Two interesting species of the genus Elaphoidella Chappuis, 1929 (Crustacea, Copepoda) from Balkan Peninsula

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TWO INTERESTING SPECIES OF THE GENUS *ELAPHOIDELLA* CHAPPUIS, 1929 (CRUSTACEA, COPEPODA) FROM BALKAN PENINSULA

by

Tomislav KARANOVIC*

I - INTRODUCTION

CHAPPUIS (1929) established the genus *Elaphoidella*, with *E. elaphoides* (Chappuis, 1924), as a type species. He separated new genus from the genus *Canthocamptus*, and at that time genus *Elaphoidella* counted twenty-five species and subspecies. In the next few decades genus *Elaphoidella* rapidly enlarges, mostly because of the great number of subterranean species. Up to 1948, fifty-three species were known, and LANG (1948) classified them into ten groups, mainly on the basis of the shape of the bizarre transformed spines on male's Exp3P4. PETKOVSKI and BRANCELJ (1988) added one new (eleventh) group. The only problem with classification into groups is necessity of both sexes, while many species are described and known just as one sex (mostly female).

One unsuccessful attempt of revision of the genus *Elaphoidella* was made by APOSTOLOV (1985). Maybe the most detailed critical annotation of that revision is given by REID (1990). What was not said in Reid's annotation is that Apostolov's revision is a very rough copy of the revision of the genus *Nitocrella*, which was made by PETKOVSKI (1976). Naturally, the same morphological characters in two different families (Canthocamptidae and Ameiridae) have not the same systematic validity. From the other hand HAMOND (1988) tried to return *Elaphoidella* to the subgeneric status of the genus *Canthocamptus*. That did not provoke particular response, because a difference between the status of subgenus and genus is cosmetic, not essential. Nowadays majority of copepodologists support generic status of *Elaphoidella*, and its separation into groups of species (ROUCH, 1988; REID & ISHIDA, 1993; GAVIRIA, 1993; PESCE & GALASSI, 1994; KARANOVIC, 1997; etc.). With almost two hundred described species *Elaphoidella* is, after *Parastenocaris*, the largest copepod genus.

One of the smallest and quite homogeneous group of species, both from a systematic and biogeographical point of view, is III.("*jeanneli*")-group, created by LANG (1948). Now it includes (surely) four species, all from Balkan Peninsula and north Apennines: *E. jeanneli* (Chappuis, 1928), described from Slovenia and later three times rediscovered in Slovenia (STAMMER, 1931; PETKOVSKI & BRANCELJ, 1985; BRANCELJ, 1986), and once in Bulgaria (APOSTOLOV, 1991); *E. stammeri* Chappuis, 1936, described and rediscovered (PETKOVSKI, 1983) from Slovenia; *E. franci* Petkovski, 1983, also from Slovenia; and *E. ruffoi* Chappuis, 1953, from north Italy. *E. charon* Chappuis, 1936, which is described and redescribed (PETKOVSKI, 1984) from Slovenia, is just a synonymous of *E. jeanneli*, as it is nicely shown by BRANCELJ (1986). *E. plesai* Pesce & Galassi, 1994, from Austria, and *E. tenera* Chappuis, 1937, from Macedonia and Bulgaria (MICHAILOVA-NEIKOVA, 1975), are still known just as females. Their belonging to the III.-group is not sure, until males will be described, although there are strong evidences for that.

During an investigation of the copepod fauna in Montenegro, one undescribed species of the genus *Elaphoidella* was identified. This new species, which belongs to the III.("*jeanneli*")-group of species, is herein described as *E. gordani* n. sp. Also *E. tenera* Chappuis, 1937, is herein redescribed after material from Macedonia collected by Trajan K. PETKOVSKI, and kindly loaned to us.

II - METHODS

Samples were collected with Karaman-Chappuis method, and also with different types of hand-nets and little rubber pumps, in two small caves in Montenegro (about 80 km from each other). The material was preserved by adding several drops of 36% formaldehyde, and very soon after that washed, and copepods were separated and removed into 70% ethanol. Specimens were dissected in a mixture of distilled water and glycerol (1:1), with fine entomological needles. All drawings have been prepared using a drawing attachment on Leica DMLS microscope with C-PLAN achromat objectives. Dissected appendages were prserved in Faure's medium.

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Abbreviations used in the text and figures are: GS = genital somite; Fu = furca; 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; Exp3P4 = third exopodite article of the fourth leg.

III - RESULTS

III. 1 - *Elaphoidella gordani* n. sp.

Material examined: 1- Holotype (male: 0,52 mm) from the cave Golubija (type locality) near the village Gornja Seoca on the mountain Rumija, south Montenegro, 31 January 1997, collected by T. Karanovic.

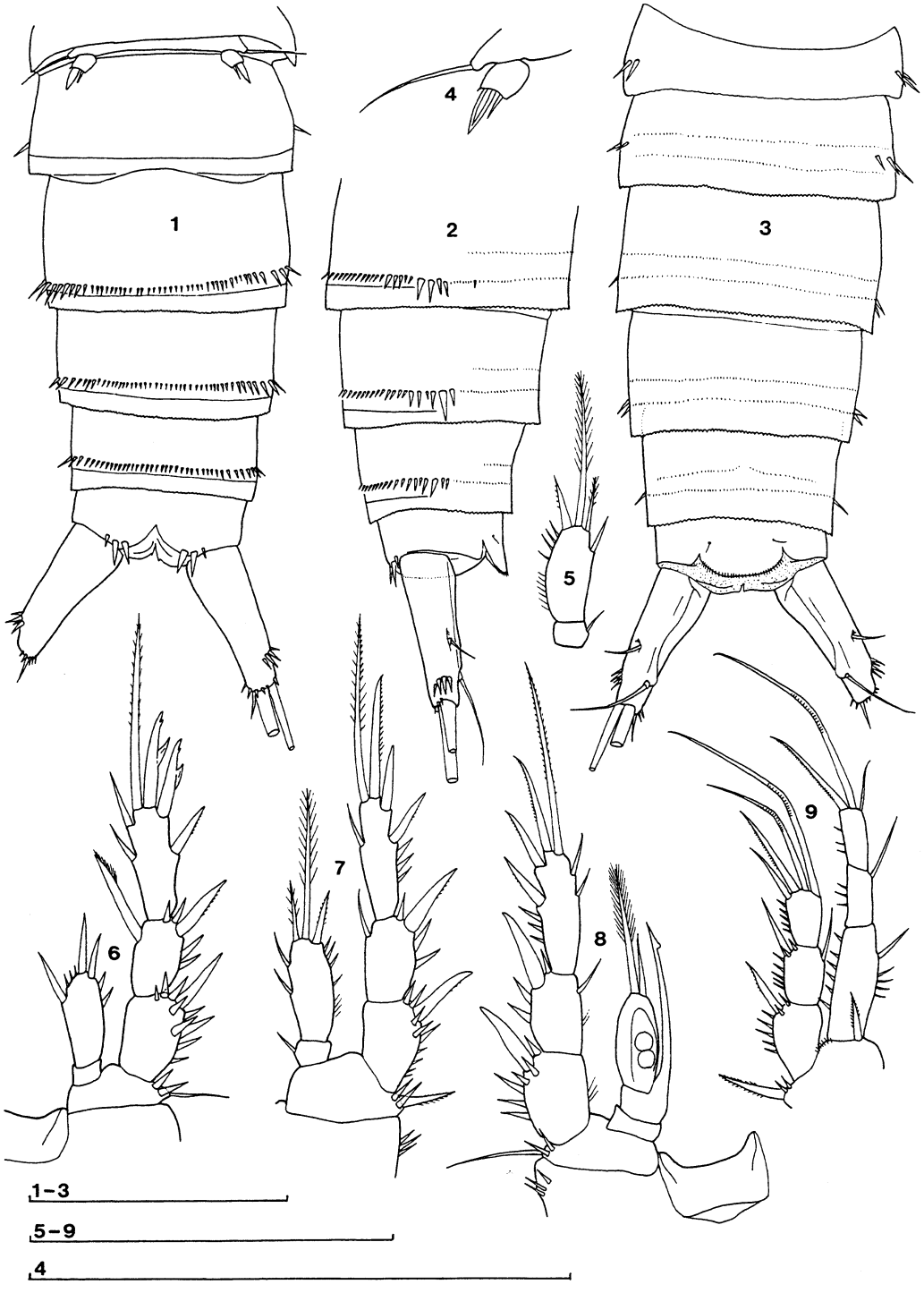

Fig. 1-9 - *Elaphoidella gordani* n. sp., holotype (male, 0.52 mm). 1 = abdomen ventral view; 2 = abdomen, lateral view; 3 = abdomen, dorsal view; 4 = P5; 5 = EnpP2; 6 = P4; 7 = P2; 8 = P3; 9 = P1. Scales = 0.1 mm.

2- One female (0,481 mm) from the cave Vidrovanska near the town Niksic, central Montenegro, 9 March 1996, collected by T. Karanovic.

Both specimens are completely dissected, mounted on slides in Faure's medium, and deposited in the author's collection (holotype: N° 8/45/0460/c; female: N° 8/76/0405/a), at the Institute of Marine Biology, Kotor, Montenegro.

Description: **Male** (holotype). Body length, including furcal rami (but excluding furcal setae), is 0.52 mm. Body elongated, cylindrical, colourless and without nauplius eye. Hind margins of cephalothorax and thoracic somites are smooth. Hind margins of abdominal somites finely serrated both on ventral and dorsal surfaces (Fig. 1, 2, 3). Last thoracic and first abdominal (GS) somites with only a few spines on the lateral sides (Fig. 3). Second, third and fourth abdominal somites with transverse row of spines ventrally and laterally on the distal part. Those on the lateral side are much bigger than those on the middle of the ventral side (Fig. 1, 2). All abdominal somites, except anal one, with two rows of small hairy spinules dorsally (Fig. 3). Anal somite bears three spines at the base of each furcal ramus. Anal operculum concave, with many spinules on its margin, and it does not reach beyond distal margin of anal somite (Fig. 3). Caudal rami strongly divergent, about 2.5 times as long as wide, and with 5 little spines at its apical margin ventrally. Proximal lateral seta is thin, short, and attached at the middle of the length (Fig. 2). Distal lateral seta is reduced completely, and there are only 4 spines at the base of its former place (Fig. 2). Dorsal seta is attached behind chitinous ridge, at the distal fifth of furcal length, and shorter than furcal ramus (Fig. 3). Inner apical seta is minute, about 5.3 times shorter than furcal ramus, while middle and outer apical setae are well developed (Fig. 13). A1 8-segmented, prehensile, and with long aesthetasc on fourth segment (Fig. 10). All setae on A1 are naked, except one on the first, and one on the second segment. A2 is 3-segmented, with 1-segmented exopodite which is armed with 4 plumose setae (Fig. 11). Md with elongated praecoxa, and 2-segmented palp (Fig. 15). Proximal segment of Md palp is unarmed, while terminal one bears 1 lateral and 4 apical setae. Arithrite of praecoxa of Mxl with 5 naked spines and 1 plumose seta; coxa with 1 strong and 1 fine seta; basipodite with 1 very strong distal seta, and 5 lateral setae (Fig. 14). Syncoxa of Mx with two endites of which proximal bearing 3, while distal bearing 2 setae. Basipodite of Mxp without seta on distal-inner corner, first endopodite segment with row of spinules on the inner margin; second endopodite segment with a strong, recurved, thorn and 1 smooth seta (Fig. 12). All swimming legs with 3-segmented exopodites, as well as endopodites of P1 and P3, while endopodites of P2 and P4 are 2-segmented. Endopodite of P1 longer than the corresponding exopodite for the length of whole terminal article; bearing 1 seta on the first, 1 on the second, and 3 setae on the terminal article (Fig. 9). Endopodite of P2 armed with one seta on the first, and 4 or 5 setae on the second article (Fig. 5, 7). Terminal exopodite article of that leg with 5 spines and setae. First endopodite segment of P3 without armature; terminal with 2 apical setae, of which the outer one is plumose and twice longer than inner naked seta (Fig. 8). Terminal exopodite article of that leg with 6 spines and setae. First endopodite segment of P4 without armature; second with 3 naked setae. Second exopodite segment of P4 with very strong seta on the inner margin, and with spine on outer. Terminal exopodite segment of that leg is armed with 6 appendages, of which the outer-apical and distal-lateral are transformed like stag's antlers (Fig. 6). Intercoxal plates in all swimming legs are convex and smooth. P5 with reduced basiendopodite, without armature. Exopodite subquadrangular, and armed apically with one very strong, short, and naked spine, and one smooth inner seta which is almost twice shorter than spine (Fig. 4). P6 consisting of a chitinous lamella, without any armature (Fig. 1).

Female. Body length is 0.481 mm. Body similar to male in general appearance, just a little less slender. Hind margins of abdominal somites finely serrated dorsally, smooth ventrally (Fig. 18, 19). Genital double-somite about 1.5 times wider than long, with three rows of small hairy spinules dorsally, and one row of spines ventrally, which is interrupted medialy (Fig. 18, 19). Genital field with characteristic pattern (Fig. 19). Second abdominal somite also with interrupted row of spines, while third segment bears an uninterrupted row of spines. Anal somite and Fu are similar to that of male, just furcal rami are little shorter (about 2.3 times as long as wide). A1 is 8-segmented, with long aesthetasc on fourth segment, reaching beyond the top of the distal segment for more than a length of penultimate and terminal segments together (Fig. 16). All setae on A1 are naked. A2, Md, Mxl, Mx, Mxp, P1, P2 (Fig. 22), and ExpP3 (Fig. 20) are very similar to those of the male. Spine and setal formula on exo- and endopodites P1-P4 (legend: inner/outer spine or seta; inner/terminal/outer):

	Exp			Enp		
Segments	1	2	3	1	2	3
P1	0/1	1/1	0/2/2	1/0	1/0	1/2/0
P2	0/1	1/1	1/2/2	1/0	2/2/1	-
P3	0/1	1/1	2/2/2	1/0	3/2/1	-
P4	0/1	1/1	2/2/2	1/0	2/2/0	-

Endopodite of P3 is 2-segmented, and bearing 1 seta on the first and 6 setae on the second segment (Fig. 20). Endopodite of P4 is also 2-segmented. Its terminal segment bears 4 setae of which two lateral are with cilia on the inner margin pasted together (Fig. 21). Basiendopodite of P5 is not protruding and bearing 4 very strong,

short setae. Exopodite small, subquadrangular, with two strong apical setae, and one thin seta on the inner margin (Fig. 17).

Variability: Distal endopodite article on male's P2 bears 5 setae on the one leg (Fig. 7), while the opposite leg bears 4 setae on that article (Fig. 5). Unfortunately, only one male and one female were found and examined.

Distribution: At present *Elaphoidella gordani* n. sp. is found only in two localities in south and central part of Montenegro. We suppose that it inhabits wide area of south Dinaric Alps.

Etymology: The specific name is dedicated to Dr. Gordan S. KARAMAN, famous amphipodologist, as a friendly acknowledgment for the great help in crustacean taxonomy he gave to author.

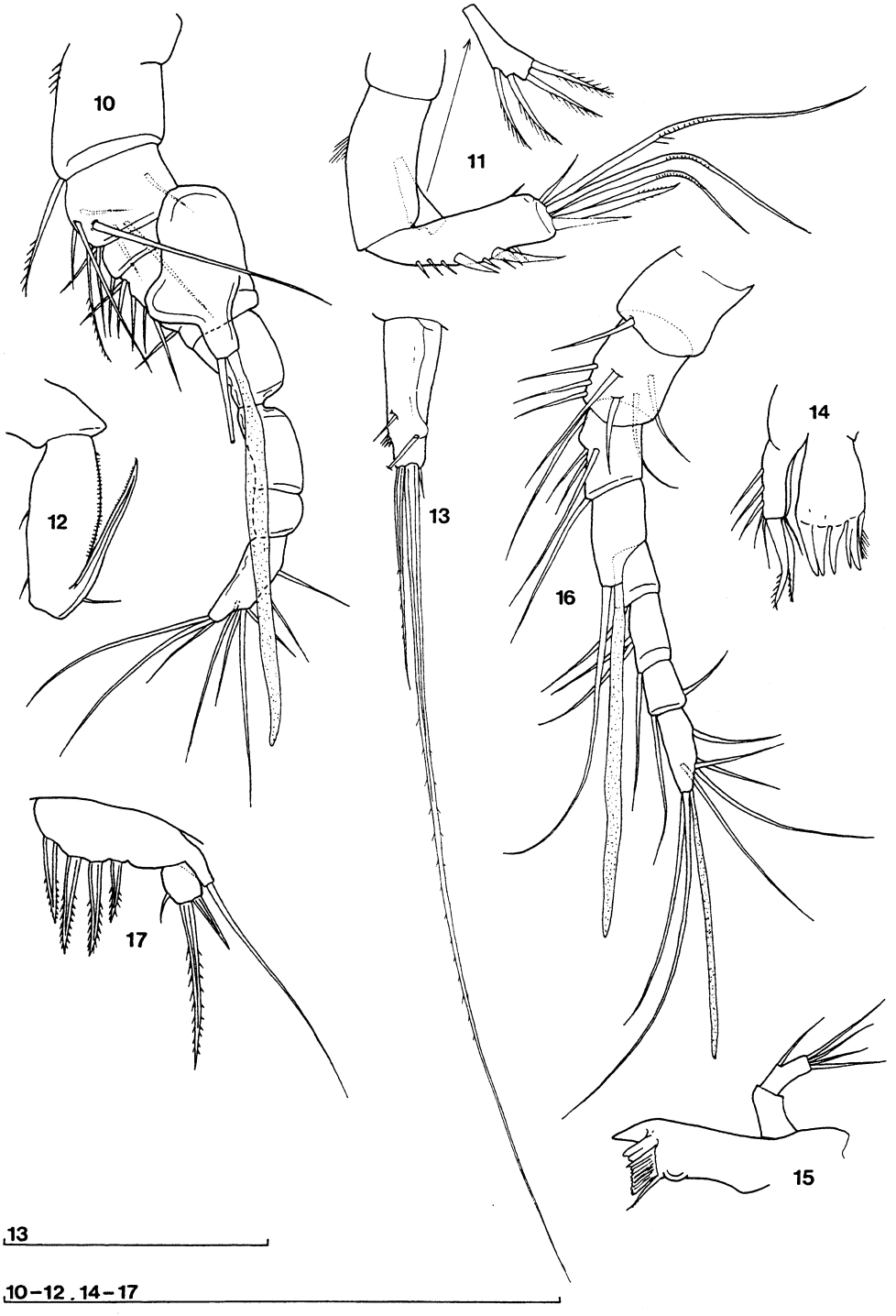

Fig. 10-17 - *Elaphoidella gordani* n. sp., 10-15: holotype (male, 0.52 mm); 16-17: female (0.481 mm). 10 = A1; 11 = A2; 12 = Mxp; 13 = Fu, dorsal view; 14 = Mxl; 15 = Md; 16 = A1; 17 = P5. Scales = 0,1 mm.

Remarks and affinities: By the shape of female's P5 and male's Exp3P4, *E. gordani* n. sp. fits well into III.("*jeanneli*")-group, in sense of the classification into groups of the genus *Elaphoidella*, which was created by LANG (1948), and supplemented by PETKOVSKI & BRANCELJ (1988). From all species in "*jeanneli*"-group, *E. gordani* is clearly distinguishable by the following characters: absence of distal lateral seta on Fu; presence of 4 setae (instead of 3) on the basiendopodite of the female's P5; only two appendages on the exopodite of the male's P5; and terminal endopodite article on the male's P4 is larger than first exopodite article of that leg. *E. franci* Petkovski, 1983, clearly differs from *E. gordani* also by the appearance of Fu, anal operculum, and male's EnpP4 and EnpP2. From *E. stammeri* Chappuis, 1936, the new species differs also by the shape of male's P6 and EnpP3. *E. jeanneli* Chappuis, 1928 (syn. *E. charon* Chappuis, 1936), differs from the new species also by the appearance of male's EnpP2, and they are the most similar species. *Elaphoidella ruffoi*

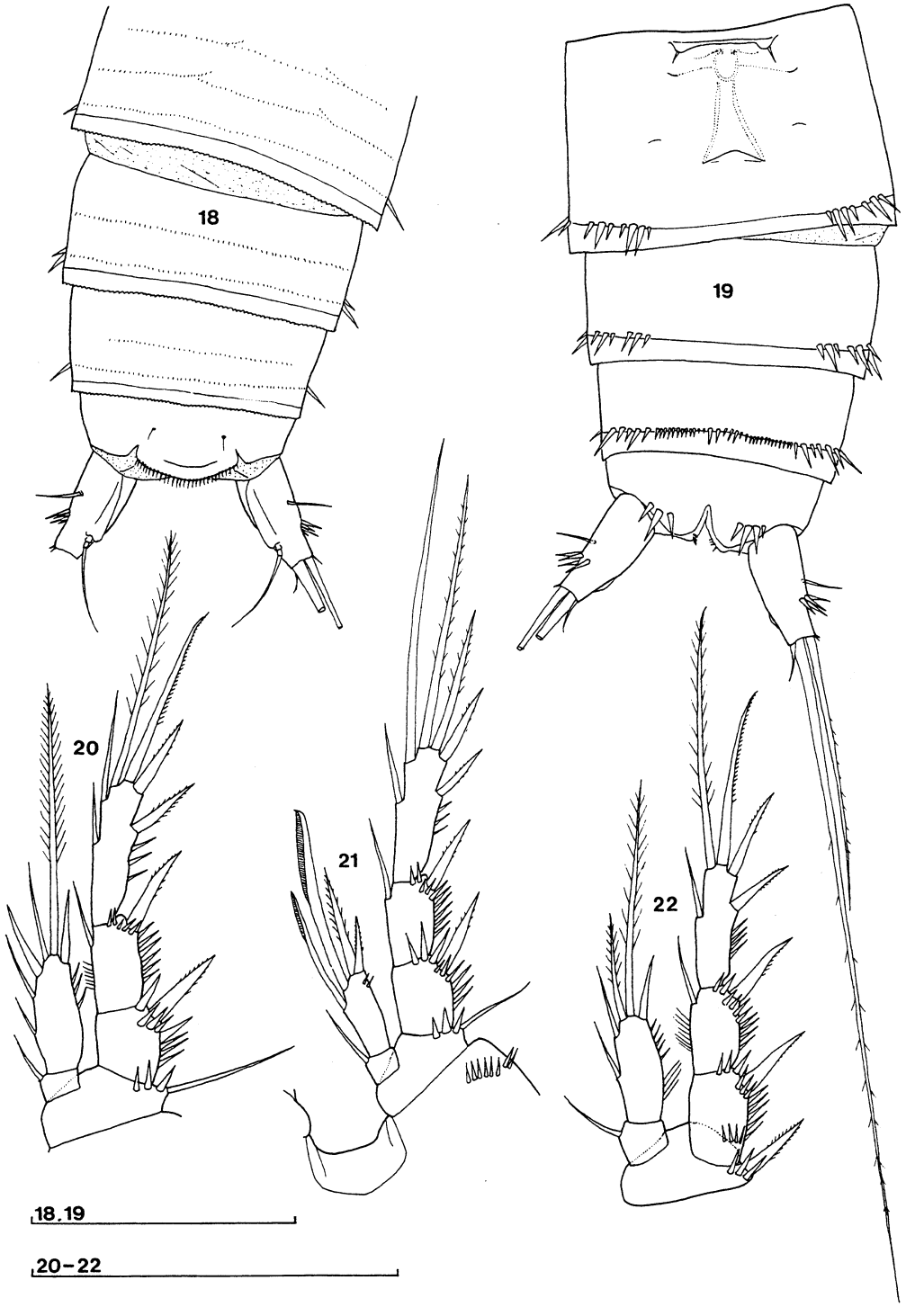

Fig. 18-22 - *Elaphoidella gordani* n. sp., female (0.481 mm). 18 = abdomen, dorsal view; 19 = abdomen, ventral view; 20 = P3; 21 = P4; 22 = P2. Scales = 0.1 mm.

Chappuis, 1953, was described and known only as a male, and it has completely fused exopodite and basipodite of P5. Many other species have some similarities with *E. gordani* n. sp., but they are easy distinguishable by many features. *E. plesai* Pesce & Galassi, 1994, which was described only after female from Austria, has similar shape of P1-P4 with the new species, but differs by the shape of P5, Fu, and Enp1P4. Absence of the distal lateral seta on Fu is also feature of *E. federicae* Pesce & Galassi, 1988, which was described from Corsica (France), but this species belongs to the I.("*similis*")-group. There is some similarities between the new species and *E. petrovae* Apostolov, 1986 (described only after female), especially on the shape of P1-P4, but they differs by the appearance of Fu and P5. Very stout spine and thin seta on the male's P5 has also *E. logifurcata* Chappuis & Kiefer, 1952, but in that species spine is on the inner side. It differs from the new species by many features.

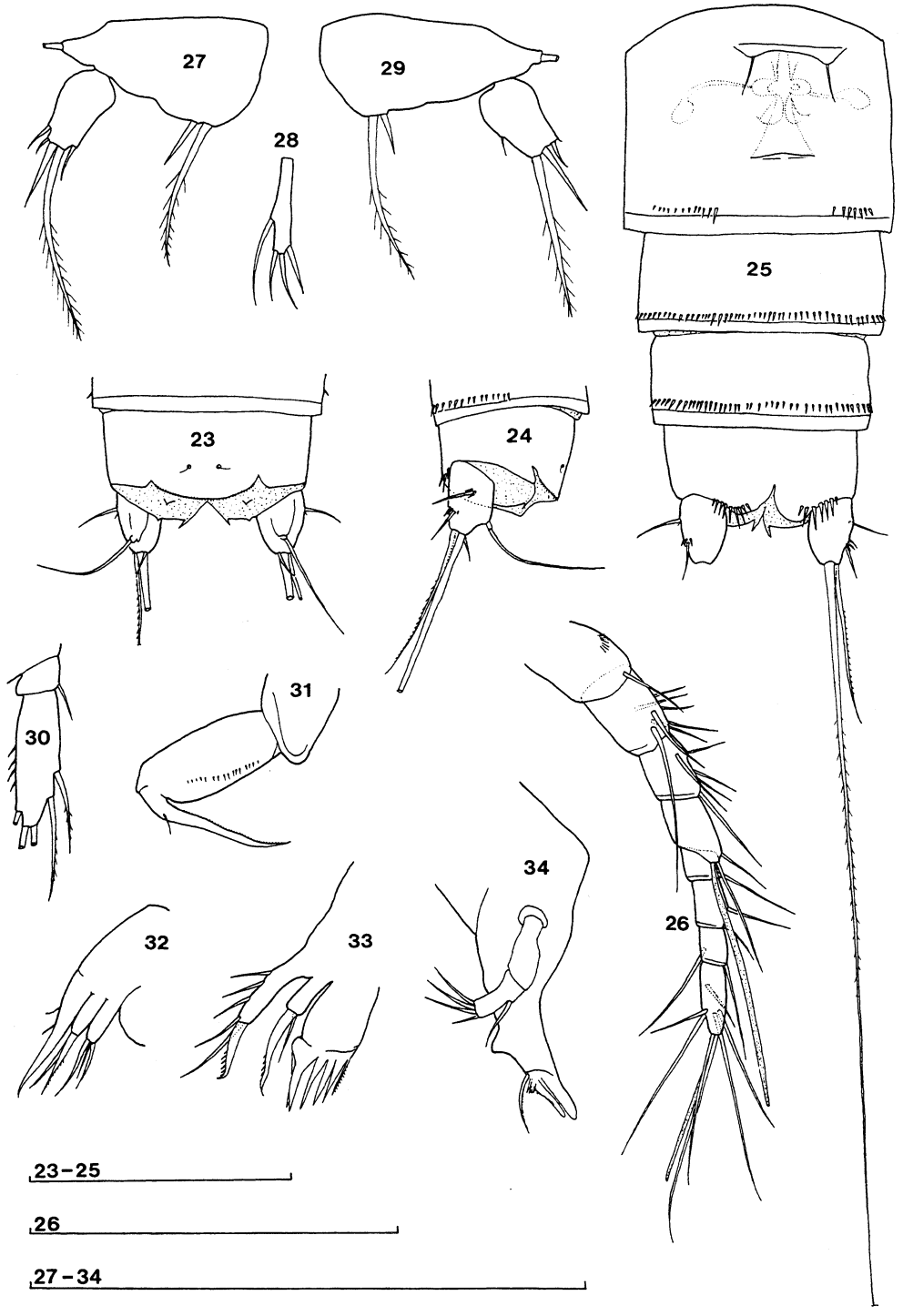

Fig. 23-34 - *Elaphoidella tenera* Chappuis, 1937, female (0.47 mm).23 = anal somite and Fu, dorsal view; 24 = anal somite and Fu, lateral view; 25 = abdomen, ventral view; 26 = A1; 27 = P5; 28 = ExpA2; 29 = P5; 30 = EnpP3; 31 = Mxp; 32 = Mx; 33 = Mxl; 34 = Md. Scales = 0.1 mm.

E. gordani n. sp. is the second species of the genus *Elaphoidella* from Montenegro. The first was *E. montenegrina* Karanovic, 1997, which was described from three caves in south part of Montenegro.

III. 2 - *Elaphoidella tenera* Chappuis, 1937

Synonymy: *Elaphoidella tenera* - CHAPPUIS, 1937, p. 515, Fig. 38-42; LANG, 1948, p. 1172, Fig. 464-4; BORUTZKY, 1952, p. 310, Fig. 85: 31-35; MIHAILOVA-NEIKOVA, 1975, p. 71.

Material examined: 1- One female (0.47 mm) from one well in village Zelenikovo near the twon Skopje, Macedonia, 5 May 1978, collected by Dr. Trajan K. Petkovski.

The specimen is completely dissected, mounted on slide in Faure's medium and deposited in the author's collection (No. 8/35/0603/b), at the Institute of Marine Biology, Kotor, Montenegro.

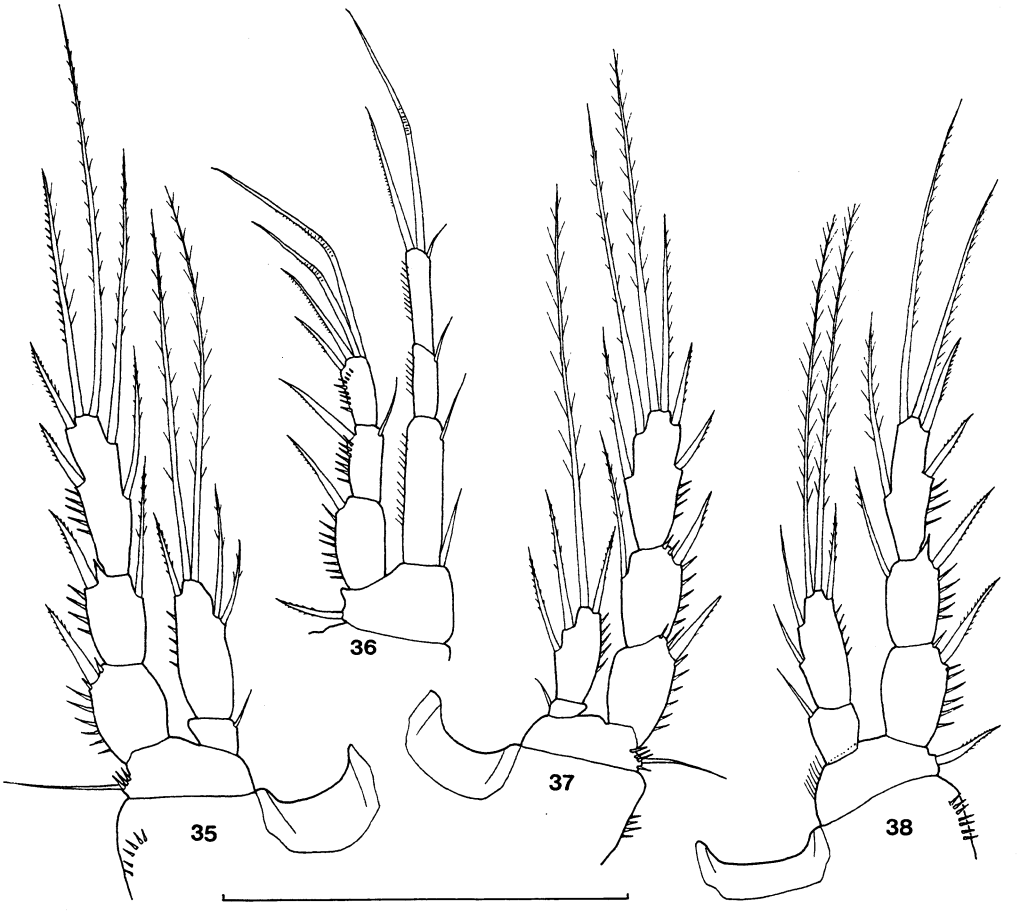

Fig. 35-38 - *Elaphoidella tenera* Chappuis, 1937, female (0.47 mm). 35 = P3; 36 = P1; 37 = P4; 38 = P2. Scale = 0.1 mm.

Description: **Female**. Body length, including furcal rami (but excluding furcal setae), is 0.47 mm. Body cylindrical, colourless and without nauplius eye. Hind margins of cephalothorax, thoracic somites, and all abdominal somites are smooth. Genital double-somite about 1.2 times wider than long, with interrupted row of small spines ventrally, and with characteristic genital field (Fig. 25). Second and third abdominal somites with uninterrupted rows of small spines. Anal somite with 7-9 spines at the base of the furcal rami (Fig. 25). Anal operculum concave, with many small spinules on its margin, and it does not reach beyond distal margin of anal somite (Fig. 23). Furcal rami short (about 1.4 times as long as wide), parallel, and with complete armature (2 lateral, 3 apical, and 1 dorsal seta). Inner apical seta is minute, and it is moved somewhat to the dorsal side (Fig. 23). Outer apical seta is somewhat moved to the ventral side, and longer than anal somite and caudal ramus together. Middle apical seta is longer than whole abdomen (Fig. 25). Dorsal seta is very long, while lateral setae are shorter than caudal ramus. A1 is 8-segmented, with all naked setae, and with aesthetasc on fourth segment, reaching beyond the top of the distal segment for more than a length of terminal segment (Fig. 26). Exopodite of A2 is 1-segmented, bearing 4 naked setae (Fig. 28). Md palp 2-segmented; first segment unarmed, second with one lateral and 4 apical naked setae (Fig. 34). Arithrie of praecoxa of Mxl with 5 naked spines and 1 plumose seta; coxa with 1 strong and 1 fine seta; basipodite with 2 distal and 4 lateral setae (Fig. 33). Syncoxa of Mx with 2 endites of which proximal one bears 3, while distal one bears 2 setae (Fig. 32). Basipodite of Mxp without seta on distal-inner corner (Fig. 31). All swimming legs with 3-segmented exopodites, as well as endopodite of P1 (Fig. 35, 36, 37, 38). Spine and setal formula on exo- and endopodites P1-P4:

	Exp			Enp		
Segments	1	2	3	1	2	3
P1	0/1	1/1	0/2/2	1/0	1/0	1/2/0
P2	0/1	1/1	1/2/2	1/0	2/2/1	-
P3	0/1	1/1	2/2/2	1/0	2/2/1	-
P4	0/1	1/1	2/2/2	1/0	2/1/1	-

Endopodite of P1 longer than the correspondig exopodite for the length of whole terminal article (Fig. 36). Intercoxal plates in all swimming legs are convex and smooth. Basiendopodite of P5 just a little protruding, bearing 2 setae, of which inner one is long and plumose, while outer is small and naked. Exopodite of that leg is about 1.5 times as long as wide, bearing 4 or 5 setae, of which only 2 are well-developed, while others are minute.

Male. Unknown.

Variability: Exopodite of P5 bearing 4 or 5 setae, and they are attached at different position (Fig. 28, 29). Lateral setae on the EnpP3 could be close to each other (Fig. 35) or between them could be some distance. Unfortunately, only one female was found and examined.

Distribution: At present *E. tenera* Chappuis, 1937, is found in two localities near the town Skopje (Macedonia), and in one locality in west part of Bulgaria.

Remarks and affinities: *E. tenera* Chappuis, 1937, was described from a single female from one well in Skopje (Macedonia). MIHAILOVA-NEIKOVA (1975) found this species (also only females) in west part of Bulgaria, but she did not give any descriptions, drawings or comments. The female that we described here differs from the original description as follows: basiendopodite of P5 with 2 setae; Enp1P4 with inner seta; and, maybe, the aesthetasc on the fourth segment of A1 is longer. By the shape of P1-P5, *E. tenera* is similar to the species from III.("*jeanneli*")-group, and LANG (1948) even classified it into this group, although male is unknown. From all species in that group, *E. tenera* is clearly distinguishable by the shape of Fu and P5. But, we must be careful with its classification into any group before males will be found, because there are species with similar shape P1-P4 that belongs to other groups. For exemple, *E. cavatica* Chappuis, 1957, belongs to V.("*phreatica*")-group, although it has P1-P4 and even P5 rather similar to *E. tenera*.

ABSTRACT

Two species of the genus *Elaphoidella* Chappuis, 1929 (Harpacticoida, Canthocamptidae), from Balkan Peninsula are presented. *E. gordani* n. sp. was collected in two caves in central and south part of Montenegro, and belongs to the "*jeanneli*"-group of species. *E. tenera* Chappuis, 1937, is herein redescribed after one female from Macedonia.

RESUME

Deux espèces du genre *Elaphoidella* Chappuis, 1929 (Harpacticoida, Canthocamptidae), de la Péninsule des Balkans sont étudiées. *E. gordani* n. sp. a été récoltée dans deux grottes du centre et du sud du Monténégro, et appartient au groupe des espèces "*jeanneli*". *E. tenera* Chappuis, 1937, est redécrite de Macédoine.

BIBLIOGRAPHY

APOSTOLOV, A. - 1985 - Étude sur quelques Copépodes Harpacticoides du genre *Elaphoidella* Chappuis, 1929, de Bulgarie, avec une révision du genre. **Acta Mus. Macedonici Sci. Nat.**, 17, 7, p. 133-163.

APOSTOLOV, A. - 1986 - Deux nouveaux Copépodes souterrains de Bulgarie (Crustacea, Harpacticoida). **Boll. Mus. Civ. Sct. Nat., Verona**, 13, p. 455-466.

APOSTOLOV, A. - 1991 - Les Harpacticoides (Copepoda) des eaux souterraines de Bulgarie. **Boll. Mus. Civ. Sct. Nat., Verona**, 15, p. 327-337.

BRANCELJ, A. - 1986 - Rare and lesser known harpacticoids (Copepoda, Harpacticoida) from the Postojna-Planina cave system (Slovenia). **Biol. Vestn.**, 34, 2, p. 13-35.

CHAPPUIS, P.-A. - 1924 - Descriptions préliminaires de Copépodes nouveaux de Serbie. **Bull. Soc. Sci. Cluj**, 2, p. 27-45.

CHAPPUIS, P.-A. - 1928 - Nouveaux Copépodes cavernicoles, descriptions préliminaires. **Bull. Soc. Sci. Cluj**, 4, p. 20-34.

CHAPPUIS, P.-A. - 1929 - Révision du genre *Canthocamptus* Westood (Note préliminaire). **Bull. Soc. Sci. Cluj**, 4, 2, p. 41-50.

CHAPPUIS, P.-A. - 1936 - Über Höhlencopepoden. **Bull. Soc. Sci. Cluj**, 8, p. 321-334.

CHAPPUIS, P.-A. - 1937 - Weitere subterrane Harpacticoiden aus Jugoslavien. **Bull. Soc. Sci. Cluj**, 8, p. 503-532.

CHAPPUIS, P.-A. - 1953 - Nouveaux Crustacés troglobies de l'Italie du Nord. **Mem. Mus. Civ. St. Nat. Verona**, 4, p. 1-12.

CHAPPUIS, P.-A. - 1957 - Notes sur les Copépodes, 24. - Une *Elaphoidella* d'une grotte du département de l'Ain. **Notes Biospéol.**, 12, p. 45-48.

CHAPPUIS, P.-A. and F. KIEFER - 1952 - Copépodes cavernicoles des Pyrénées. **Notes Biospéol.**, 7, p. 113-131.

GAVIRIA, S. - 1993 - Zwei Canthocamptidae (Copepoda, Harpacticoida) aus kolumbianischen Andengewässern. **Ann. Naturhist. Mus. Wien**, 94-95, p. 361-375.

HAMOND, R. - 1988 - Non-marine harpacticoid copepods of Australia, I. Canthocamptidae of the genus *Canthocamptus* Westwood s. lat. and *Fibulacamptus*, gen. nov., and including the description of a related new species of *Canthocamptus* from New Caledonia. **Invert. Taxon.**, 1, 8, p. 1023-1247.

KARANOVIC, T. - 1997 - Two new species of harpacticoid copepods (Copepoda, Harpacticoida, Canthocamptidae) from Montenegro (Balkan Peninsula). **Bull. Zool. Mus. Univ. Amsterdam**, 16, 1, p. 1-9.

LANG, K. - 1948 - *Monographie der Harpacticiden*. Stockhlom-Lund, 1683 pp.

MIHAILOVA-NEIKOVA, M. - 1975 - Contribution to the Study of Harpacticoida (Copepoda, Crustacea) of Carstic Sources Near the Village of Bankya, Trun District (West Bulgaria). **Hydrobiol. Sofia**, 2, p. 66-80.

PESCE, G. L. and D. P. GALASSI - 1988 - *Elaphoidella federicae* spec. nov., a new harpacticoid copepod from phreatic waters of Corsica (Crustacea Harpacticoida: Canthocamptidae). **Stygologia**, 4, 3, p. 262-266.

PESCE, G. L. and D. P. GALASSI - 1994 - *Elaphoidella plesai* n. sp., from ground waters of Austria (Copepoda Harpacticoida: Canthocamptidae). **Ann. Limnol.**, 30, 2, p. 91-94.

PETKOVSKI, T. K. - 1976 - Drei neue *Nitocrella* Arten von Kuba, zugleich eine Revision des Genus *Nitocrella* Chappuis (s. restr.) (Crustacea Copepoda, Ameiridae). **Acta Mus. Macedonici Sci. Nat.**, 15, 1, p. 1-26.

PETKOVSKI, T. K. - 1983 - Neue höhlenbewohnende Harpacticoida (Crustacea, Copepoda) aus Slovenien. **Acta Mus. Macedonici Sci. Nat.**, 16, 6, p. 177-205.

PETKOVSKI, T. K. - 1984 - Neue und seltene Copepoden (Crustacea) aus Jugoslawien. **Acta Mus. Macedonici Sci. Nat.**, 17, 6, p. 135-164.

PETKOVSKI, T. K. and A. BRANCELJ - 1985 - Zur Copepodenfauna (Crustacea) der Grotten Skocjanske Jame in Slowenien. **Acta Mus. Macedonici Sci. Nat.**, 18, 1, p. 1-25.

PETKOVSKI, T. K. and A. BRANCELJ - 1988 - *Elaphoidella serbica* n. sp., ein neuer Harpacticoide aus Ostserbien (Crustacea, Copepoda). **Fragmenta Balcanica, Mus. Macedonici Sci. Nat.**, 14, 6, p. 47-58.

REID, J. W. - 1990 - *Canthocamptus* (*Elaphoidella*) *striblingi*, new species (Copepoda: Harpacticoida) from Costa Rica. **Proc. Biol. Soc. Wash.**, 103, 2, p. 336-340.

REID, J. W. and T. ISHIDA - 1993 - New species and new records of the genus *Elaphoidella* (Crustacea: Copepoda: Harpacticoida) from the United States. **Proc. Biol. Soc. Wash.**, 106, 1, p. 137-146.

ROUCH, R. - 1988 - *Elaphoidella boui* n. sp., Copépode Harpacticoide stygobie du Sud-Ouest du Massif Central. **Ann. Limnol.**, 24, 2, p. 131-137.

STAMMER, H. J. - 1931 - Die Fauna des Timavo, Ein Beitrag zur Kenntnis der Höhlengewasser, des Süss- und Brackwassers im Karst. **Zool. Jahrb.**, 63, p. 521-655.