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TWO NEW SPECIES OF HARPACTICOID COPEPODS (COPEPODA, HARPACTICOIDA, CANTHOCAMPTIDAE) FROM MONTENEGRO (BALKAN PENINSULA)

Tomislav Karanovic

Key words: Taxonomy, Copepod, *Moraria*, *Elaphoidella*, Montenegro

ABSTRACT

In the present paper two new species of harpacticoid copepods (family Canthocamptidae) are described from several subterranean localities in Montenegro, Crmnica region. *Moraria jana* n.sp. is most similar to *M. catalana* Chappuis & Kiefer, 1952. It is also alike *M. brevipes* (Sars, 1863). *Elaphoidella montenegrina* n.sp. belongs to the "gracilis"-group and is similar to *E. pescei* Apostolov, 1986. Both species are stygobionts and probably acyclic.

RÉSUMÉ

Deux espèces nouvelles de Copépodes harpacticoides (famille Canthocamptidae) des eaux souterraines du Monténégro, Crmnica région, sont décrites. *Moraria jana* n.sp. est la plus similaire de *M. catalana* Chappuis et Kiefer, 1952. Aussi elle est proche de *M. brevipes* (Sars, 1863). *Elaphoidella montenegrina* n.sp. appartient au groupe "gracilis" et elle est très proche d'*E. pescei* Apostolov, 1986. Toutes les deux espèces sont stygobies et presumable acycliques.

INTRODUCTION

During an investigation of the copepod fauna in Montenegro (Yugoslavia), we took some samples from subterranean waters in the old karst valley of the Cetinjska River. This valley is in the south-eastern part of the Old-Montenegrin Karst Plateau, between the mountain Lovcen and the lake Skadar, and belongs to the Dinaric Alps (Petrovic, 1982). The basic geological material are Jurassic and Cretaceous limestones and, to a lesser extent, dolomites. They are several kilometers thick, tectonically deformed and lifted, and on their surface there is the typical karst (Besic, 1980).

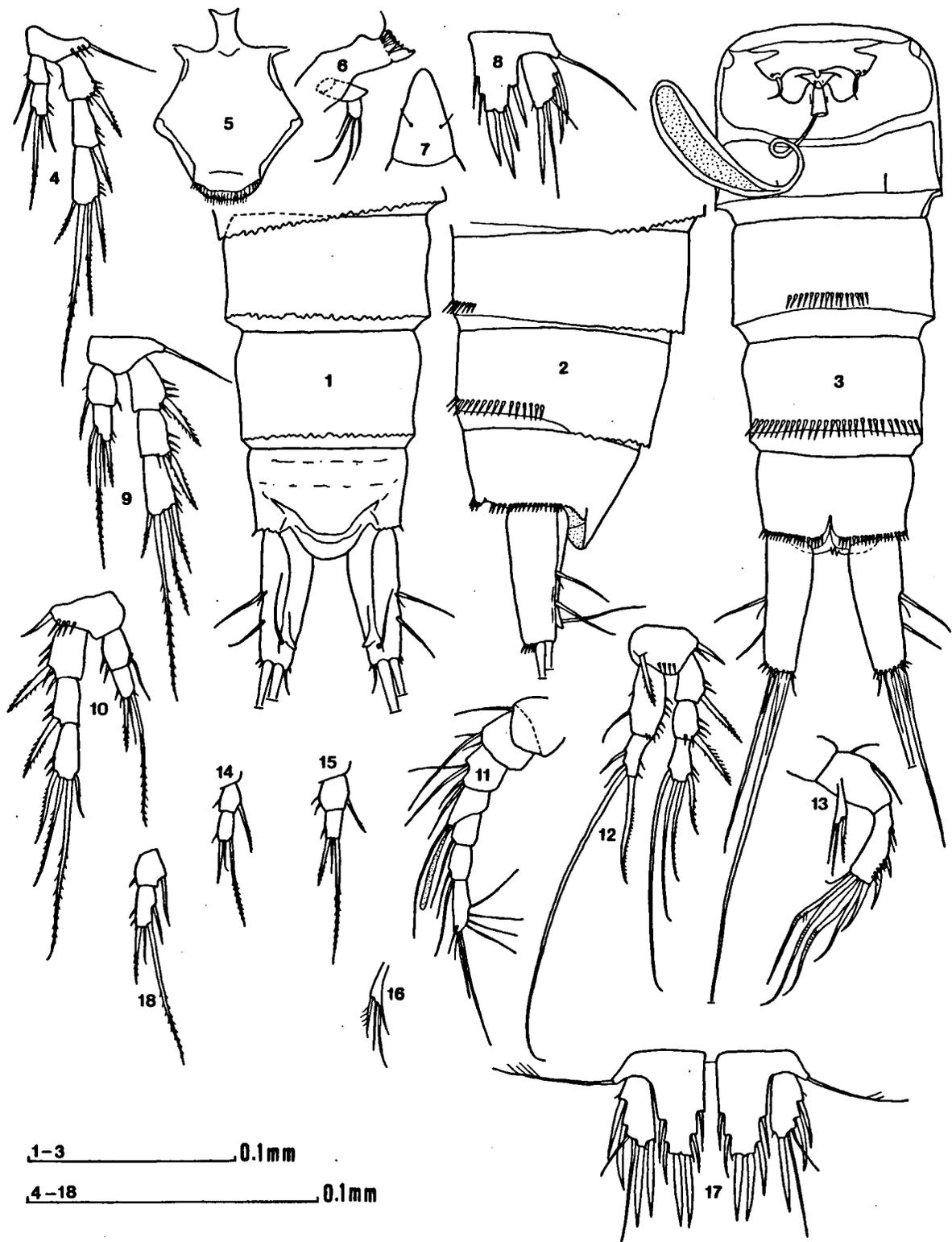
The Cetinjska River drainage area is the south-western part of the lake Skadar drainage area, which is the biggest drainage area in Montenegro. High precipitation contributed to the formation of surface and underground

karst relief. The annual precipitation ranges from 2500 mm to 3400 mm, depending on location in an average year, whereas the mean annual temperature is about 10° C (Lasca et al., 1981).

Among other copepod species we found two new harpacticoid species, which are described in this paper.

METHODS

The samples were taken with a plankton net of 0.05 mm mesh size and fixed by several drops of 36% formaldehyde. They were washed and copepods were sorted with a stereoscopic binocular Wild-M5 and removed into 70% ethyl alcohol. The specimens were dissected in a mixture of distilled water and glycerol (1:1) with fine entomological needles. Dissected appendages were removed on a slide (also in a mixture of water and glycerol) and covered with



Figs. 1-13. *Moraria jana* n. sp., holotype (female 0.53 mm): 1 - abdomen dorsally; 2 - abdomen laterally; 3 - abdomen ventrally; 4 - P4; 5 - La; 6 - Md; 7 - Ro; 8 - P5; 9 - P3; 10 - P2; 11 - A1; 12 - P1; 13 - A2.
 Figs. 14-17. *Moraria jana* n. sp., spring on the saddle Belveder near the town Cetinje (female 0.46 mm): 14 - EnpP4; 15 - EnpP3; 16 - ExpA2 17 - P5.
 Fig. 18. *Moraria jana* n. sp., cave in the valley Jabukov Do (female 0.48 mm): EnpP4.

a coverslip. For the larger parts (abdomen, etc.) two hairs between the slide and the coverslip were used, so the parts could not be smashed.

Dissected appendages were examined and figured using a binocular microscope Wild-M20 with drawing-tube attachment and were preserved in the Faure's medium. Specimens not dissected are preserved in 70% ethyl alcohol.

In the descriptions were used standard abbreviations of the characters: Gsg - genital segment; Fu - furca; Ro - rostrum; A1 - antennula; A2 - antenna; Md - mandible; Mxl - maxillula; Mx - maxilla; Mxp - maxillipede; P1 - first leg, P2 - second leg; ...; P6 - sixth leg; Enp - endopodite; Exp - exopodite; Enp2P3 - second article of the third leg.

DESCRIPTIVE PART

Moraria jana n.sp.

Material examined

1) Holotype (female 0.53 mm), allotype (male 0.53 mm), and 8 paratypes (3 females, 3 males and 2 copepodids) from the cave Babosuta near the village Trnovo, Crmnica Region, South Montenegro, 30 April 1995. Two paratypes (male and female) from the type locality, are deposited in the Zoological Museum Amsterdam (ZMA Co. 202.632).

2) Two females and two males from the cave Grbocica near the village Trnovo, 1 May 1995.

3) Three females and one copepodid, from a spring on the saddle Belveder, near the town Cetinje, 28 April 1995.

4) Two females, from a nameless cave in the Jabukov Do valley, Crmnica Region, 10 January 1993; 3 females, 3 males and 4 copepodids from the same locality, 30 April 1995.

Holotype, allotype, one paratype female and 3 other specimens (2 females and 1 male) were dissected and mounted on a slide in Faure's medium. The other specimens were preserved in a glass test tube in 70% ethyl alcohol. The specimens are deposited in the author's collection in Podgorica, Montenegro.

DESCRIPTION

Female (holotype). - Body length, including furcal rami (excluded furcal setae), is 0.53 mm. Body cylindrical and colourless. Nauplius eye absent. Rostrum large, even well rounded (Fig. 7). Hind margins of abdominal segments serrated dorsally, smooth ventrally. Gsg width about 1.3 times broader than long, its hind margin unarmed ventrally. Genital field with characteristic pattern (Fig. 3) and with spermatophore attached. Second abdominal segment armed with a transverse row of spines, medially only on the ventral side. Third abdominal segment with continuous row of spines ventrally. Anal segment armed laterally and ventrally (at the base of the furcal rami) with a row of spinules. Anal operculum concave, smooth, reaching beyond distal margin of anal segment (Fig. 1). Caudal rami divergent, subcylindrical, about 2.7 times longer than wide, having dorsally a well-developed chitinous ridge, behind which a dorsal seta is attached (at distal 1/6 of furcal length). Furcal ramus also bearing two lateral setae with a hair on base of proximal one. Distal margin of caudal ramus armed with a row of spinules ventrally, and with 3 apical

setae (Fig. 3). Inner apical seta very short (about 5 times shorter than caudal ramus). Middle and outer setae well-developed (outer one about 1.4 times longer than caudal ramus). A1 is 7-segmented, with the aesthetasc on fourth segment, not reaching the top of distal segment (Fig. 11). Exopodite of A2 is 1-segmented, with 1 lateral and 2 apical setae (Fig. 13). Md palp is very large, 2-segmented and armed with 4 setae on distal segment (Fig. 6). Mxp prehensile, with a row of spinules on inner margin of second segment. All swimming legs with 3-segmented exopodites and 2-segmented endopodites (Fig. 4, 9, 10 and 12). Setation formula of legs 1-4:

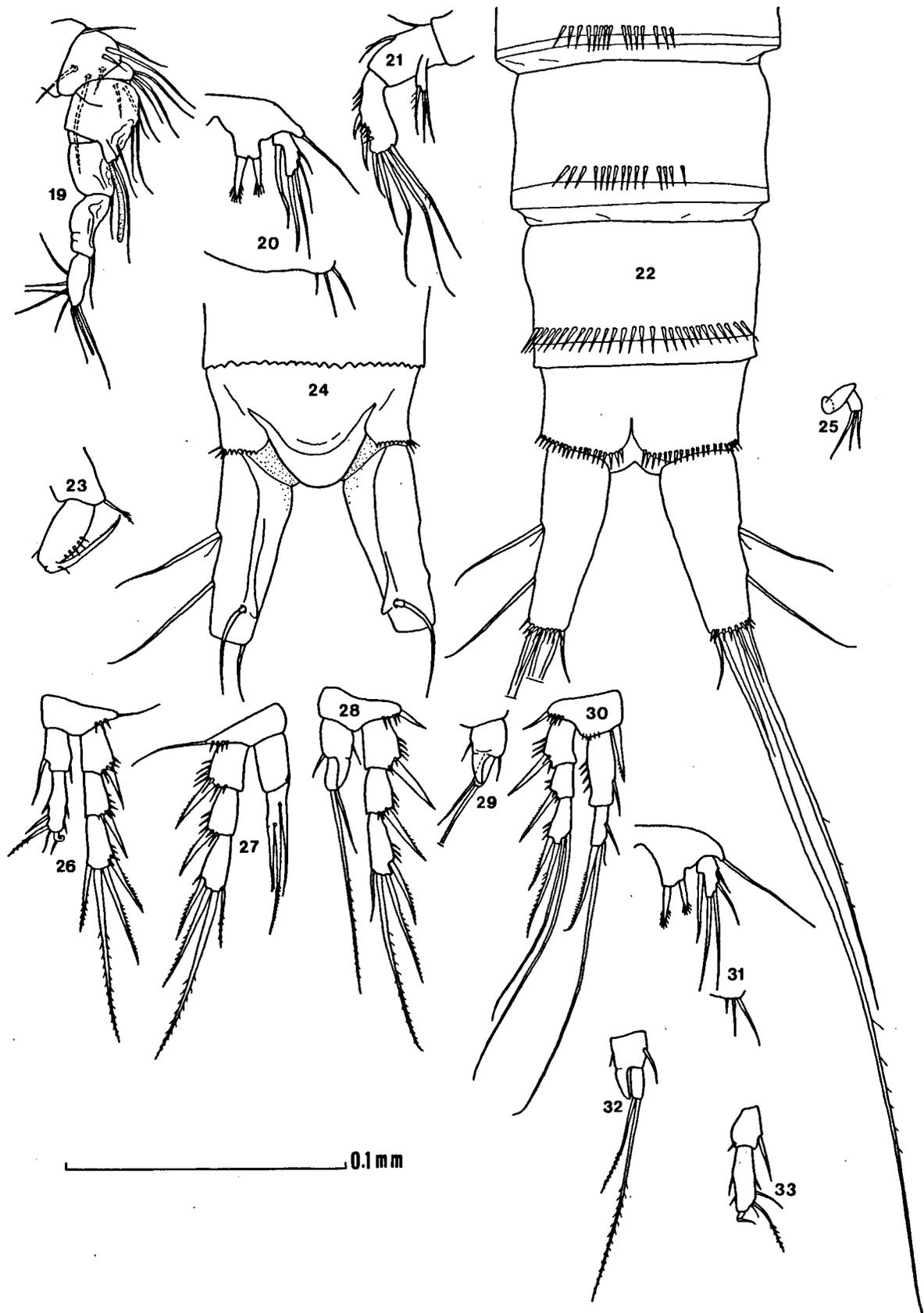
	Exp			Enp	
	1	2	3	1	2
P1	01	01	121	10	220
P2	01	01	022	10	030
P3	01	01	022	10	220
P4	01	01	022	10	130

Endopodite of P1 is as long as exopodite. Endopodites of P2 and P3 reaching half way second segments of exopodites; endopodite of P4 little shorter. P5 with 6 spiniform and smooth setae on distal margin of basienpodite (Fig.8). Exopodite about 1.6 times as long as width, armed with 5 setae; its distal margin aligned with distal margin of basienpodite.

Male (allotype). - Body length is 0.53 mm. Body similar to female in general appearance. Gsg unarmed. Second and third abdominal segments armed with a transverse row of spines, just medially on ventral side (Fig. 22). Fourth abdominal segment ventrally with continuous row of spines. Anal segment and Fu similar to that of female, just furcal rami bearing proportionally longer setae (outer apical seta about 2.3 times longer than caudal ramus, inner apical seta about 3.2 times shorter than caudal ramus). A1 prehensile, bearing a very short aesthetasc on fourth segment (Fig. 19). Md palp armed with 3 setae on distal segment (Fig. 25). A2, mouth parts, P1, and ExpP2-P4 are similar in females. EnpP2 2-segmented (Figs. 28 and 29). First segment bears one short seta subapically on inner margin, and one very strong, spiniform, apophysis, reaching top of distal segment (Figs. 28 and 29). Distal segment armed with two unequal apical setae. EnpP3 characteristically modified, its first segment unarmed (Fig. 27). EnpP4 is 2-segmented (Fig. 26); first segment having one seta on inner margin, and one spinule on outer margin. Second segment longest of all segments at fourth swimming leg. It has 3 spinules and 4 setae, of which the apical one spirally curved. P5 with two spines on distal margin of basienpodite, both with tuft of hairs on tips (Fig. 20). Exopodite elongated, armed with 5 smooth setae. Inner seta attached at proximal 1/3 of exopodite length. P6 armed with 3 setae, of which outer and middle one equal, and inner one about 2 times shorter.

VARIABILITY

Thirty specimens (23 adults) of *Moraria jana* n.sp., from 4 localities were found and examined. One female has



Figs. 19-30. *Moraria jana* n. sp., allotype (male 0.53 mm): 19 - A1; 20 - P5 & P6; 21 - A2; 22 - abdomen ventrally; 23 - Mxp; 24 - anal segment with caudal rami, dorsally; 25 - Md palp; 26 - P4; 27 - P3; 28 - P2; 29 - EnpP2; 30 - P1.

Figs. 31-33. *Moraria jana* n. sp., cave in the valley Jabukov Do (male 0.52 mm): 31 - P5 & P6; 32 - EnpP2; 33 - EnpP4.

Enp2P3 and Enp2P4 with only 3 setae (Figs. 14 and 15), ExpA2 with 4 setae (Fig. 16) and ExpP5 with 6 setae on one leg, with the opposite leg normally build (Fig. 17). The other female has Enp2P4 with the inner seta moved to the middle of the inner margin (Fig. 18). One female was found from a spring on the saddle Belveder (near the town Cetinje) with reduced armature on the second and third abdominal segments: 3 spines only at the middle of the ventral side. One male shows some minor differences, compared with the allotype, in its P5, P6, Enp2P2, and Enp4 (Figs. 31, 32 and 33).

ECOLOGY

Moraria jana n.sp. is probably a stygobiont species. Four specimens, found in one spring (locality 3), were colourless like all other specimens. They were probably ejected by subterranean waters. *Moraria jana* is an acyclic (or maybe polycyclic) species, in view of the fact that at the beginning of January as well as at the end of April copepodids and females with attached spermatophores were found together. Water temperature on the localities ranged from 9° to 12° C. No females with egg sacs were found.

DISTRIBUTION

At present, *M. jana* is found only in four localities, which belong to the Cetinjska River drainage area. This species is probably endemic to the Old-Montenegrin Karst Plateau (South Montenegro).

ETYMOLOGY

The species is named *jana* after Janus, Roman god of any beginning.

RELATIONSHIPS

M. jana is maybe most similar to *M. catalana* Chappuis & Kiefer, 1952, which is described from two localities in the French Pyrénées (Chappuis & Kiefer, 1952), later found also in two other localities in the Pyrénées (Dussart, 1967). *M. catalana* is evidently distinguishable from *M. jana* by the combination of the following characters:

1. Hind margins of abdominal segments smooth dorsally (serrated in *M. jana*),
2. Fu with one row of spines on proximal part of inner margin (smooth in *M. jana*),
3. Aesthetasc on fourth segment of female's A1 reaching beyond top of distal segment (not so in *M. jana*),
4. Distal margin of the basiendopodite female's P5 clearly reaching beyond distal margin of exopodite, and with spines armed with denticles (in *M. jana* the basiendopodite is aligned with exopodite or reaching slightly beyond its distal margin, having smooth spines),
5. Female's ExpP5 with 4 spines (5 or 6 in *M. jana*),
6. Female's Enp2P1 with 2 setae only (4 in *M. jana*),
7. Male's Enp1P3 with 1 seta on the inner margin (unarmed in *M. jana*),
8. Inner apical seta on male's Enp2P2 aligned with top of exopodite (considerably reaching beyond top in *M. jana*),

9. Basiendopodite of male's P5 very extended, exopodite bearing two spines, armed with denticles (basiendopodite less extended, and all spines on exopodite smooth in *M. jana*).

More small differences between the species exist in the length of some setae on the swimming legs.

M. jana also looks alike the European species *Moraria brevipes* (Sars, 1863), which differs from *M. jana* as follows:

1. Hind margins of abdominal segments smooth dorsally,
2. Anal operculum triangular,
3. Aesthetasc on female's A1 reaching beyond top of distal segment,
4. Female's Exp3P4 with 5 setae (one on inner margin),
5. Female's ExpP5 oval and much shorter than distal margin of basiendopodite,
6. Enp2P1 with 3 setae,
7. Male's ExpP5 more oval, bearing 3 spines armed with denticles,
8. Male's Enp1P3 with 2 setae (one on inner, and one on outer margin),
9. Apophysis on male's Enp1P2 attached under distal margin.

Other differences between these species (e.g. the appearance of furcal rami or the length of some setae on the swimming legs) are not emphasized here because of the great variability of *M. brevipes* (see Lang, 1948; Kulhavy, 1957; Kiefer, 1963; Dussart, 1967; Kiefer, 1968).

Elaphoidella montenegrina n.sp.

Material examined

1) Holotype (female 0.835 mm), allotype (male 0.8 mm) and 12 paratypes (6 females, 4 males and 2 copepodids), from the cave Grbocica near the village Trnovo, Crmnica Region, South Montenegro, 1 May 1995. Two paratypes (male and female) from the type locality are deposited in the Zoological Museum Amsterdam (ZMA Co. 202.631).

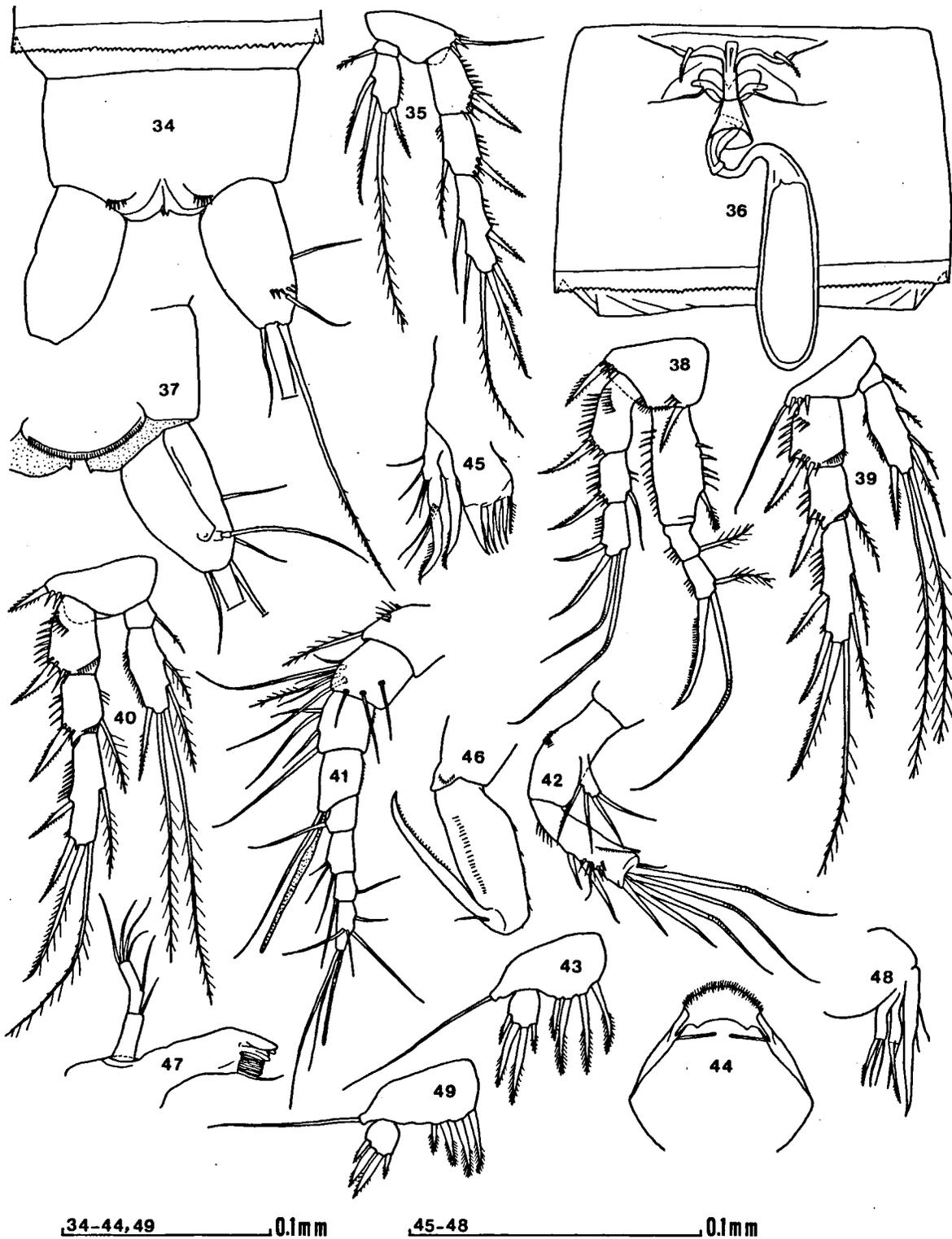
2) Four males and one female on the fourth copepodid stage, from the cave Babosuta near the village Trnovo, 30 April 1995.

3) Two females, from a nameless cave in the Jabukov Do valley, Crmnica Region, 10 January 1993; one female from the same locality, 30 April 1995.

Holotype, allotype and 4 other specimens (3 females and 1 male) were dissected and mounted on a slide in Faure's medium. The other specimens were preserved in a glass test tube in 70% ethyl alcohol. The specimens are deposited in the author's collection in Podgorica, Montenegro.

DESCRIPTION

Female (holotype). - Body length, including furcal rami (excluded furcal setae), is 0.835 mm. Body cylindrical, colourless and haired like a mammalian pelt (hairs very small, dense, and practically impossible to draw). Hind margins of abdominal segments finely serrated both on ventral and dorsal surfaces, without rows of spines. Gsg with about 1.5 times broader than long, with characteristic genital field and attached spermatophore (Fig. 36). Anal segment armed ventrally at base of furcal rami, with an arch and short row of 6 spinules (Fig. 34). Anal operculum



Figs. 34-48. *Elaphoidella montenegrina* n. sp., holotype (female 0.835 mm): 34 - anal segment with caudal rami, ventrally; 35 - P4; 36 - genital segment; 37 - Fu dorsally; 38 - P1; 39 - P3; 40 - P2; 41 - A1; 42 - A2; 43 - P5; 44 - La; 45 - Mxi; 46 - Mxp; 47 - Md; 48 - Mx.

Fig. 49. *Elaphoidella montenegrina* n. sp., cave in the valley Jabukov Do (female 0.72 mm): P5.

concave with one row of hairs on distal edge, not reaching beyond distal margin of anal segment (Fig. 37). Furcal rami divergent, tapering toward end (their distal margins about 3 times narrower than proximal margins), with a well-developed chitinous ridge behind which a dorsal seta is attached (at distal 1/5 of furcal length). Outer margin of caudal ramus armed with 2 setae with a transverse row of 5-6 spinules at base of distal seta (Fig. 34). Inner apical seta about 1.6 times shorter than caudal ramus, and 3.3 times shorter than outer seta. Furcal rami about 1.8 times longer than width. Labrum with concave distal margin (Fig. 44). A1 8-segmented, with aesthetasc on fourth segment, slightly reaching beyond top of distal segment (Fig. 41). ExpA2 1-segmented, armed with 4 setae (Fig. 42). Md palp 2-segmented, with one subapical seta on first segment and with 4 apical and 1 lateral setae on second segment (Fig. 47). Maxillula and maxilla are shown in Fig. 45 and Fig. 48. Mxp is prehensile and without seta on first segment (Fig. 46). All swimming legs with 3-segmented exopodites (Figs. 35, 38, 39 and 40). Setation formula of legs 1-4:

	Exp			Enp		
	1	2	3	1	2	3
P1	01	11	022	10	10	120
P2	01	11	122	10	221	-
P3	01	11	222	10	321	-
P4	01	11	222	10	211	-

EnpP1 is also 3-segmented, with its first segment reaching half way to Exp3P1. EnpP2-P4 are 2-segmented, with a very small first segment and with the second segment approximately as long as last exopodite segment. Basiendopodite of P5 just a little protruding, bearing 4 setae, which are rather small, plumose, and armed with denticles. Exopodite subquadrangular, bearing 4 setae of which two in the middle are like those on basiendopodite; inner and outer setae more than twice shorter (Fig. 43).

Male (allotype). - Length approximately 0.8 mm. Body similar to female in general appearance. Anal segment without spinules on ventral surface (Fig. 50). On dorsal side two hairs over the anal operculum (Fig. 52). Furcal rami little more elongate than those of female. A1 prehensile (Fig. 59). A2, mouth parts, P1 and ExpP2-P3 similar to female. EnpP2 similar to female, except for an inner subapical seta on the second segment (Fig. 54). EnpP3 characteristically modified, its apophysis of the second segment plump, relatively short, and with a simple, obtuse, tip (Fig. 55). Distal segment bearing two apical setae of which inner one very short, the outer seta reaching distal margin of third exopodite segment. EnpP4 2-segmented. First segment very small and unarmed. Second segment bearing one seta on inner margin, one apical seta (on inner side), and one short and smooth apical spine (on outer side) (Fig. 56). Exp3P4 bearing two setae on inner margin, two apical setae and two spines on outer margin. Distal seta on inner margin, outer apical seta, and both spines smooth. Proximal spine characteristically modified, very plump and thumb-like (Fig. 56). P5 with reduced basien-

dopodite, without armature. Exopodite subquadrangular and very similar to that of female, bearing 3 plumose setae only of which the middle one is longest (Fig. 60). P6 completely reduced.

VARIABILITY

Twenty-two specimens (19 adults) of *Elaphoidella montenegrina* n.sp. were collected and studied. All specimens are very similar in morphological characteristics. One female has P5 with less protruding distal margin of basiendopodite, and with shorter setae than those on holotype (Fig. 49).

ECOLOGY

Elaphoidella montenegrina n. sp. is a real troglobiont species. Couples *in copula* were found. Females with attached spermatophores and copepodid stages (on the type locality) were collected together at the end of April. One female with attached spermatophore was found at the beginning of January (locality 3). We, therefore, believe *E. montenegrina* being an acyclic species. Females with egg-sacs were not encountered.

DISTRIBUTION

At present, *E. montenegrina* is found on three localities only in the Cetinjska River drainage area.

ETYMOLOGY

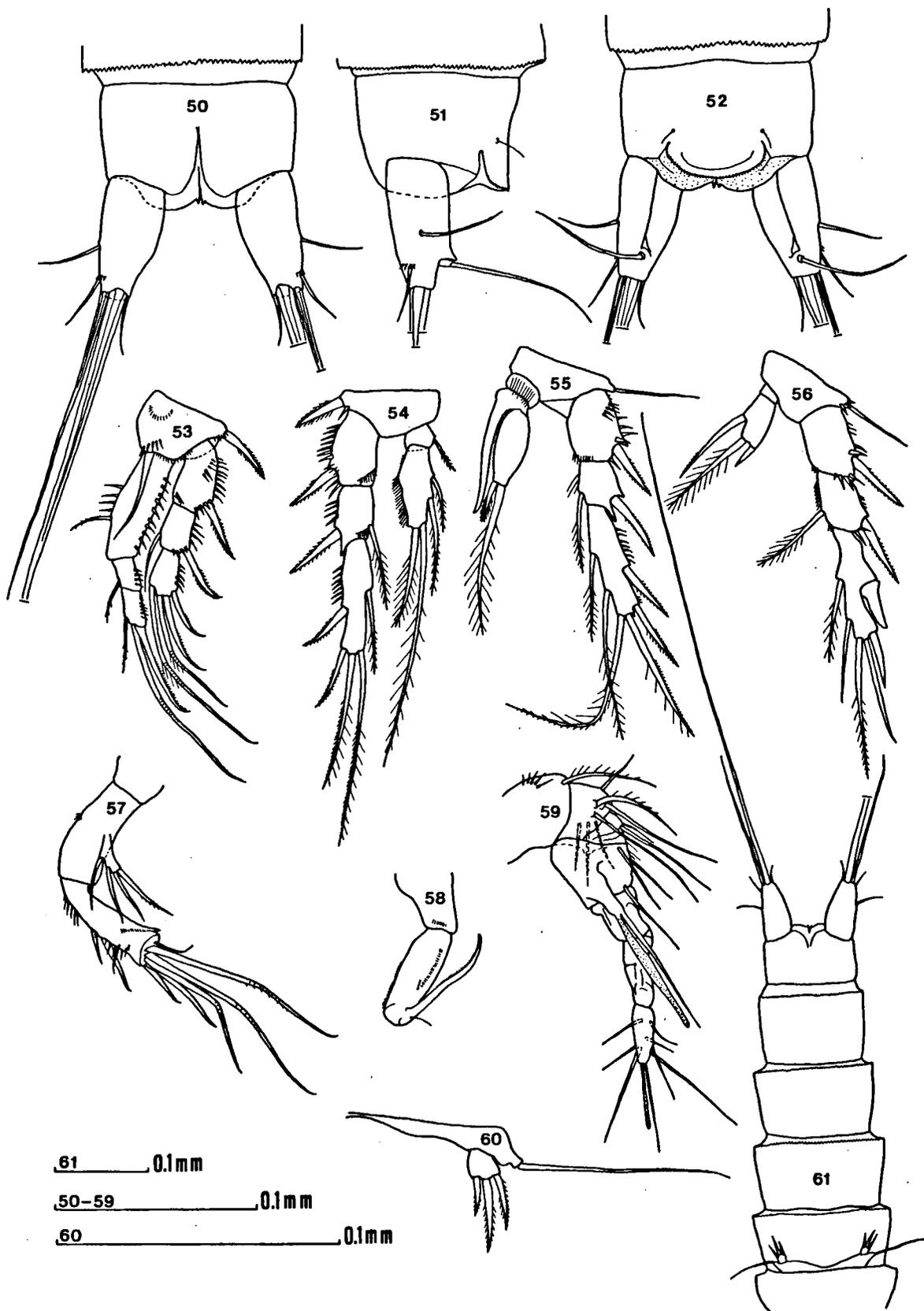
The species is named *montenegrina* after the name of the republic Montenegro where the material was collected.

RELATIONSHIPS

Elaphoidella montenegrina n.sp. belongs to the II. ("*gracilis*") - group, in sense of the classification into groups of the genus *Elaphoidella*, which was created by Lang (1948), and supplemented by Petkovski & Brancelj (1988). I do not agree with the review of the genus *Elaphoidella* by Apostolov (1985), because it neglects many affinities among species. It seems unwise to split a genus only because it contains too many species.

Elaphoidella montenegrina is most similar to *E. pescei* Apostolov, 1986, which is described from three localities in West Bulgaria (Apostolov, 1986). *E. pescei* however, is evidently distinguishable from the new species as follows:

1. Hind margins of abdominal segments smooth and armed with row of spines,
2. Furcal rami shorter, less narrow on distal part, and much smaller compared to anal segment,
3. Proximal lateral seta on Fu attached at first 1/3 of furcal length,
4. Enp1P1 shorter (reaching to distal end of Exp2P1),
5. Female's A1 with all segments much longer,
6. Female's ExpP5 about 2 times longer than wide, bearing 5 setae,
7. Female's basiendopodite of P5 narrower, longer, and bearing much longer setae,
8. Male's ExpP5 bearing 4 setae,
9. Male's Enp1P3 without seta,



Figs. 50-61. *Elaphoidella montenegrina* n. sp., allotype (male 0.8 mm): 50 - anal segment with Fu, ventrally, 51 - anal segment and Fu, laterally; 52 - anal segment and Fu, dorsally; 53 - P1; 54 - P2; 55 - P3; 56 - P4; 57 - A2; 58 - Mxp; 59 - A1; 60 - P5; 61 - abdomen ventrally.

10. male's Exp3P4 much longer, its proximal, modified, spine much shorter (as long as 1/3 of distal segment's length).

There are, moreover, differences between these species in the length of some setae on the swimming legs.

E. montenegrina also is alike *E. reedi* Wilson, 1975, which is described from Canada (Wilson, 1975); however it is evidently distinguishable from the latter by many features. Differences between *E. montenegrina* and all other known species in the "*gracilis*"-group are much greater.

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T. KARANOVIC
Department of Biology, Faculty of Sciences,
University of Montenegro
P.O.Box 307 YU-81000 PODGORICA
YUGOSLAVIA

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