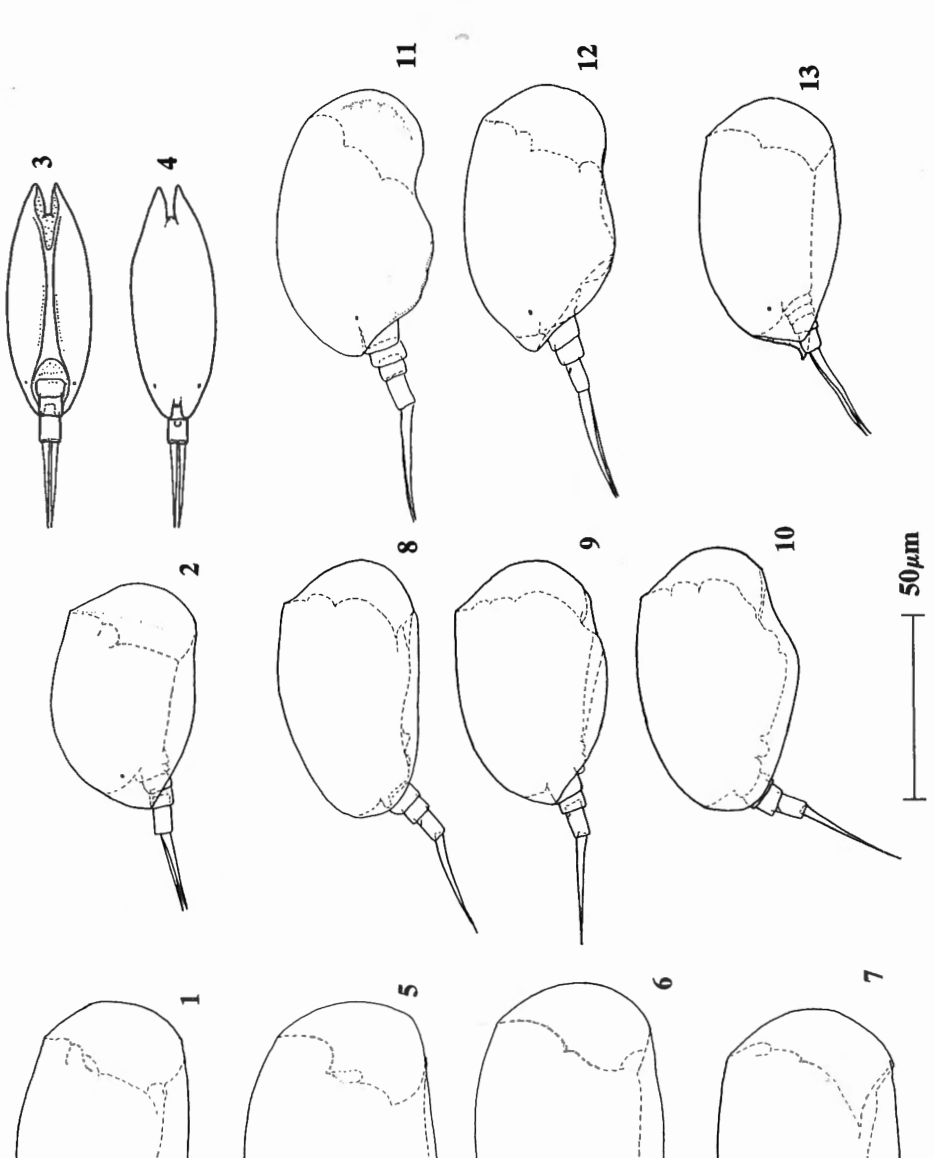
Steinecke (1917) p. 90, 97 figs 4a-b; Hauer (1924) p. 177-180 figs 1, 2; Donner (1951) p. 637-638 fig. 27; Wiszniewski (1954) p. 38; Althaus (1957a) p. 132 fig. 21e, f; Koste (1978) p. 167-170.

Differential diagnosis: *Colurella hindenburgi* has relatively long lorica and toes, when compared to *C. obtusa* (Gosse). The dorsal margin of the lorica is straight anteriorly, curved posteriorly (evenly curved in *C. colurus* (Ehrenberg)). The head aperture is dorsally marked by a notch, the foot groove extends to dorsally.

Measurements: Lorica length 70-75 µm, height 38-44 µm, toe length 30-33 µm.

Comments: *Colurella hindenburgi* is a variable species with respect to size and certain aspects of lorica shape (see Donner, 1970; Koste, 1978). Notwithstanding the fact that the synonymy of *C. hindenburgi* and *C. gastracantha* has long been recognised, the latter name has remained in use to denote an infrasubspecific variant of the former, characterised by the presence of a projection anterior to the insertion of the foot. The presence of such a projection, however, appears to result from the formation of transverse folds of the relatively soft membrane of the ventral sulcus, in conjunction with mobility of the foot. As such, it has no ecological or taxonomical relevance. Although it may be informative to separate ecologically relevant forms of polymorphous species (*e.g.*, environmentally-induced spined forms of *Brachionus* species) by using infrasubspecific names, this is not the case here. I therefore suggest that the use of f. *gastracantha*, for the above-mentioned variant be abandoned.

According to Donner (1951), *C. geophila* differs from the *C. hindenburgi-C. gastracantha* group by the uniformly high dorsal margin (anteriorly higher in *C. gastracantha*), and by the deep head and foot apertures. As can be judged from Figs 8-10, these features are subject to variation within the same population. In fact, the specimen illustrated in Fig. 8 strikingly resembles Donner's (1951) drawing of *C. geophila*, while Figs 9-10 correspond to *C. hindenburgi*. This suggests that the two are synonyms. The *C. geophila hal-*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lensis of ALTHAUS (1957a), considered a variant of *C. geophila* by KOSTE (1978), indeed appears to be nothing more than that. *C. geophila limnetica* Althaus, 1957a probably belongs to *C. colurus*, as far as can be judged from the poor description while *C. subtilis* Althaus, 1957c (*nom. nov.* for *C. gracilis* Althaus, 1957a *non* (Hilgendorf, 1898); *C. geophila* f. *gracilis* after Koste, 1978) is unidentifiable and may represent an artifact: the description of the single specimen known is reminiscent of specimens of *C. colurus* that have been rolled around their longitudinal axis under slight compression.

Colurella salina Althaus, 1957
(Figs 11-12)

Synonym: ?*Colurella colurus* (Ehrenberg) after Althaus, 1957b (partim: fig. 2, microphotograph)

ALTHAUS (1957a) p. 134 figs 25a-h; KOSTE (1978) p. 173 plate 54 figs 1a-f.

Differential diagnosis: *C. salina* is a medium-sized *Colurella* spcies that can be distinguished from congeners by the absence of a deep ventral furrow, by the characteristic ventral margin with clear postoral concavity and medially convex margin, and by being relatively broad.

Measurements: Lorica length 70-72 µm, height 39-42 µm, toe length 29-32 µm.

Comments: After its description from Germany, no subsequent illustrated records of *C. salina* were published although the animal has been reported from New Zealand (RUSSELL, 1960), Spain (VELASCO, 1990) and Florida, U.S.A. (TURNER, 1993). A microphotograph of a Black Sea specimen, identified as *C. colurus* (Ehrenberg) by ALTHAUS (1957b) may also refer to this species. The distribution of this evidently rare animal is insufficiently documented, and the New Zealand record especially needs confirmation.

Family Dicranophoridae

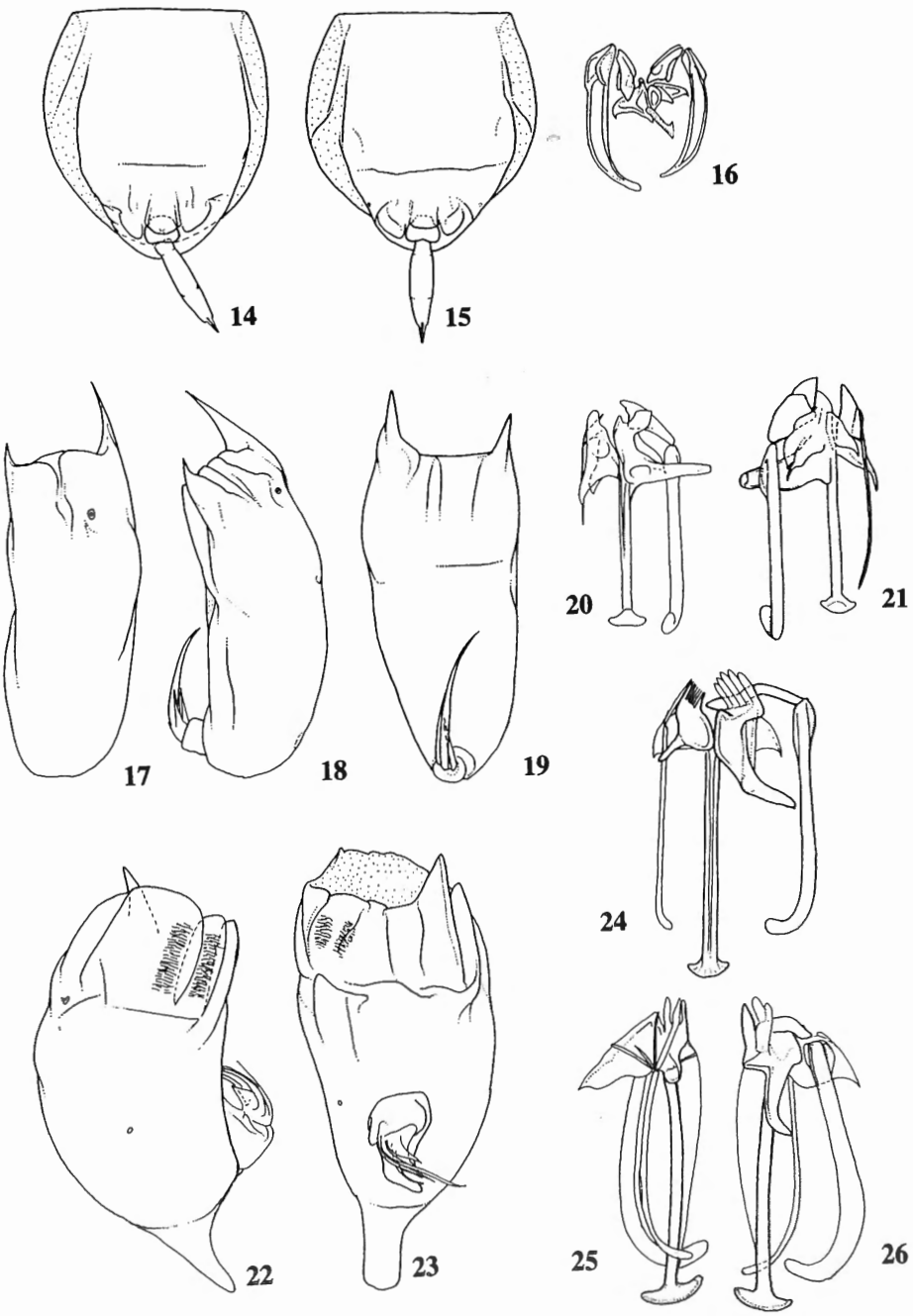
Encentrum villosum Harring & Myers, 1928
(Figs 27-30)

Synonym: *Encentrum glaucum* Wulfert after Althaus (1957a)

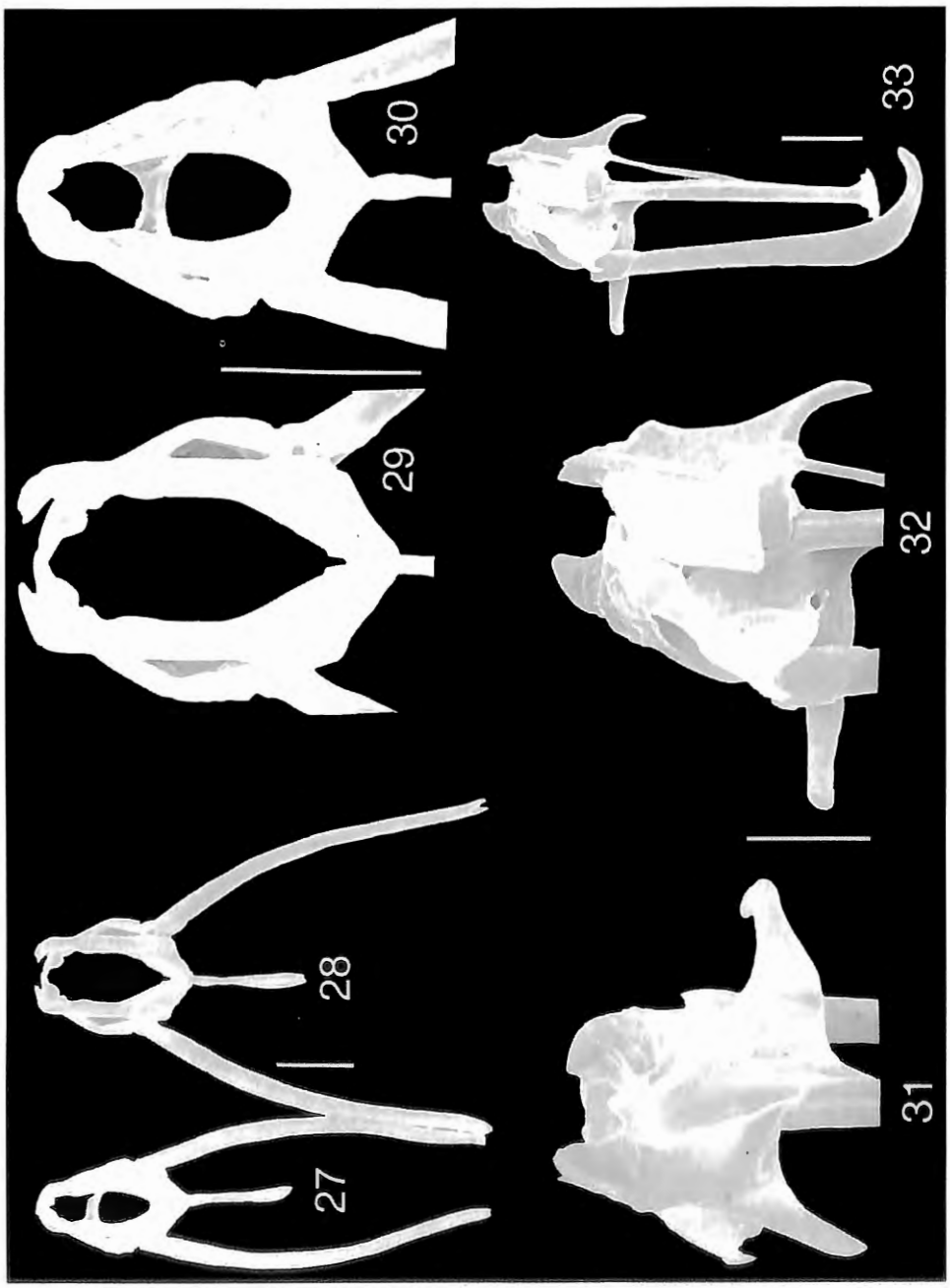
HARRING & MYERS (1928) p. 772-773 plate 43 figs 3, 4; DE SMET (1997) p. 222 figs 648-649.

Differential diagnosis: *E. villosum* resembles *E. rousseleti* Lie-Pettersen and *E. salsum* Myers by their similar rami and unci, a basally-dilated fulcrum and outcurved manubria tips. The low number of vitellarium nuclei (18-20 in *E. rousseleti*, 4-8 in the two others) and red-pigmented eyespot and granules in the retrocerebral sac (colourless in *E. salsum*) readily distinguish the morphospecies.

Figs 1-13. – *Colurella* spp. – 1: *C. adriatica* – 2-4: *C.* cf. *anodonta* – 5-7: *C. colurus* – 8-10: *C. hindenburgi* – 11-12: *C. salina* – 13: *C. sinistra*. (1-2, 5-13: lateral, 3: ventral, 4: dorsal).



50μm (figs 14-15, 17-19, 22-23)
25μm (figs 16, 20-21, 24-26)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Measurements: trophi length 27 µm, fulcrum 8 µm, incus width 5 µm, uncus length 4 µm, manubrium length 23 µm.

Comments: *E. villosum* inhabits coastal sand pools and has been recorded from North America (Atlantic: HARRING & MYERS, 1928) and Europe (W. Mediterranean: DE SMET, 1997; Baltic Sea: THANE-FENCHEL, 1968; North Sea). ALTHAUS' (1957a) record is from athallassic saline waters in Germany.

Family Lecanidae

Lecane psammophila (Wiszniewski, 1932)
(Figs 14-16)

WISZNIEWSKI (1932) p. 97 plate 4 figs 18-20; SEGERS (1995) p. 145-146 figs 368-369, 514.

Differential diagnosis: *L. psammophila* is readily recognised by its dorsal lorica plate being consistently broader than the ventral, and by its bulged toe bearing two short pseudoclaws. The species can be confused with the North American *L. gallagherorum* Segers. This latter species is larger, and has a longer, less-bulged toe bearing pseudoclaws and accessory claws. Both *L. psammophila* and *L. gallagherorum* differ from *L. obtusa* (Murray, 1913) by a difference in type of prepedal fold: it is narrow and bears a median projection distally in L. obtusa, and is wide and smoothly rounded distally in the two others.

Measurements: Dorsal plate length 56-62 µm, width 59-60 µm, ventral plate length 63-65 µm, width 45-46 µm. Toe length 12-13, width 5-6 µm, pseudoclaw length 4-5 µm. Trophi length 19 µm, fulcrum 4.5 µm, incus width 10 µm, uncus length 6-7 µm.

Comments: There are several recent records of *L. psammophila*, all of which are from Central Europe (Romania, Estonia, Poland, Russian Federation, North East Germany, Macedonia: see DE RIDDER & SEGERS, 1997). The species has been reported from the U.S.A. (*e.g.*, MYERS, 1942; EVANS, 1984), but it is likely that these records concern the recently recognised *L. gallagherorum*, as was shown for Myers' records (SEGERS, 1997). The present record is the first for Western Europe. Both the European *L. psammophila* and its North American relative *L. gallagherorum* are exclusively psammobiontic, and occur outside the psammon only during periods of mass abundance. They probably constitute a pair of vicariant sister taxa.

Legend to the figures (see pages 40-41)

Figs 14-16. – *Lecane psammophila*. – 14-15: habitus ventral – 16: trophi ventral.

Figs 17-21. – *Trichocerca taurocephala*. – 17-19: habitus – 17: dorsal – 18: lateral – 19: ventral – 20-21: trophi – 20: ventral – 21: dorsal.

Figs 22-26. – *Trichocerca insolens*. – 22-23: habitus – 22: lateral – 23: ventral – 24-26: trophi – 24: ventral – 25-26: lateral. (19, 21-26: Lenape Lake, 25 August 1997. New Jersey, USA)

Figs 27-30. – *Encentrum villosum*, trophi.

Figs 31-33. – *Trichocerca taurocephala*, trophi.

Scale bars: 5µm.

Family Trichocercidae

***Trichocerca taurocephala* (Hauer, 1931)**
(Figs 17-21, 31-33)

Recently, KOSTE & ZHUGE (1996) suggested a synonymy between *T. taurocephala* (Hauer), *T. pygocera* (Wiszniewski, 1932) and *T. insolens* (Myers, 1936) and attributed priority to the name *T. pygocera*. Apart from the fact that *T. taurocephala* is the senior synonym, a comparison of *T. taurocephala* from Europe (present material, figs 17-18, 20, 31-33) with co-occurring *T. taurocephala* (figs 19, 21) and *T. pygocera* (figs 22-26) from North America (Lenape lake, NJ, coll. 6 July 1996), reveals that at least this synonymy is questionable. As can be seen from the figures, the two have little in common besides a weak superficial resemblance and the fact that both are psammobionts. WISZNIEWSKI (1934a) provides a detailed comparison between *T. taurocephala* and *T. pygocera*, in which the large similarity between the two is commented upon, and the diagnostic features outlined. In fact, it is unlikely that KOSTE & ZHUGE'S (1996) record concerns either *T. taurocephala*, *T. pygocera* or *T. insolens*, considering the deviating trophi of the specimen as represented in their figure 15c (crescent-shape of left alulus and large apophysis on posterior edge of left ramus). Their material may belong to an unnamed taxon belonging to a group of *Trichocerca* species with similar lorica morphology but different trophus, containing the above-mentioned species and *T. pediculus* Remane, 1949.

DISTRIBUTION

As previously mentioned, 25 rotifer morphotaxa were found in the two samples examined. Most represented are the genera *Cephalodella* (7 species) and *Colurella* (6 species). The former genus is known to contain many psammon species. Other distinctly interstitial rotifers are *Trichocerca taurocephala* and *Lecane psammophila*. The report of a large number of *Colurella* species is in contrast with reports on both freshwater (WISZNIEWSKI, 1934a; MYERS, 1936) and marine (TZSCHASCHEL, 1979) psammon rotifers, but agrees well with ALTHAUS' (1957a) reports on brackish-water psammon rotifers. Some of the animals recorded are noteworthy for their rarity, especially *L. psammophila* which has so far been recorded from Central Europe, and the brackish-water *Colurella salina* and *Encentrum villosum* which are known only from few localities. The influence of the sea as evidenced by the presence of brackish-water animals is important, but is not surprising in the case of a coastal dune pool. To my knowledge, there are no further literature records signalling the existence of a psammon rotifer community similar to the one reported here, although it is clear that it must exist elsewhere. Factors affecting the occurrence of psammon rotifers are well-known, and include grain size distribution, oxygen concentration and detritus content (see RUTTNER-KOLISKO, 1955; 1961). Generally, psammon rotifers can only survive in areas with exposed sand in the contact zone between land and water. Some types of dune pool naturally contain such biotopes, as a result of the dynamics of sand due to wind action and human trampling, and water level fluctuations. At present, the

available habitat for an interstitial rotifer community in the Eendeput is reduced by the stabilisation of the sandy shore and corresponding development of a reed belt.

Another component of the rotifer fauna of the Eendeput, is formed by taxa such as *Asplanchna girodi*, *Euchlanis dilatata*, *Keratella cochlearis* and *Pompholyx sulcata* which form a species-poor pelagic community of common, widely distributed species known to occur in many types of water, including polluted ones. In addition, a bloom of cyanobacteria (*Anabaena* sp., det. K. Sabbe) was observed in the pelagic zone of the pool on 12 July 1997. A pelagic rotifer community consisting of the above-mentioned taxa, and a bloom of cyanobacteria are indications that the ecosystem of the pond may be disturbed. The present, limited data do not permit any assessment of the impact or causes of this disturbance. However, DENYS (1996, unpublished report*) recently cautioned against the further deterioration of the water quality in the nature reserve, and suggested that organic pollution by overwintering water birds may contribute significantly to this.

Considering the above, it appears that the interstitial rotifer community of the pond is threatened, but it is not possible to assess the importance of this as our knowledge on the distribution on these animals is very limited. It does illustrate, however, that it may be relevant to incorporate data on this, and other similarly cryptic taxonomic groups in the assessment of nature conservation priorities and measures.

CONCLUSIONS

Twenty-five rotifer species are registered from the psammon of the Eendeput, in the Fonteintjes nature reserve, Zeebrugge, Belgium. Several of the taxa found are of special faunistic importance including nine species that are new to the Belgian fauna. *Lecane psammophila* had previously been recorded from Central Europe, while both *Colurella salina* and *Encentrum villosum* are only known from a few localities worldwide. The synonymy of *Colurella hindenburgi* and of *Trichocerca taurocephala* is discussed.

The interstitial rotifer community of the nature reserve is threatened by the stabilisation of the sandy shore and extension of a reed belt, and by the apparent deterioration of water quality. It is suggested that more research effort is necessary, directed toward the collection of data on the distribution of this and similar taxonomic groups, before a reliable assessment can be made of the significance of the present observations.

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* DENYS, L. (1996) – Algemeen historisch referentiekader t.b.v. natuurontwikkelingsprojecten in stilstaande zoete waters: samenstelling van diatomeeengemeenschappen in Vlaanderen voor de tweede wereldoorlog als ecologisch referentiekader voor stilstaande zoete waters. II. Enkele gevalstudies. Departement Biologie, Universitair Centrum Antwerpen, 43 pp., annex.

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