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Notes on the monogonont rotifers from submerged mosses collected on Hopen (Svalbard)

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In this contribution 17 samples of submerged mosses, collected on Hopen (Svalbard), were studied for their rotifer content. Fourteen taxa have been identified, eleven to species level. Among these species six are new to Svalbard.

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1. INTRODUCTION

With the exception of Richard (1898:328) who mentioned «quelques Podures, de rares Rotifères et un assez grand nombre de Tardigrades . . . dans des mares insignifiantes au milieu de mousses», hydrobiological information on the water bodies of Hopen is non-existent.

During a biological expedition of the Antwerpen University to Svalbard in August and September 1985, we did extensive limnological fieldwork on Edgeøya, and occasionally visited Barentsøya, Bjørnøya and Hopen.

The present contribution deals with the rotifers collected in submerged mosses from seventeen water bodies at the SE-part of Hopen.

2. MATERIAL AND METHODS

2.1. General features

Hopen (76°31'N, 25°01'E) is a high-arctic island of the Svalbard archipelago, situated in the Barents Sea, S-SE of Edgeøya. It takes the form of a narrow strip (Fig. 1), about 37 km long and 0.9 to 1.8 km wide, and consists of a series of plateau-shaped mountains (200-370 m a.s.l.) separated by seven gaps or saddles right across. The island is built up of horizontal beds of sandstones and shales belonging to the Cretaceous system (Werenskiold in Iversen 1929, Winsnes *et al.* 1962).

The island is normally surrounded by ice about 10 months of the year. The mean annual temperature (Steffensen 1969) is below freezing (tundra climate). The absolute minimum air temperatures are between -30°C and -40°C. July and August are the warmest months with mean temperatures of 2.0°C and 2.2°C respectively. The mean temperature for September is 0.9°C. Mean temperatures for the other months are below freezing. Mean monthly relative humidity varies between 80% and 95% with a maximum in the summer months. The precipitation is scarce with mean yearly amounts below 400 mm.

During our stay on the island (06 September 1985), air temperature varied between 0.5 and 0.8°C (from 11.30 a.m. till 16.30 p.m.).

2.2. Waters investigated

Seventeen water bodies at the south-eastern part of the island were sampled (Fig. 2). Three of them are situated in a stretch of lowland along the coast (Heniesalen - Koefoedodden), 4 are from a mountain plateau (Werenskioldfjellet) and 10 lie in a saddle (Husdalen).

N° 61: puddle in lowland behind a raised beach ridge near Bekkeskardet, ca 40 m from high tide, 10 m x 3 m, depth 5—10 cm, substratum muddy; total hardness >7-14°dH (125—250 mg $CaCO_3.1^{-1}$). Used as a bathing pool by glaucous gulls *(Larus hyperboreus).*

N°62: small puddle in lowland near Bekkeskardet, ca 2 m from high tide, 1 m diam., depth 5 cm, substratum muddy with gravel, manured by birds; total hardness >7—14°dH.

N°63: puddle on Werenskioldfjellet mountain plateau, 10 m x 5 m, depth 2—5 cm,

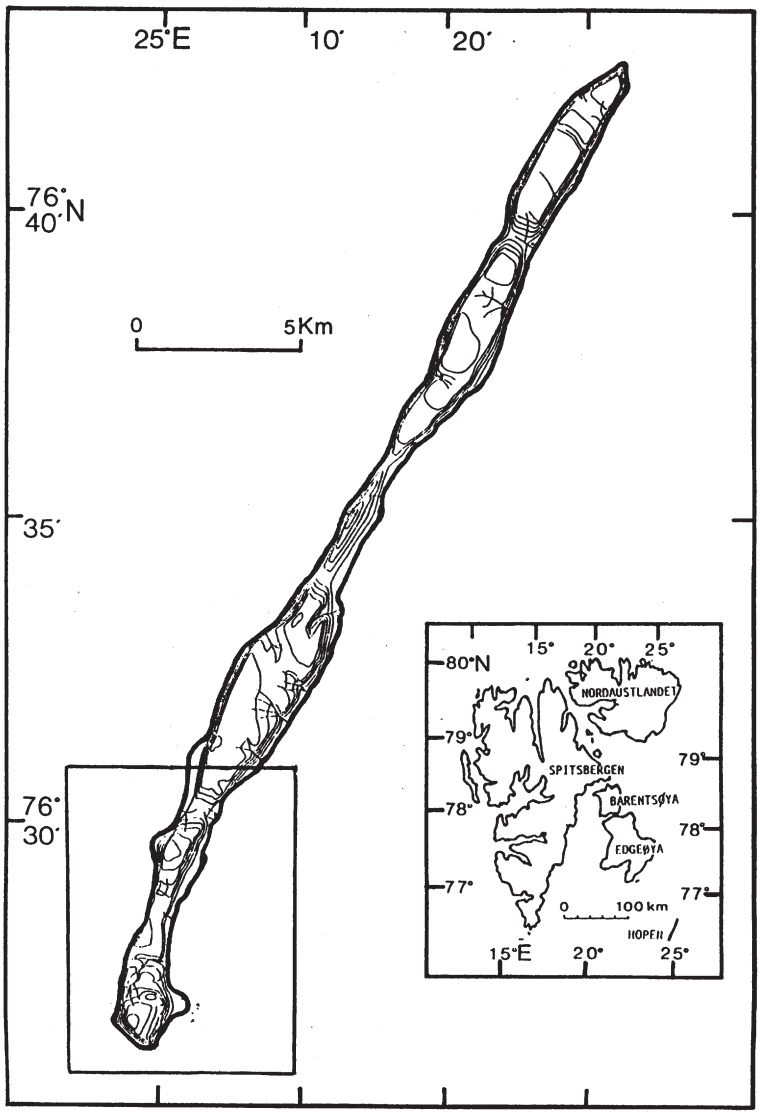

Fig. 1. Map of Hopen with sampling area indicated.

substratum muddy; total hardness <3°dH (<50 mg $CaCO_3.l^{-1}$).

N°64: puddle on Werenskioldfjellet mountain plateau, 5 m x 3 m, depth 2—5 cm, substratum muddy; total hardness <3°dH.

N°65: puddle on Werenskioldfjellet mountain plateau, 5 m x 5 m, depth 2—5 cm, substratum muddy; total hardness <3°dH.

N°66: Husdalen, pool, 2 m diam., depth 5—10 cm, manured by birds; total hardness >7—14°dH.

N°67: Husdalen, pool, 5 m x 3 m, depth 15 cm, manured by birds; total hardness <3°dH.

N°68: Husdalen, pool, 7 m x 5 m, depth 20—30 cm, manured by birds; total hardness <3°dH.

N°69: Husdalen, pool, 10 m x 5 m, depth 20—30 cm, manured by birds; total hardness <3°dH.

N°70: Husdalen, pool, 8 m x 4 m, depth 10 cm, manured by birds; total hardness <3°dH, pH 7.5, conductivity 461 μS.cm^{-1} (25°C), Cl 64.8 mg.l^{-1}, SO_4 30 mg.l^{-1}, NH_4.N 0.05 mg.l^{-1}, NO_2 5 μg.$^{-1}$, NO_3 not detectable, ortho-PO_4 100 μg.l^{-1}, Ca 6.8 mg.l^{-1}, Mg 5.8 mg.l^{-1}, Na 32.2 mg.l^{-1}, K 1.4 mg.l^{-1}.

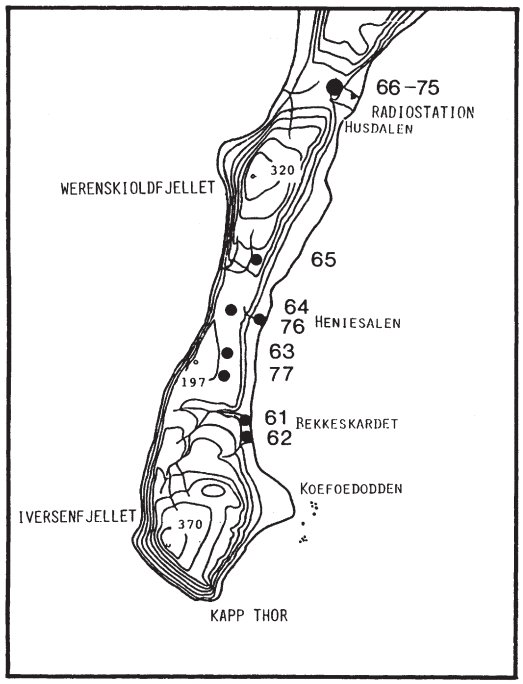

Fig. 2. Map of sampling area. Numbers 61—77 indicate the localities investigated.

N°71: Husdalen, pool, 7 m x 4 m, depth 10—15 cm, manured by birds; total hardness <3°dH.

N°72: Husdalen, pool, 7 m x 3 m, depth 10—15 cm, manured by birds; total hardness <3°dH.

N°73: Husdalen, pool, 7 m x 3 m, depth 10—15 cm, manured by birds; total hardness <3°dH.

N°74: Husdalen, pool, 5 m x 3 m, depth 10—15 cm, manured by birds; total hardness <3°dH.

N°75: Husdalen, small pool behind radiostation, 3 m x 1 m, depth 15—20 cm; total hardness >4—7°dH (>70—125 mg.l^{-1} $CaCO_3$).

N°76: drainage area behind raised beach ridge near Heniesdalen, 10 m from high tide; total hardness <3°dH.

N°77: small puddle on Werenskioldfjellet mountain plateau, 40 cm x 40 cm, depth 5 cm; total hardness <3°dH.

3. RESULTS

3.1. Faunal assemblages

The micrometazoans collected in the submerged mosses (Tab. 1) belong to the Rotifera, Tardigrada, Nematoda, Gastrotricha (*Chaetonotus* sp.), Copepoda Harpacticoida, Diptera (larvae of Chironomidae) and Oligochaeta. Bdelloid rotifers, Tardigrada and Nematoda were present in all samples; monogonont rotifers could not be found in the samples n°63, 65 and 76. The remainder of the taxa show an irregular occurrence. The faunal assemblages are dominated by the rotifers (15—89%, average 48% of total number of individuals collected), Tardigrada (1—73%, x = 29%) and Nematoda (4—71%, x = 23%). Together these three groups account for 98% or more of the total number of individuals collected in each of the samples. When present, monogonont rotifers make up <1—14% (x = 3%) of the fauna. The relative importance of the bdelloids varies from 10 to 98% (x = 45%).

There is no apparent difference in the faunal assemblages of the different water bodies with respect to their overall character and the topography of the sampling sites.

3.2. Annotated list of rotifers

Rotifers recorded are listed systematically following Koste (1978) with minor modifications.

The abbreviations used are:

Abundance: r = individual specimens or rare; f = frequent, more than 5% of recorded rotifers; m = many, more than 20% of rotifers recorded; a = abundant, more than 50% of rotifers recorded; + = empty lorica.

Dimensions: lo = length; wi = width; he = height; lo = lorica; bo = body; to = toe; ma = mastax; f = fulcrum; m = manubrium; r = ramus; u = uncus.

BDELLOIDEA

Bdelloidea indeterm. predominant (a) at all sampling localities.

MONOGONONTA

Family Brachionidae

Notholca latistyla (Olofsson, 1918) (Fig. 3a—e)

Samples 67r, 73r, 74r. Dimensions of the

Table 1. The percentage composition (number of individuals) of micrometazoans in submerged mosses.

Sample N°	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77
ROTIFERA	59	24	84	69	89	48	77	42	50	17	28	63	63	15	28	15	39
Bdelloidea	49	23	84	67	89	47	70	42	48	16	27	63	58	10	25	15	25
Monogononta	10	1	-	2	-	1	7	<1	2	1	1	<1	5	5	3	-	14
TARDIGRADA	1	4	7	27	6	23	4	17	29	73	46	26	31	63	27	69	33
NEMATODA	40	71	9	5	4	29	19	41	21	9	26	11	5	29	44	16	26
COPEPODA	-	<1	-	-	-	-	-	<1	+	-	<1	-	1	1	<1	-	1
DIPTERA	-	<1	<1	-	1	-	-	-	-	<1	-	-	-	1	-	1	1
OLIGOCHAETA	-	<1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
GASTROTRICHA	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-

+ : remains

specimens found on the low side of the known range for the species (lole 104—147 μm). Caudal appendage short and broad with marked variation. In some specimens it becomes noticeably broader terminally and shows salient angles (Fig. 3b, c, e), while in others it more or less progressively decreases in width and displays rounded angles (Fig. 3a, d). Both forms co-occurring but the specimens with salient-angled appendages predominant. A species with arctic distribution.

Dimensions: lole (inclusive caudal appendage) 90—104 μm, lowi 59—68 μm, caudal appendage 5—10 μm, antero-median spines 9—14 μm.

Svalbard records: Barentsøya (De Smet in prep.), Bjørnøya (De Smet 1988), Edgeøya (De Smet *et al.* 1988), Spitsbergen (Olofsson 1918 sub *N. foliacea* var. *latistyla;* Amrén 1964).

Notholca squamula (O.F. Müller, 1786) (Fig. 6)

Samples 67r, 74r. The length (110—155 μm) of the specimens found is smaller than usual for this species (120—190 μm after Koste 1978). From his results on zooplankton investigations in the southern part of the estuary of Isfjorden (Spitsbergen), Amrén (1964) stressed that the smallest forms of the species seem to occur in the smallest and most extreme arctic localities. Almost cosmopolitan.

Dimensions: lole 110—115 μm, lowi 92—105 μm.

Svalbard records: Barentsøya (De Smet in prep.), Edgeøya (De Smet *et al.* 1988), Nordaustlandet (Thomasson 1958), Spitsbergen (Olofsson 1918, sub *N. striata* (O.F.M.); Thomasson 1961; Amrén 1964).

Family Colurellidae

Colurella adriatica Ehrenberg, 1831 (Fig. 8)

Samples 64r, 74+, 77m. Caudal corners of lorica strongly curved towards ventral side, which results in low indices for lole/lohe comparable to those for *C. uncinata* (O.F.M., 1773). Cosmopolitan.

Dimensions: lole 86—94 μm, lohe 54—57 μm, lowi up to 36 μm, tole 28—31 μm, index lole/lohe 1,50—1,70.

Svalbard records: Barentsøya (De Smet in prep.), Bjørnøya (De Smet 1988), Edgeøya (De Smet *et al.* 1988), Spitsbergen (Bryce 1897, sub *Colurus caudatus* Ehr.; Olofsson 1918).

Lepadella patella (O.F. Müller, 1786) (Fig. 5 a—b)

Samples 73r, 75f. The species was represented by two separate but co-occurring forms, viz. an oval form with foot-opening narrowing posteriorly (Fig. 5b) and a suboval form with caudally broadening foot-opening (Fig. 5a). All specimens seen dis-

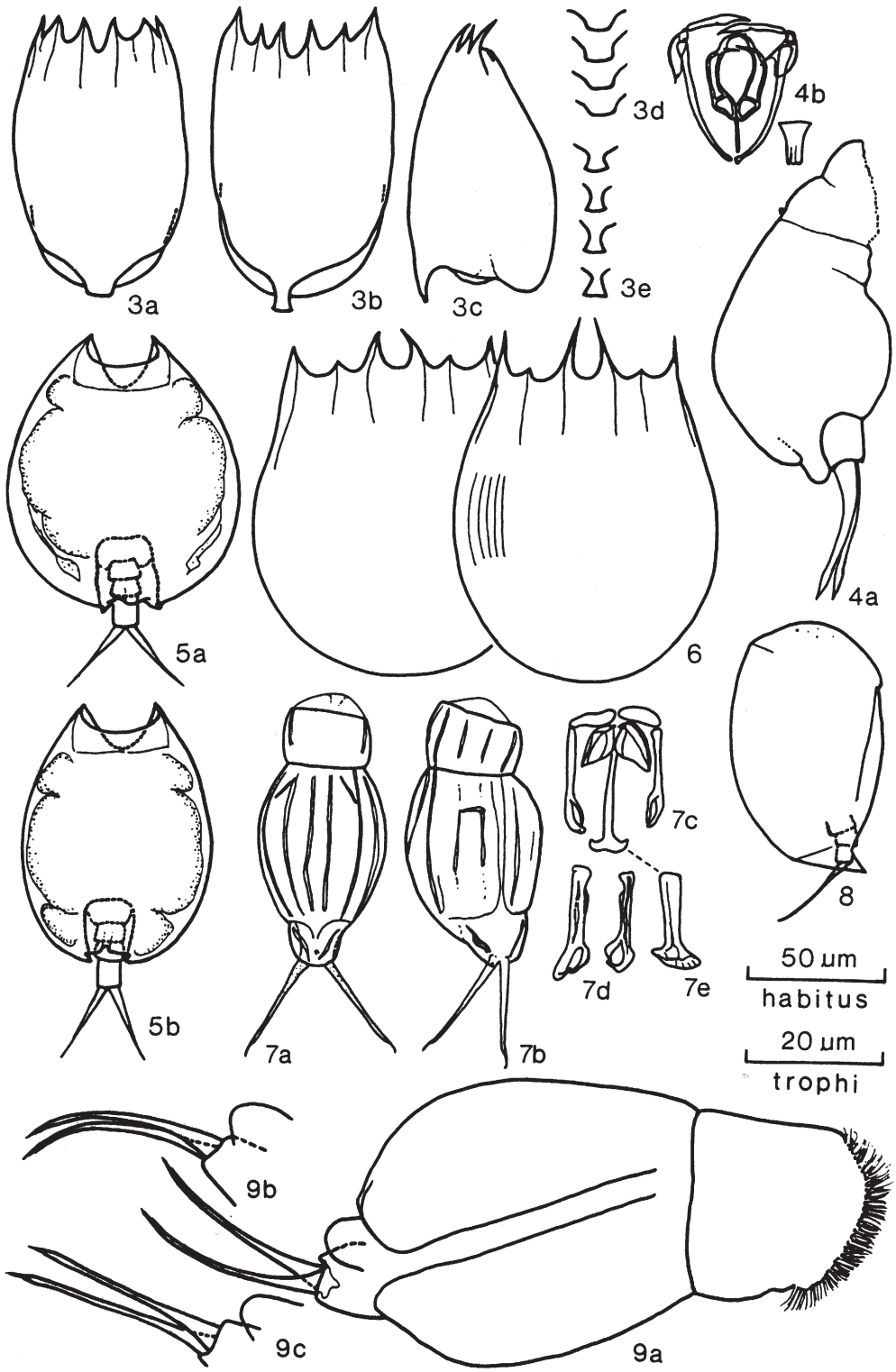

Fig. 3a—e *Notholca latistyla;* 4a—b *Dicranophorus uncinatus;* 5a—b *Lepadella patella;* 6 *Notholca squamula;* 7a—e *Cephalodella misgurnus;* 8 *Colurella adriatica;* 9a—c *Cephalodella gibba.*

played a medio-dorsal fold terminally above the foot-opening. Cosmopolitan.

Dimensions: lole 96—111 μm, lowi 46—49 μm, lohe 40—49 μm, tole 29—33 μm, index lole/lowi = 1,23—1,41.

Svalbard records: Barentsøya (De Smet in prep.), Bjørnøya (De Smet 1988), Edgeøya (De Smet *et al.* 1988), Nordaustlandet (Thomasson 1958), Spitsbergen (Bryce 1897 sub *Metopidia lepadella* Ehr.; Bryce 1922; Olofsson 1918 sub *Metopidia oblonga* (Ehrbg.) and *M. lepadella* Ehrbg.; Summerhayes & Elton 1923 sub *L. patella* and *Metopidia lepadella* Ehrbg.; Thomasson 1961).

Family Notommatidae

Cephalodella forficula (Ehrenberg, 1838) (Fig. 13)

Sample 75r. A single small specimen with large toes. Cosmopolitan.

Dimensions: lole 83 μm, tole 65 μm.

Cephalodella gibba (Ehrenberg, 1838) (Fig. 9a—c)

Samples 64r, 66r, 67r, 68r, 69+, 70r, 71r, 73r, 74r, 75r. Besides the more frequently found animals with upwardly curved toes, a few specimens with straight or downwardly curved toes.

Dimensions: lole 138—198 μm, tole 64—110 μm.

Svalbard records: Barentsøya (De Smet in prep.), Bjørnøya (De Smet 1988), Edgeøya (De Smet *et al.* 1988), Spitsbergen (Olofsson 1918 sub *Diaschiza gibba* (Ehrbg.)).

Cephalodella misgurnus Wulfert, 1937 (Fig. 7a—e)

A single specimen of this species, known from mud of running waters in Central Europe (Koste 1978), was found in submerged moss from the small puddle n°62. Terminal ends of manubrium touching but not completely fused into a closed loop as pictured by Wulfert (1937).

Dimensions: bole 100 μm, tole 42 μm, male 20 μm (f 15 μm, m 14,8 & 15,6 μm, r 8 μm, u 7 μm).

Cephalodella sterea (Gosse, 1887) (Fig. 14a—c)

Samples 61f, 62r, 64r, 67f, 68r, 69r, 72r, 73r, 75f. Pleural rods could not be demonstrated. Cosmopolitan.

Dimensions: bole 140 μm, tole 30—32 μm, male 26—28 μm (f 18 μm, m 20—21 μm & 23 μm, r 10 μm, u 8—9 μm & 10 μm).

Family Dicranophoridae

Dicranophorus uncinatus (Milne, 1886) (Fig. 4a—b)

Sample 64r. Gut content: pennate diatoms (53—65 μm). Cosmopolitan.

Dimensions: bole 125 μm, tole 51 μm, male 17 μm (f 6 μm, m 19 μm, r 10 μm, u 10 μm).

Svalbard records: Bjørnøya (De Smet 1988), Edgeøya (De Smet *et al.* 1988).

Encentrum mucronatum Wulfert, 1936 (Fig. 12a—b)

Samples 62r, 70f, 71r, 73r, 74f, 75r, 77f. Cosmopolitan?

Dimensions: bole 212—234 μm, tole 16—19 μm, male 28—32 μm (f 12—14 μm, m 29—30 μm, r 14 μm, u 12—16 μm).

Encentrum sp. (Fig. 10a—b)

A single specimen in sample 74 could not be classified into one of the species-groups. Toes middle long, slightly inflated at their base. Mastax large, intramallei with long supramanubria, fulcrum longer than one third of the manubrium, rami with small alulae, unci with one tooth, rami with three terminal teeth.

Dimensions: bole 225 μm, tole 20 μm, male 46 μm (f 17 μm, m 36 μm, r 18 μm, u 18 μm), egg 87/70 μm.

Family Flosculariidae

Ptygura sp. (Fig. 11a—b)

Samples 61r, 68r, 69r, 74r. The specimens found could not be identified to species level. Unci with 4 large and about 8 small teeth. No distinct dorsal antenna(e).

Dimensions: bole (contracted) 270—295 μm, male 12—13 μm.

Svalbard records: Barentsøya (De Smet in prep.), Bjørnøya (De Smet 1988), Edgeøya (De Smet *et al.* 1988).

Family Collothecidae

Collotheca ornata (Ehrenberg, 1832) (Fig. 15a—b)

Samples 67r, 68r, 69r, 71r, 72r, 73r, 75f. All specimens met with belonged to the var. *cornuta* (Dobie, 1849) and showed a well

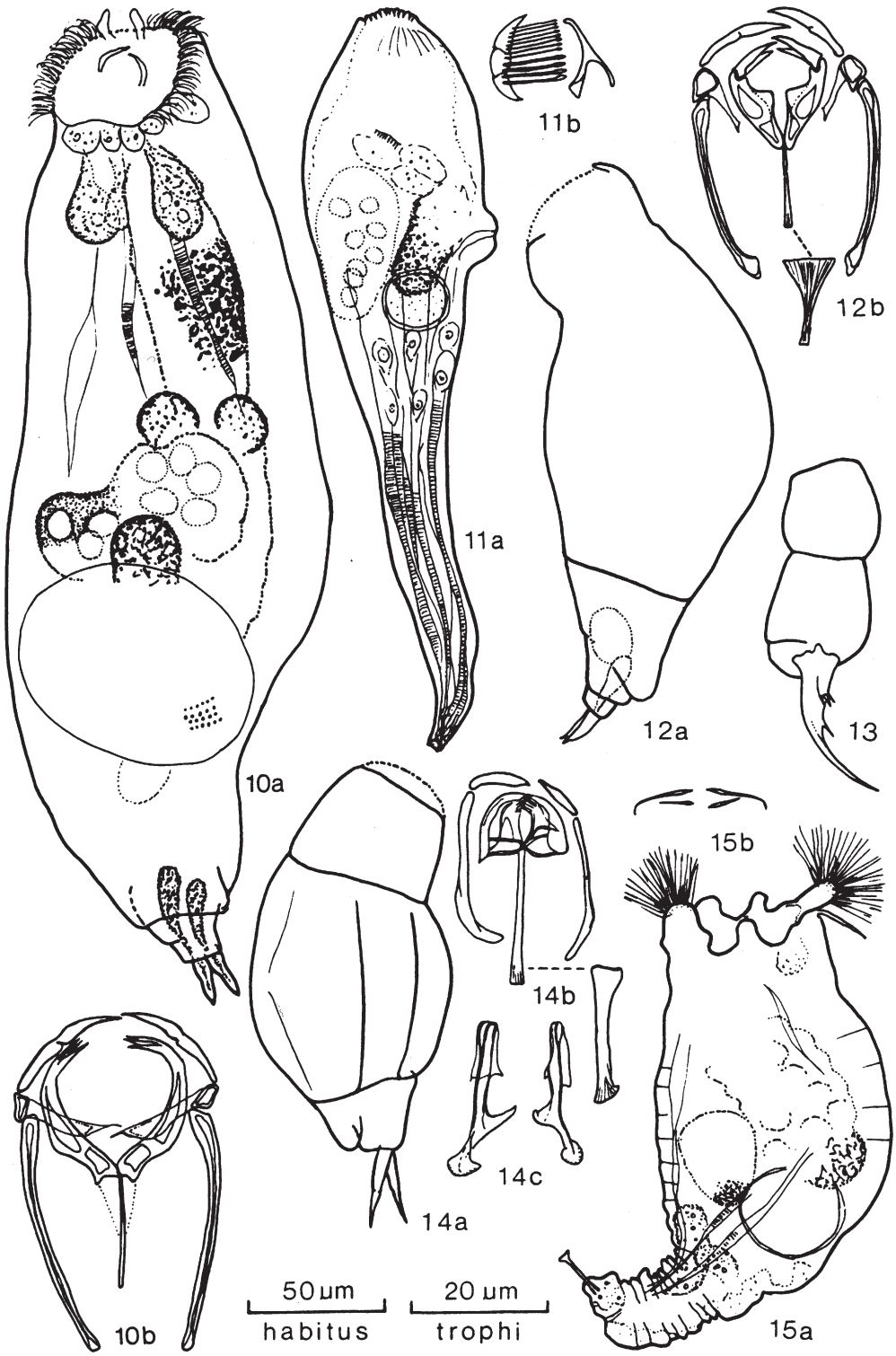

Fig. 10a—b. *Encentrum* sp.; 11a—b *Ptygura* sp.; 12a—b *Encentrum mucronatum;* 13 *Cephalodella forficula;* 14a—c *Cephalodella sterea;* 15a—b *Collotheca ornata* var. *cornuta.*

developed dorsal tentacle. Each uncus with one large and one small tooth. The forma *typica* which should be sympatric (Koste 1978) with the var. *cornuta* was not found.

Dimensions: bole (contracted) up to 230 μm, largest uncinal tooth 9—11 μm.

Svalbard records: specimens belonging to the Formenkreis *ornata* were found at Barentsøya (De Smet in prep.) and Edgeøya (De Smet *et al.* 1988).

4. GENERAL REMARKS

The rotifer fauna of the waters studied was very poor at the moment of sampling: 14 taxa (1 unidentified Bdelloidea and 13 Monogononta) were found. Eleven of the rotifers were identified to species level. The number of taxa present in each of the samples is very low and varies from 1 to 10. Species diversity (Shannon-Wiener) is also very low (0—1.81, average 0.48). The poor species richness and species diversity largely point towards unfavourable conditions. Bdelloidea were present at all sampling localities. None of the monogononts was common to all samples. The most frequently encountered species are *Cephalodella gibba* (present in 10 of the 17 samples), *C. sterea* (9/10), *Encentrum mucronatum* (7/10) and *Collotheca ornata* var. *cornuta* (7/10).

Concerning their geographical distribution, the majority of the monogonont species is cosmopolitan. One species, *Notholca latistyla,* is restricted to the arctic region. Six taxa *(Cephalodella forficula, C. misgurnus, C. sterea, Encentrum mucronatum, Encentrum* sp., *Collotheca ornata* var. *cornuta)* are new to Svalbard.

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