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DESCRIPTION OF *ENCENTRUM DIETERI* sp. nov. (ROTIFERA, DICRANOPHORIDAE) FROM THE HIGH ARCTIC, WITH REDESCRIPTION OF *E. BIDENTATUM* (LIE-PETTERSEN, 1906) AND *E. MURRAYI* BRYCE, 1922

by

WILLEM H. DE SMET
Departement Biologie
Universiteit Antwerpen, University Centre of Antwerp,
Groenenborgerlaan 17, B-2020 Antwerpen, Belgium

SUMMARY

Encentrum dieteri sp. nov. (Rotifera, Monogononta : Dicranophoridae) collected from littoral marine algae of two fjords in Spitsbergen, Svalbard, is described and illustrated. *E. murrayi* Bryce, 1922 is reported for the first time since its description from Spitsbergen ; it is redescribed and illustrated. Also described and illustrated is *E. bidentatum* (Lie-Pettersen, 1906) ; *E. linnhei* Scott, 1974 is synonymised with *E. bidentatum*.

Keywords : Rotifera, taxonomy, *Encentrum*, new species, Arctic, Svalbard.

INTRODUCTION

The rotifer genus *Encentrum* Ehrenberg, 1838 is, with about 90 species, the most species-rich of the Dicranophoridae. However, the validity of many of these species is questionable because of poor descriptions and illustrations. Also a considerable number of species have not been reported since their description.

The study of the genus has long been neglected due to difficulties in obtaining well-preserved specimens and insufficient sampling efforts of its habitats. As most of the dicranophorids, *Encentrum* species mainly occur in periphytic and interstitial habitats of the littoral zone, both marine and freshwater. The genus is considered to be cold stenotherm with predominantly temperate distribution.

In this paper *Encentrum dieteri* sp. nov. is described from littoral algae of a fjord on the west coast of Spitsbergen (Svalbard), *E. murrayi* Bryce, 1922 is reported for the first time since its description and redescribed, and *E. linnhei* Scott, 1974 is synonymised with *E. bidentatum* (Lie-Pettersen, 1906).

Encentrum dieteri sp. nov.
Figs 1-8

Type locality

Sassenfjorden near Gipshukodden, Bünsow Land, Spitsbergen, Svalbard. Coordinates : 78° 26′ 18″ N, 16° 23′ 34″ E. Obtained from marine algae (*Ectocarpus* sp., *Fucus vesiculosus* L., epilithic filamentous Cyanobacteria) growing in sublittoral fringe.

Material examined

Holotype : a female in a permanent, glycerine glass slide mount deposited in the Koninklijk Belgisch Instituut voor Natuurwetenschappen (K.B.I.N.), Brussels, Belgium, N° AI.28.175.

Paratype : one female mounted in glycerine and one trophus preparation mounted in polyvinyl lactophenol, same data as holotype, in the K.B.I.N. ; 30 females in glycerine, 7 trophi preparations in polyvinyl lactophenol and 3 trophi mounted for SEM with the author in the Department of Biology, University Centre of Antwerp (R.U.C.A.).

Further material examined : 3 females collected among *Fucus vesiculosus* L., *Ectocarpus* sp. and microscopic epilithic algae from the littoral of Trygghamna, adjacent to Alkhornet, Daudmannsøyra, Spitsbergen (coordinates 78° 12′ 54″ N, 12° 50′ 42″ E).

Description

Body stout, more or less parallel-sided in dorsal view, slightly curved in lateral view ; broadly oval in cross-section, higher than wide, greatest diameter near mid-length. Head large, c. 1/3 total length ; neck part large, c. 1/2 head length, distincly set-off, with longitudinal folds ; anterior half of head narrower, retractable within neck part by two strong muscles attached to the corona with insertion in neck part (visible in contracted specimens as short twists in neck region) and two muscles attached to the mastax and inserted in the anterior region of the trunk. Dorsal antenna apparently paired, somewhat posterior to the middle of neck region, sunk in shallow depression. Rostrum very small, indistinct. Corona almost frontal. Trunk more or less abruptly narrowing at c. 1/4 from its posterior in dorsal view ; dorsally and laterally with a series of longitudinal folds, ventrally two short, curved folds. Tail broadly rounded. Foot with two short pseudosegments of equal length. Toes divergent, relatively long, nearly 1/4 total length, bases narrower in lateral view, slightly decurved, dorsal margins slightly curved, ventral margins slightly undulate, at c. 1/4 from the tips narrowing to tubular points ; in dorsal view more or less gradually tapering to the tubules. A pronounced terminally rounded, cylindrical papilla between toes. Eyespots absent. Retrocerebral sac long, saccate. Subcerebral glands well-developed, with globule. Salivary glands present. Gastric glands rounded to bean-shaped, short-stalked. Stomach and intestine separated, connected by distinct tube opening dorsally into intestine. Pedal glands large, club-shaped, extending into posterior part of trunk. Vitellarium with eight nuclei.

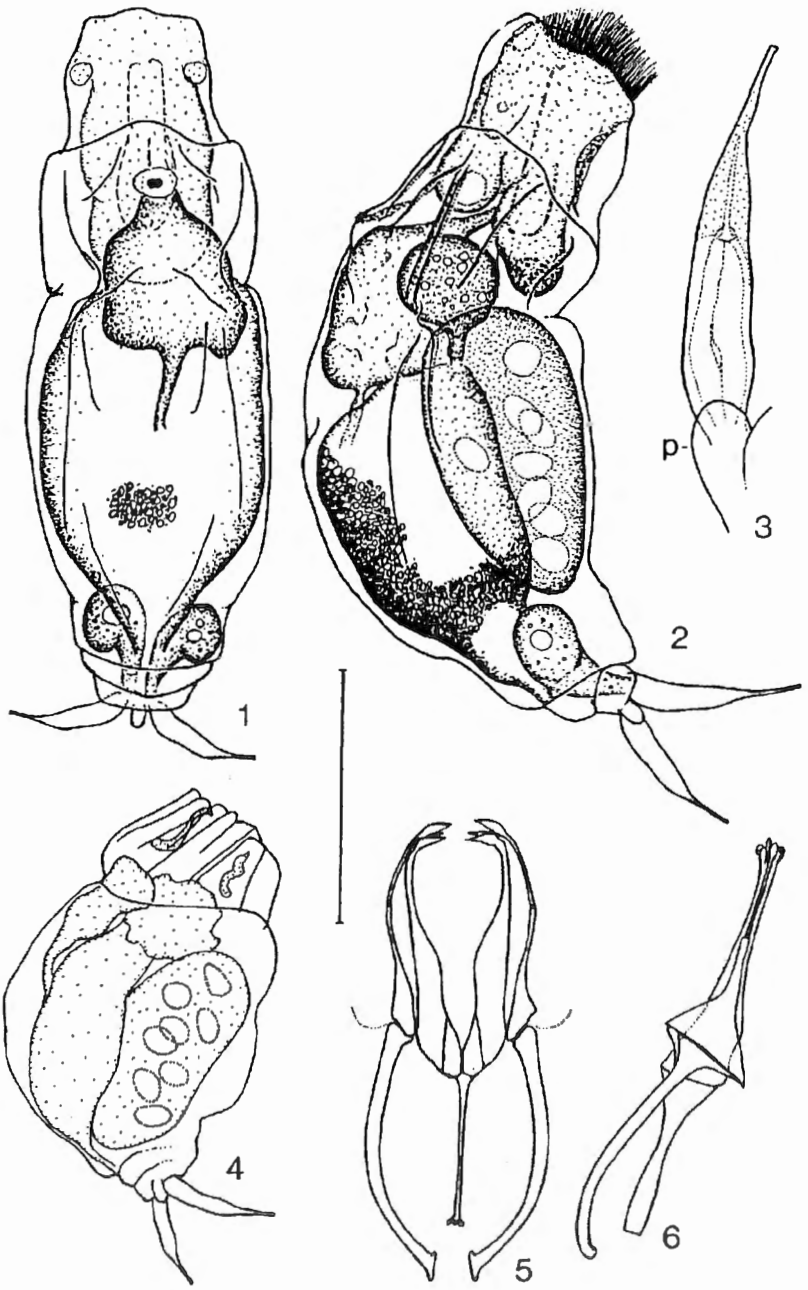
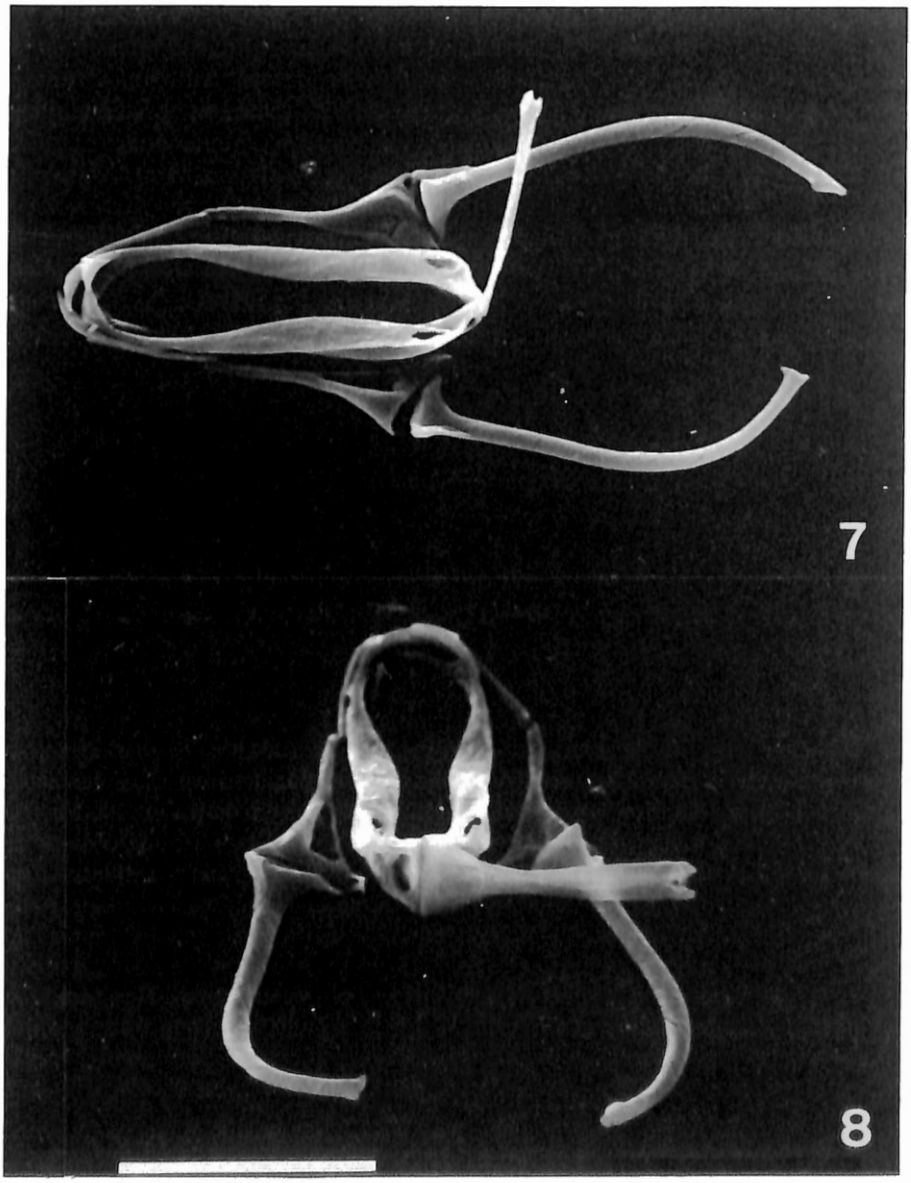


Fig. 1-6. — *Encentrum dieteri* sp. nov. — 1. Dorsal view, ♀ holotype (brain omitted). — 2. Lateral view. — 3. Toe ; p = papilla. — 4. Contracted specimen, lateral view. — 5. Trophi, dorsal view. — 6. Trophi, lateral view.
(Scale bar = 50 μm for 1,2 ; 20 μm for 3,5,6 ; 78 μm for 4).



Figs 7-8. — *Encentrum dieteri* sp. nov., SEM photographs. — 7. Trophi, dorsal view. — 8. Idem, fulcrum in lateral view.
(Scale bar = 10 μm).

Trophi elongate, very slender. Rami long, straight, outer margins parallel, median opening elongate pyriform ; each ramus terminating in a short, stout, slightly clubbed tooth, set at a right angle to the axis ; ventrally from each terminal

tooth a similarly shaped and oriented pre-uncinal tooth. Fulcrum long, c. 2/3 ramus length, rod-shaped in dorsal view, posterior end slightly expanded ; in lateral view with broad basis, gradually narrowing to half its length, afterwards expanding again and continuing more or less parallel-sided. Unci slender, slightly curved ; head short, slightly clubbed, tips acute ; shaft slightly expanded dorso-ventrally prior to basis of head. Intramallei long with broad triangular basal half and rod-shaped anterior half. Supramanubria absent. Manubria ramus length, curved in posterior half ; head expanded with ventrally projecting spine, posterior end slightly crutched ; head laterally with delicate, short, curved appendage that dissolves during hypochlorite treatment.

Neither males nor eggs were seen.

Measurements

Total length 160-200 µm, toe 28-38 µm, papilla 5-7 µm.

Trophi 34-36 µm : ramus 18-19 µm, fulcrum 10-12 µm, uncus 8-9 µm, intramalleus 11-12 µm, manubrium 18-19 µm.

Derivation of name

The species is named for my son Dieter, in recognition of his much appreciated help with sampling, field analyses and logistics.

Differential diagnosis

The papilla between the toes is a rare structure of unknown function within the genus *Encentrum*. It has only been reported for *E. (Parencentrum) longipes* (Wulfert, 1936), *E. (Parencentrum) walterkostei* Jersabek, 1994, *E. sacculiforme* Tzschaschel, 1979, *E. sorex* Wulfert, 1951 and *E. valkanovi* Althaus, 1957. *Encentrum dieteri* is easily distinguished from the above mentioned papilla bearing species, by the shape of its relatively long toes. The species can not be confused with any other congener by its characteristic elongate trophi. The only other *Encentrum* with extremely slender trophi is *E. bidentatum* (Lie-Pettersen, 1906), from which *E. dieteri* is distinguished by the entirely different external morphology (Fig. 9-10) and major differences in the trophi (Fig. 11-12, 15-18), such as the elongate pyriform median opening instead of a wedge-shaped one, longer and differently shaped unci, shape of intramallei and manubria.

Ecology and distribution

Encentrum dieteri occurred in Sassenfjorden and Trygghamna, which are side arms of the large Isfjorden in high arctic Spitsbergen. The species was collected in samples of *Ectocarpus* sp., *Fucus vesiculosus* L. and filamentous microscopic algae and Cyanobacteria growing on boulders and stones below the low water level. The highest numbers were counted among *Ectocarpus* sp. ; it was not found among *Fucus vesiculosus* from the intertidal region. Temperature was 3-4° C, salinity 29.2-33.8 ‰, Cl^- 16.2-18.7 mgl^{-1}, SO_4^{2-} 2.4-5.0 mgl^{-1}, Na^+ 9.1-11.2 mgl^{-1}, K^+ 0.3-0.4 mgl^{-1}, Ca^{2+} 0.4 mgl^-, Mg^{2+} 1.1-1.8 mgl^{-1}.

The rotifer assemblages with the new species comprised *Aspelta clydona* Harring and Myers, 1928, *Colurella* spp., *Encentrum algente* Harring, 1921, *E. graingeri* Chengalath, 1985, *E. marinum* (Dujardin, 1841), *Encentrum* spp., *Keratella quadrata* (O.F. Müller, 1786), *Proales halophila* (Remane, 1929), *P. reinhardti* (Ehrenberg, 1834), and *P. theodora* (Gosse, 1827).

The analysis of the gut contents revealed a single *Colurella* sp. only, so we can say nothing definite about the feeding habits of *E. dieteri.*

Encentrum bidentatum (Lie-Pettersen, 1906)

Figs 9-18

Pleurotrocha bidentata : LIE-PETTERSEN (1906), p. 32-33, Taf. II, fig. 6-7 ;

Encentrum bidentatum (Lie-Pettersen, 1906) after GODSKE ERIKSEN (1968), p. 26-28, fig. 2A-D ;

E. linnhei : SCOTT (1974), p. 247-251, fig. 1-2 ;

non *Diglena bidentata* (Lie-Pettersen) after VON HOFSTEN (1911-12), p. 210-212, fig. 5a-d ;

non *Encentrum bidentatum* (Lie-Pettersen) after REMANE (1929), p. 144, 151, fig. 176A-D.

Material examined

Two permanent slide preparations labelled « *Encentrum bidentatum* (Lie-Pettersen) leg. et det. Brit Godske Eriksen, Z.M.U.B., 49.148 neotype and 49.149 paraneotype, rockpool with *Enteromorpha,* Flatevossen, Raunefjorden Tarna, 27 Nov. 1967 », in the collections of the Zoological Museum, Bergen, Norway.

A permanent slide preparation labelled « *Encentrum linnhei* Type. Scott, 1974, Rock pools, Loch Linnhé, West coast of Scotland, N° 1973.737-739 » in the collections of the British Museum (Natural History), London.

Living and preserved specimens of *E. linnhei* Scott, 1974 from rockpool water, Loch Linnhé, Scotland. One female and trophus preparation deposited in the K.B.I.N., Brussels, Belgium (N° A.I. 28.175) ; 20 females in glycerine, 15 trophi preparations in glycerine or Faure and 5 trophi mounted for SEM with the author in the Department of Biology, R.U.C.A.

Description

Body more or less parallel-sided in dorsal view, tapering posteriorly. Head c. 1/4 total length, distinctly offset by neck-fold ; a secondary faint transverse fold near mid length. Rostrum very small, indistinct. Corona almost frontal ; a long, stiff bristle laterally on each side of mouth. Dorsal antenna anterior to neck-fold. Trunk curved dorsally, flattened ventrally, slightly compressed laterally. Tail broadly rounded. Foot short, c. 1/5 total length, conical, composed of one pseudosegment, slightly decurved ventrally. Toes small, c. 1/17-1/23 total length, set close together, more or less conical, bases somewhat swollen, tips slightly decurved ventrally in lateral view (occasionally outcurved laterally), with more or less offset tubules. Salivary glands present. Oesophagus relatively long ; stomach and intestine weakly

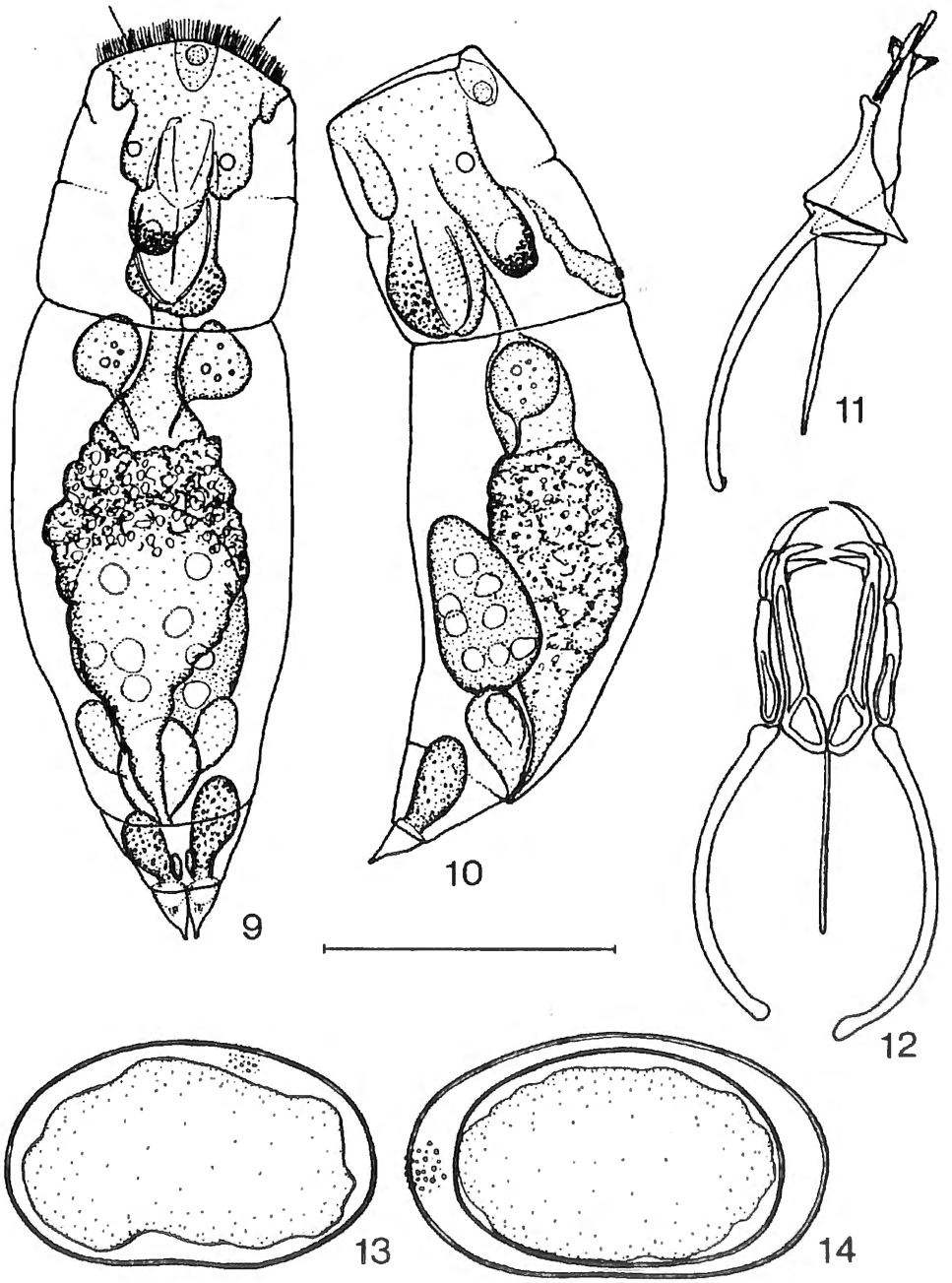


Fig. 9-14. — *Encentrum bidentatum* (Lie-Pettersen, 1906). — 9. Specimen in dorsal view. — 10. Specimen in lateral view. — 11. Trophi, lateral view. — 12. Trophi, dorsal view. — 13. Subitaneous egg. — 14. Resting egg.
(Sale bar = 50 µm for 9,10,13,14 ; 20 µm for 11,12).

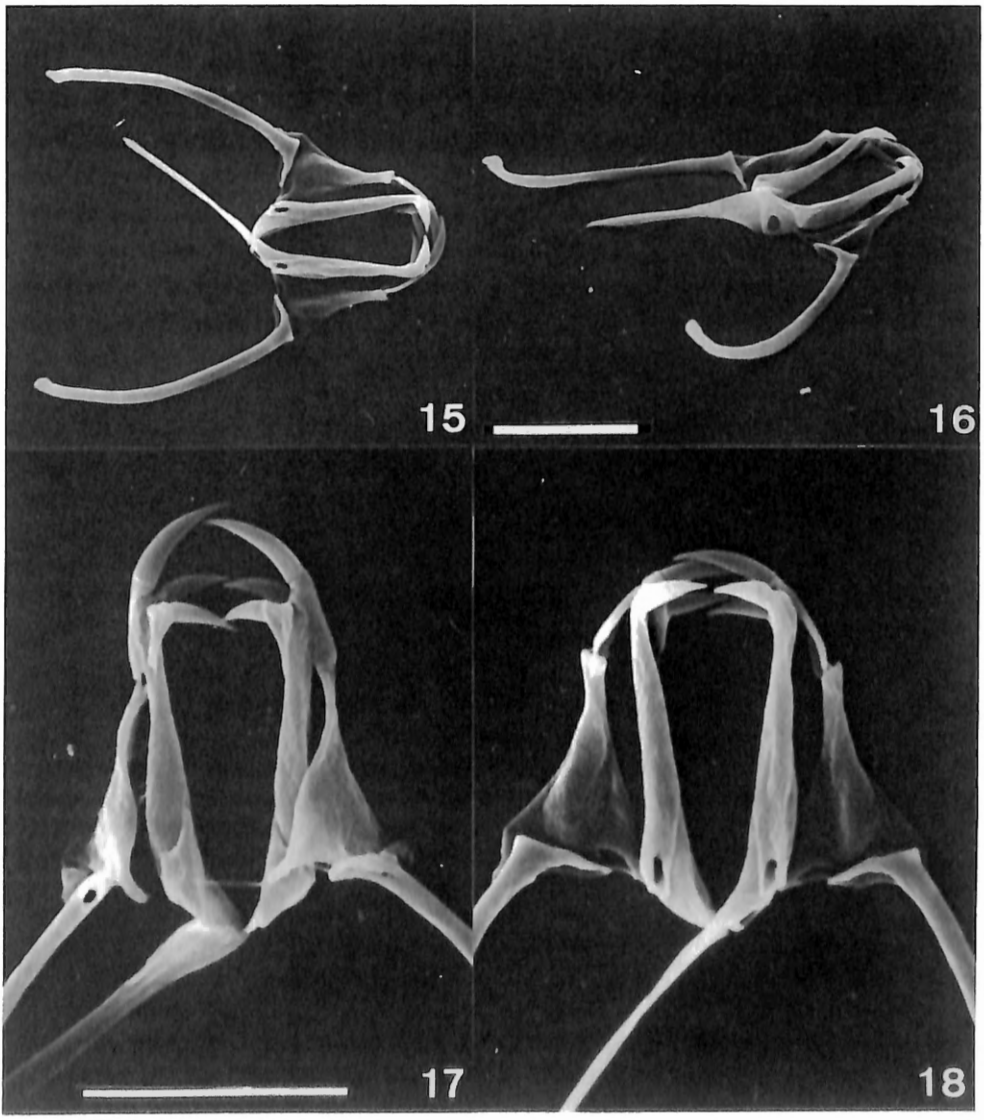


Fig. 15-18. — *Encentrum bidentatum* (Lie-Pettersen, 1906), SEM photographs. — 15. Trophi, dorsal view. — 16. Idem, fulcrum in lateral view. — 17. Trophi detail, ventral view. — 18. Idem, dorsal view.
(Scale bar = 10 μm).

separated. Gastric glands prominent, rounded to broad fusiform, with thin medium-long stalks. Pedal glands foot length, pyriform. Eyespots absent. Retrocerebral sac and subcerebral glands present. Two light refracting globules laterally from mastax. Vitellarium with eight nuclei.

Trophi large, elongate, slender. Rami nearly straight, broader at bases, outer margins slightly diverging anteriorly, median opening wedge-shaped; each ramus terminating in a sharp, inwardly projecting tooth, set at a right angle to the axis; at the base of each terminal ramus tooth ventrally a pre-uncinal element with at a right angle an inwardly projecting tooth. Fulcrum long, nearly ramus length, rod-shaped in dorsal view; in lateral view broad at base, gradually tapering till mid-length, continuing elongate-lanceolate. Unci slender, curved, acutely pointed, head c. 1/2 uncus length. Intramallei long, with broad triangular basal part and short, more or less rod-shaped anterior third. Supramanubria absent. Manubria c. 3/4 incus length, curved, both ends slightly expanded in dorsal view, head with acute projection ventrally.

Male unknown.

Subitaneous and resting eggs ovate, one long side slightly flattened, covered with short, fairly close-set pustules; pustules of resting eggs coarser.

Measurements

Total length 130-220 µm, toe 10-18 µm.

Trophi 30-34 µm : ramus 13-14 µm, fulcrum 12 µm, uncus 7-8 µm, intramalleus 8-9 µm, manubrium 19-21 µm.

Subitaneous egg 51-66 µm x 38-42 µm; resting egg 65-80 µm x 44-47 µm.

Distribution

So far the species has only be reported from rockpools in Scotland and Norway.

Comments

The study of the type material of *E. bidentatum* (Lie-Pettersen, 1906) and *E. linnhei* Scott, 1974 showed that both species are conspecific.

The shape of the body and toes, and the morphology of the inner organs of the specimens studied agree fairly well with the description given by LIE-PETTERSEN (1906) of *Pleurotrocha bidentata*. As mentioned already by GODSKE ERIKSEN (1968), LIE-PETTERSEN's drawing of the trophi is rather inaccurate. One can obtain his figure however, if the trophi are studied *in situ* at a certain orientation of the body.

The specimens collected among Fucaceae from the Swedish west coast by VON HOFSTEN (1911-12) and identified as *Diglena bidentata* (Lie-Pettersen) definitely do not belong to this species. His species shows longer and more slender toes, the foot is long and slender, the corona is distinctly ventral, there is a pronounced rostrum, light refracting bodies are absent and the rami outline is circular. The records of *E. bidentatum* by REMANE (1929), who takes over VON HOFSTEN's (1911-12) figures, from shore pools in the Bay of Kiel and by SICK (1933) who reported it from the same area, likewise do not concern the species described by LIE-PETTERSEN (1906).

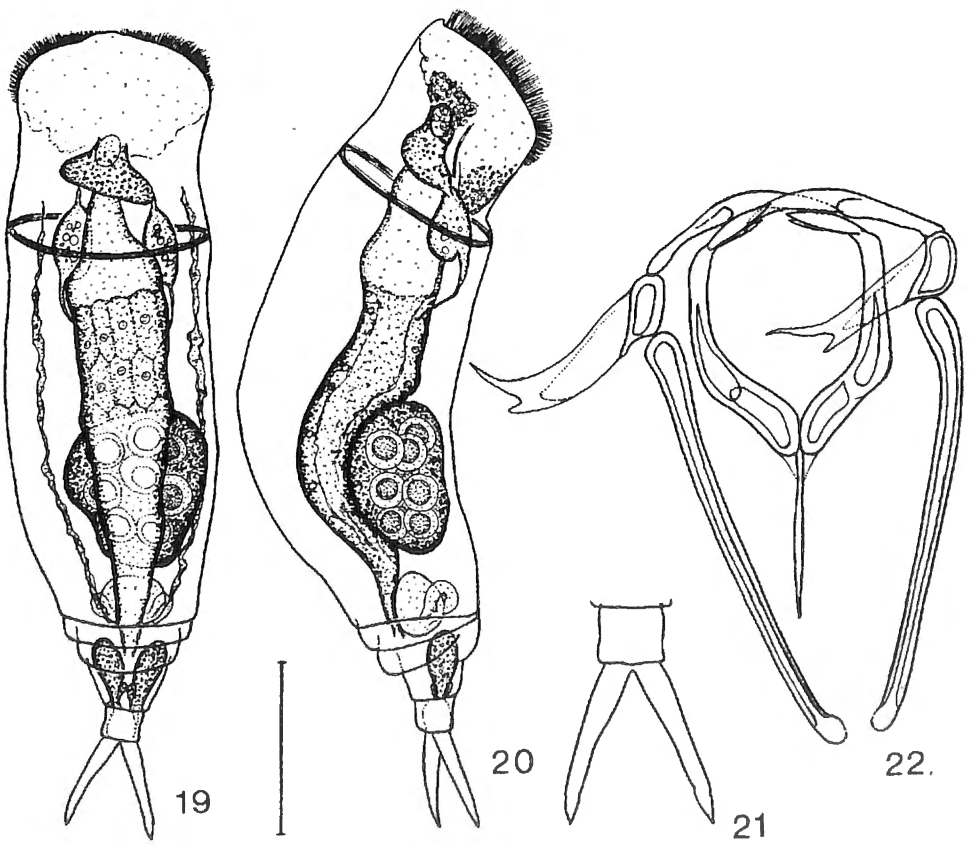
Encentrum murrayi Bryce, 1922
Figs 19-26

Material examined

Five females collected on 29.07.1994 from temporarily submerged mosses in frost crack bordering tundra polygon on strandflat adjacent to Alkhornet, Daudmannsøyra, Spitsbergen, Svalbard ; coordinates 78° 12′ 54″ N, 12° 50′ 42″ E. One female deposited in the K.B.I.N., Brussels, Belgium (N° A.I. 28.175) ; two females in glycerine and two trophi mounted for SEM with the author in the Department of Biology, R.U.C.A.

Description

Body rather slender, elongate ; in dorsal view tapering to conical foot ; in lateral view gibbous dorsally. Head c. 1/4-1/5 total length, offset by indistinct shallow neck-fold and pronounced circular muscle. Rostrum small and narrow, rounded.



Figs 19-22. — *Encentrum murrayi* Bryce, 1922. — 19. Dorsal view. — 20. Lateral view. — 21. Toes, detail. — 22. Trophi, dorsal view.
(Scale bar = 83 µm for 19,20 ; 50 µm for 21 ; 20 µm for 22).

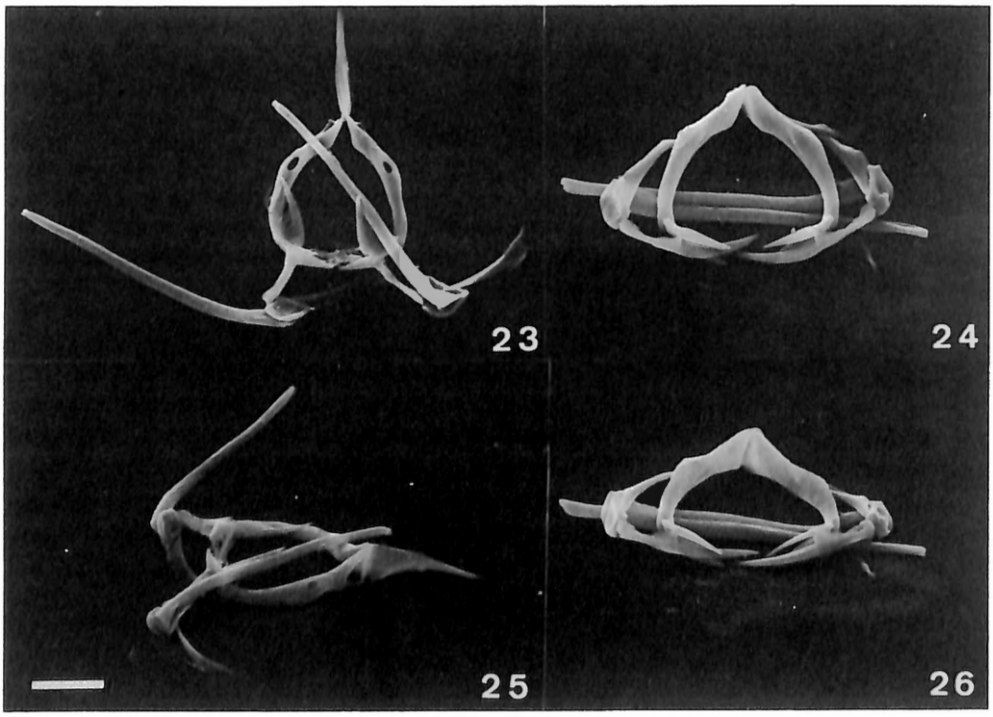


Fig. 23-26. — *Encentrum murrayi* Bryce, 1922, SEM photographs. — 23. Trophi, dorsal view. — 24. Trophi, ventral view. — 25. Trophi, lateral view. — 26. Trophi, oblique frontal view.
(Scale bar = 10 µm).

Corona slightly oblique. Foot with two pseudosegments, the posterior sometimes appearing two-jointed due to an additional faint transverse fold ; anterior pseudosegment with dorsal fold overlying basal part of posterior one. Toes very stout, relatively short, c. 1/8 total length, strongly divergent, bases set close together, apparently fused ; slightly decurved ventrally, almost parallel-sided in lateral view, very gradually tapering in dorsal view, tips short, slightly set off, with short tubules. Salivary glands present. Gastric glands oval ; stalks thin, gland length, apparently connected with retrocerebral sac. No distinct constriction between stomach and intestine. Two pairs of pedal glands, outer pair almost as long as foot, inner pair much smaller ; with reservoir in posterior foot pseudosegment. Eyespots absent. Retrocerebral sac expanded laterally. Vitellarium with eight nuclei.

Trophi large, rami lyrate, each ramus terminating in robust, incurved, lanceolate acute tooth ; at base of terminal tooth ventrally a pair of prominent, inwardly projecting lanceolate pre-uncinal teeth ; ventral pre-uncinal tooth largest, as large as terminal ramus tooth ; anterior 2/3 of outer margins of rami more or less parallel-sided, posterior 1/3 tapering towards fulcrum, median opening obovoid ; inner

marginal teeth and alulae absent. Fulcrum 3/4 ramus length, elongate lanceolate in dorsal view; in lateral view with broad base, rapidly tapering towards posterior end, slightly curved dorsally, dorsal margin more strongly curved. Unci long, single-toothed, curved, in frontal view laterally broadened in posterior half, with ventral and dorsal expansions near mid-length. Manubria somewhat longer than incus, slightly incurved anteriorly, head slightly clubbed. Intramallei small, more or less drop-shaped. Supramanubria long, on dorsal margin of intramallei, at more or less right angles to incus, parallel-sided, free end bifid with long acute part and short blunter part, anterior margin and free end reinforced. Two epipharyngeal fans with very thin and long rays.

Measurements

Total length 390-568 µm, toe 47-55 µm.

Trophi 49-64 µm : ramus 22-30 µm, fulcrum 15-20 µm, uncus 18-24 µm, pre-uncinal tooth 10-11 µm, intramalleus 6-10 µm, manubrium 38-52 µm.

The specimens seen by BRYCE (1922) were 300 to 375 µm long, the variation being to some extent dependent upon the length of the toes which measured about 25 µm to 48 µm; for the manubria he reported a length of about 33 µm.

Differential diagnosis

Encentrum murrayi is characterized by its overall dimensions (300-568 µm) and stout, diverging, almost parallel-sided toes (25-55 µm). The species is closest to *Encentrum lutra* Wulfert, 1936, *E. permolle* (Gosse, 1886) and specimens described as *Dicranophorus permollis giganthea* by DARTNALL and HOLLOWDAY (1985) on the basis of the virtually identical trophi. *Encentrum lutra* and *E. permolle* are usually smaller (257-380 µm and 195-396 µm respectively) and display shorter, more or less conical toes (16-23 µm and 13-22 µm respectively). *Dicranophorus permollis giganthea* is a large species (overall length 446 µm, toe length 36 µm) known from several lakes at Signy Island (South Orkney Islands), Antarctica; it shows a frontal eyespot (absent in *E. murrayi*), a single foot pseudosegment (two in *E. murrayi*), apparently more strongly curved and tapering toes, rami terminating in simple incurved points (not lanceolate) and apparently absent pre-uncinal teeth.

Ecology

The species was found among temporarily submerged mosses. Water temperature 4.2° C, conductivity 54 μScm^{-1}, pH 7.5, alkalinity 1.04 mmole l^{-1}, oxygen 10.0 mgl^{-1}, Cl^- 4.02 mgl^{-1}, SO_4^{2-} 10.8 mgl^{-1}, PO_4^{3-} < 40 μgl^{-1}, NO_3^- 0.8 mgl^{-1}, NO_2^- 0.0 mgl^{-1}, NH_4^+ 0.0 mgl^{-1}, Si 0.35 mgl^{-1}, Na^+ 4.33 mgl^{-1}, K^+ 0.33 mgl^{-1}, Ca^{2+} 18.3 mgl^{-1}, Mg^{2+} 1.5 mgl^{-1}.

The accompanying rotifer fauna mainly consisted of numerous bdelloid species and the monogononts *Bryceella stylata* (Milne, 1886), *Colurella uncinata* (O.F. Müller, 1773), *Lepadella ovalis* (O.F. Müller, 1786), *Encentrum lutra* Wulfert, 1936 and *E. mucronatum* Wulfert, 1936.

Analysis of the gut contents showed that *E. murrayi* feeds on bdelloids.

Comments

The species described here is certainly identical with the *Encentrum murrayi* described by BRYCE (1922) and never reported since. BRYCE (1922) hatched « about a dozen living examples » from washings of dry ground mosses collected at the strandflat near Brycebyen, Billefjorden (Bünsow Land, Spitsbergen). Our specimens were collected from a similar type of habitat in the same great fjord area of Isfjorden.

ACKNOWLEDGEMENTS

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