

On some *Niphargus* (*Orniphargus*) species (Crustacea, Gammaridea, fam. Niphargidae) from the Balkans (Contribution to the knowledge of the Amphipoda 278)

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Summary. Several taxa of the subgenus *Niphargus* (*Orniphargus*) (Amphipoda: Gammaridea, fam. Niphargidae) from the western Balkan are investigated. The very briefly described species *Niphargus* (*Orniphargus*) *pachytelson* Sket, 1960 is redescribed from the type locality “Jama pri Luknji” Cave near Novo Mesto, and Podpeška Jama Cave in Slovenia, and its relationship regarding *N. salonitanus* S. Karaman, 1950 and some other similar taxa is discussed. *Niphargus* (*Orniphargus*) *steueri subtypicus* Sket, 1960 is redescribed from the type-locality cave “Jama pri Stolbah” near Črnopolje, Slovenia and its relationship to *Niphargus jalzici* G. Karaman, 1989 and some other taxa is discussed. *Niphargus* (*Orniphargus*) *steueri kolombatovici* S. Karaman, 1950 is cited from new caves in Bosnia and Herzegovina. A key to the subspecies *Niphargus* (*Orniphargus*) *steueri* Schellenberg, 1935 is presented. *Niphargus* (*Orniphargus*) *arbiter* G. Karaman 1984 is discovered in new localities in Croatia and Bosnia and Herzegovina.

Keywords: Amphipoda, Balkan, *Niphargus* (*Orniphargus*) *pachytelson*, *steueri subtypicus*, *kolombatovici*, *arbiter*, taxonomy.

INTRODUCTION

Recently there has been a rise in more intensive research of subterranean Amphipoda fauna in the karstic region of the Western Balkans. This increase has been driven by various expeditions by several scientists (Karaman S., Sket B., Karaman G., Fišer C., Andreev S., etc.) and has led to the discovery of numerous new localities of already known taxa of the genus *Niphargus* Schiödte, 1849 (Amphipoda, Gammaridea, fam. Niphargidae), as well as new species and subspecies of this genus.

The increased number of discovered localities of each taxon shows the range of the variability of taxonomical characters for every taxon over the entire known distribution area, and the accumulation of certain taxonomic differences within populations of some parts of the area.

In fact, the taxonomy of genus *Niphargus* contains nu-

merous described subspecies, but almost always without known transitive populations which could suggest the subspecies status of this taxon. This has led to recent attempts by many scientists to use other characters (cytogenetic and DNA analyses, chromosomes, molecular analyses, anatomy, etc) to distinguish various taxonomic categories, especially species and subspecies.

During our recent investigations provided by the International speleo-diving expedition “Abys Kovači – Spring of Ričina 2014, organized by the Speleological Society „Mijatovi Dvori“ Tomislavgrad (Bosnia and Herzegovina), we visited several caves to collect Amphipoda.

The present study describes part of the material collected during this expedition in 2014, combined with additional material collected during previous expeditions since 2009.

In this work, we used classic morphological and eco-

logical methods to recognize single taxa, trying to re-describe poorly or incomplete existing descriptions of single taxa, such as *Niphargus (Orniphargus) pachytelson* and *N. steueri subtypicus*, as well as mentioning new localities for some taxa. Thus, the present study can provide a good base for further non morphological approaches to the taxonomy of genus *Niphargus*.

MATERIAL AND METHODS

All amphipod specimens were preserved in 70% ethanol, then dissected in a mixture of glycerin and water for study using a Wild M 20 stereomicroscope. Later dissected specimens were transferred on slides in Liquid of Faure for final preservation. An advantage of preservation in Faure liquid is the possibility of reanalyzing specimens. Samples preserved in Faure liquid can be re-dissolved in normal water, enabling reuse of dissected pieces for further studies.

Body length of the examined specimens was measured by tracing individual mid-trunk lengths (from the tip of the rostrum to the end of the telson). Dissected pieces were drawn using a camera lucida attachment and inked manually. Some morphological terminology and seta formulae follow Karaman's terminology (G. Karaman, 1969; 1993; 2012).

Material used in the present study were obtained from our personal investigations, and include specimens from the following collections: S. Karaman's Collection; samples collected by B. Sket from Ljubljana; samples collected by R. Ozimec and B. Jalžić from Zagreb; T. Rađa's collection from Split; and samples collected by F. Stoch from L' Aquila, Italy. All studies in this work are based on classic morphological, ecological and zoogeographical studies.

TAXONOMICAL PART

Family Niphargidae

Niphargus (Orniphargus) pachytelson Sket, 1960

(Figs 1-4)

Niphargus (Orniphargus) croaticus pachytelson Sket, 1960: 75, Fig. 5;

Niphargus croaticus pachytelson G. Karaman, 1972: 5; G. Karaman, 1974: 17; Barnard JL and Barnard CM 1983: 690; G. Karaman and Ruffo, 1986: 524;

Niphargus pachytelson Fišer et al., 2006: 2012.

Material examined

Slovenia:

- Jama pri Luknji Cave near Novo Mesto, 1960, 3 spec. (holotype and paratypes) (leg. B. Sket);
- AMD/00339- Podpeška Jama Cave (S. 17), Videm,

Grosuplje, SE. of Ljubljana, 9.7.1984, was intermixed with *N. longiflagellum* (leg. F. Stoch);

- AMD 00643- Podpeška Jama Cave (S. 17) ("torrente nel ramo di sinistra"), Podpeč, Dobropolje, Suha Krajina, 16.7. 1994, 1 exp. (=S-5269) intermixed with *Niphargus longiflagellum* S. Kar. (leg. F. Gasparo & F. Stoch);

- AMD/00644- ibid, 16.7.1994, 1 exp. intermixed with *Niphargus longiflagellum* (leg. F. Gasparo & F. Stoch);

- AMD/00641-Tatrc (S. 96), Potiskavec, Dobropolje, Suha Krajina, Slovenia, 16.7.1994, 1 exp. intermixed with *N. longiflagellum*. (leg. F. Gasparo & F. Stoch).

Description

Female 23.0 mm (Holotype). Body stout, metasomal segments 1-3 along dorsoposterior margin with row of setae only (spines absent).

Epimeral plate 1 quadrate, with marked ventroposterior corner with one strong spine-like seta, posterior margin of plate is convex, bearing nearly 9 short setae. Epimeral plates 2 and 3 slightly pointed, with sinusoid posterior margin bearing nearly 9 short setae; on the epimeral plate 2 are attached 3 subventral spines, on the epimeral plate 3 are attached 3 subventral spines (Fig. 1H).

Urosomal segment 1 with 3 spines on each dorsolateral side, urosomal segment 2 with 4 spines on each dorsolateral side, urosomal segment 3 naked. Urosomal segment 1 with one ventroposterior strong spine near basis of peduncle of uropod 1 (Fig. 1I).

Head with slightly convex dorsal surface (in lateral projection), lateral cephalic lobes short, subrounded, eyes absent.

Antenna 1 long, peduncle moderately slender, peduncular articles 1-3 of unequal length (ratio: 70:75:40) scarcely setose, spines absent (Fig. 1A); main flagellum with 49 articles (most of articles with 1 short aesthetasc each); accessory flagellum very short, 2-articulated, shorter than half of peduncular article 3 (Fig. 1A).

Antenna 2 slender, article 3 short, at ventral margin with distal bunch of setae nearly as long as diameter of article itself (Fig. 1B); peduncular articles 4 and 5 of equal length; along ventral margin with 4-5 bunches of long setae, along dorsal margin with several bunches of short setae (Fig. 1B), 2 single spines are attached on peduncular article 4; flagellum slender, longer than last peduncular article (ratio: 88:73), consisting of 17 articles scarcely setose (Fig. 1B); antennal gland cone short.

Labrum and labium well developed, normal.

Mandible: molar triturative, incisor toothed. Mandibular palpus article 1 smooth, palpus article 2 with 16 setae; palpus article 3 slightly longer than 2 (ratio: 56:42), subfal-ciform, with 26 D and 9 E setae; on outer face appear 9 A-setae attached in 2 bunches (7+2), on inner face 15 B-setae attached in 5 groups (3,4,3,2,3) (Fig. 1C).

Maxilla 1: inner plate with 3 setae, outer plate with 7 spines (all spines or only 6 spines with 1 lateral tooth each, 0-1 spine with 2 lateral teeth); palpus 2-articulated, not reaching tip of outer plate spines, distal article bearing 7 setae (Fig. 2A).

Maxilla 2: both plates with marginal setae only.

Maxilliped: inner plate short, with 4 distal spines; outer plate reaching nearly half of second palpus article and bearing distolateral row of spines; article 4 (dactylus) with 4 distal setae at inner margin and one median seta at outer margin (Fig. 1D), nail shorter than pedestal (Fig. 1D).

Coxae 1-4 slightly longer than broad, with short disto-marginal setae. Coxa 1 missing in female 21.0 mm [in female 19.0 mm hardly longer than broad, with subrounded, unproduced ventroanterior corner and straight anterior margin (Fig. 2I); Coxa 2 longer than broad (ratio: 56:46) with row of marginal setae (Fig. 2E). Coxa 3 slightly longer than broad (Fig. 1E). Coxa 4 longer than broad (ratio: 62:52), without distinct ventroposterior lobe (Fig. 1G). Coxa 5 broader than long (ratio: 74:50), with subrounded anterior lobe (Fig. 3A); Coxa 6 smaller than 5, broader than long (ratio: 57:39), with subrounded anterior lobe (Fig. 3C). Coxa 7 entire, broader than long (ratio: 51:26) (Fig. 3E).

Gnathopods 1-2 large, with article 6 larger than corresponding coxae. Gnathopod 1 is remarkably smaller than gnathopod 2, with article 2 bearing long setae along anterior and posterior margin (Fig. 2B); article 3 at posterior margin with 1 distal group of setae. Article 5 shorter than 6 (ratio: 33:44), along anterior margin with one distal bunch of setae (Fig. 2B). Article 6 (propodus) trapezoid, nearly as long as broad, with nearly 14 transverse rows of setae along posterior margin (Fig. 2C); palm convex, inclined over half of propodus-length, defined on outer face by strong corner S-spine accompanied laterally by 4 slender L-spines and 4 facial M-setae, on inner face by one short subcorner R-spine (Fig. 2D); dactylus reaching posterior margin of propodus, along outer margin with nearly 11 short single or paired setae (1-1-1-2-2-2-1-1) (Fig. 2C).

Gnathopod 2: article 3 with 1 group of posterior setae (Fig. 2E); article 5 shorter than article 6 (ratio: 45:62), along anterior margin with bunch of setae. Article 6 (propodus) trapezoid, broader than long (ratio: 115:103), along posterior margin with nearly 11 transverse groups of setae (Fig. 2F); palm inclined nearly 2/3 of propodus-length, convex, defined on outer face by 1 strong corner S-spine accompanied by 3 L-spines sitting behind S-spine and 4 facial M-setae, on inner face by 1 short subcorner R-spine (Fig. 2G). Dactylus not reaching completely posterior margin of propodus, along outer margin with 11 single or paired short setae (Fig. 2F).

Pereopods 3-4 similar to each other, relatively slender. Pereopod 3: articles 4-6 of unequal length (ratio: 55:41:43), article 4 along both margins with bunches of setae not exceeding the width of article itself (Fig. 1E), article 5 at posterior margin with short spines and single setae; article 6 at

posterior margin with 5-6 bunches of short spines and setae; dactylus strong, much shorter than article 6 (ratio: 23:43), at inner margin with one short spine near basis of the nail along outer margin with one median plumose seta; nail shorter than pedestal (ratio: 32:37) (Fig. 1F).

Pereopods 5-7 moderately long. Pereopod 5 is only slightly shorter than pereopods 6 and 7, article 2 longer than broad (ratio: 93:53), along anterior slightly convex margin with nearly 15 single or paired spine-like setae, along posterior poorly convex margin with nearly 14 setae, ventro-posterior lobe not distinctly developed (Fig. 3A). Articles 4-6 of unequal length (ratio: 63:78:81), along both margins with bunches of short spines (Fig. 3A); article 6 is slightly shorter than article 2 (ratio: 81:93). Dactylus is much shorter than article 6 (ratio: 23:81), strong, at inner margin with one short spine near basis of the nail, at outer margin with one median plumose seta; nail is shorter than peduncle (ratio: 29:37) (Fig. 3B).

Pereopod 6: article 2 remarkably longer than broad (ratio: 100:58), ventroanterior corner is not produced, anterior margin slightly convex bearing nearly 9 single or paired spine-like setae, posterior poorly convex margin with nearly 16 short setae, ventroposterior lobe is poorly marked (Fig. 3C); articles 4-6 of unequal length (ratio: 81:103:121); article 2 is shorter than article 6 (ratio: 100:121). Dactylus strong, much shorter than article 6 (ratio: 25:121), at inner margin with one short spine near basis of the nail, at outer margin with one median plumose seta; nail shorter than pedestal (ratio: 36:46) (Fig. 3D).

Pereopod 7: article 2 remarkably longer than broad (ratio: 100:55), along anterior slightly convex margin with 8 groups of single or paired spine-like setae, along posterior poorly convex margin with nearly 11 short setae; ventroanterior corner is not produced, ventroposterior lobe is poorly visible (Fig. 3E). Articles 4-6 of unequal length (ratio: 71:93:122), along both margins with bunches of short spines (Fig. 3E); article 2 slightly shorter than article 6 (ratio: 100:122). Dactylus strong, much shorter than article 6 (ratio: 35:122), at inner margin with one short spine near basis of the nail, at outer margin with one median plumose seta (Fig. 3F), nail shorter than pedestal (ratio: 35:52).

Pleopods 1-3 with 2 retinacula each. Peduncle of pleopods 1-2 almost naked; peduncle of pleopod 3 at anterior margin with 2 distal setae, along distal posterior margin with 2 pairs of short setae (Fig. 2H).

Uropod 1: peduncle with dorsoexternal and dorsointernal row of spines; rami nearly of equal length, with lateral and distal short spines, intermixed along margins with several simple short setae (Fig. 1I).

Uropod 2: inner ramus slightly longer than outer one, both with short lateral and distal spines (Fig. 1I).

Uropod 3 relatively short, peduncle poorly longer than broad, bearing median and distal bunches of spines (Fig. 4B). Inner ramus short, scale-like, with bunch of distal spines and

1 seta; Outer ramus 2-articulated: first article along outer margin with 5 bunches of spines, along inner margin with 9 bunches of spines accompanied usually with 1 long plumose seta (Fig. 4B); second article of outer ramus is much shorter than first one (ratio: 11:108), bearing several distal short simple setae.

Telson short, hardly broader than long (ratio: 68:65), incised nearly 2/3 of its length; each lobe is provided with 3 distal spines, one inner marginal and 1 facial spine; a pair of short plumose setae appears near the middle of each lobe (Fig. 4A).

Coxal gills ovoid, occur on mesosomal segments 2-6.

Oostegites broad, with long marginal setae, occur on mesosomal segments 2-5.

Males similar to females.

Variability

Female (ovigerous), 19 mm (Paratype). Metasomal segments 1-3 with dorsoposterior marginal setae only. Epimeral plates 2-3 slightly more pointed (Fig. 4D), with 3 subventral spines each, and bearing a row of short setae along posterior sinusoid margin.

Antenna 1 peduncular article 3 exceeding half of article 2 (ratio: 36:62).

Mandibular palp article 3 with 1 group of A-setae and 6 groups of B-setae.

Maxilla 1: inner plate with 2 setae, outer plate with 7 spines (6 spines with 1 lateral tooth, one spine with 2 teeth), palpus with 6 setae.

Maxilliped: inner plate with 4+1 spine, palpus article 4 along inner margin with 2 setae only, along outer margin with 2 median setae; outer plate reaching nearly half of second palpus article; dactylus (article 4) at inner margin with 2 setae near basis of the nail, along outer margin with 1-2 median setae.

Gnathopod 1 is remarkably smaller than 2. Gnathopod 1 propodus trapezoid, nearly as long as broad, along posterior margin with 16 transverse rows of setae; palm inclined nearly half of propodus-length, defined by 1 S-spine accompanied laterally by 4 slender L-spines and 3 facial setae, on inner face by 1 R-spine. Dactylus reaching posterior margin of propodus, along outer margin with 9 setae (1-1-1-3-2-1).

Gnathopod 2 propodus trapezoid, slightly broader than long (ratio: 94:87), bearing along posterior margin nearly 17 transverse rows of setae (Fig. 4C); palm convex, inclined slightly less than 2/3 of propodus-length, defined on outer face by 1 S-spine accompanied by 3 slender L-spines sitting behind S-spine, and 3 facial setae, on inner face by 1 short R-spine. Dactylus reaching posterior margin of propodus, along outer margin with row of 8 single median setae.

Pereopods 5-7 article 2 without ventroposterior lobe. Article 2 of pereopod 5 longer than broad (ratio: 83:53), an-

terior margin more convex in distal part (but not produced), bearing 8-9 single or paired short spines or spine-like setae, along posterior rather convex margin with 15 setae (Fig. 4E).

Article 2 of pereopod 6 longer than broad (ratio: 89:56), along anterior convex margin with 8 groups of spines and setae; posterior margin almost straight in the middle and provided with 14 setae (Fig. 4F).

Article 2 of pereopod 7 longer than broad (ratio: 87:54), along anterior convex margin with 7-8 single or paired slender spines, along posterior convex margin with 11 setae (Fig. 4G).

Inner ramus of uropod 1 with spines and 2-3 simple setae only, outer ramus with spines and 1 subdistal simple seta only. Telson nearly as long as broad, incised less than 2/3 of telson-length, each lobe with 3 distal spines, 1 outer marginal spine and 0-1 facial spine (Fig. 4H).

Female 20 mm. Telson is slightly longer than broad, each lobe with 3 distal and one outer marginal spine (Fig. 4I). Article 2 of pereopods 5-7 is slightly broad (but never as broad as that in *N. salonitanus*), with poorly marked ventroposterior lobe.

Remarks and affinity

Sket (1960) described this taxon under the name *Niphargus croaticus pachytelson*, n. ssp. Later G. Karaman (1984) removed the taxon *N. croaticus* (sensu auct.) to the new species, *N. arbiter* G. Kar., 1984. Fišer et al. (2006) elevated *pachytelson* to the rank of distinct species.

One more detailed comparison of specimens of *N. pachytelson* with those of *N. salonitanus* S. Karaman, 1950 from Dalmatia (from Split to Cavtat) showed large affinity between these two taxa through numerous characters.

Niphargus pachytelson from type-locality differs from *N. salonitanus* from type-locality by the slightly more narrowed article 2 of pereopods 5-7, which have a poorly developed or absent ventroposterior lobe, by rather shorter coxae, by the presence of several short simple setae on rami of uropods 1-2, by more unequal rami of uropod 2, by the scarcely shorter peduncular article 3 of antenna 1 and by a broader telson.

Specimens from Podpeška jama Cave (females 15-21.5 mm) possess a narrowed article 2 of pereopods 5-7, with a poorly marked ventroposterior lobe, rami of uropods 1-2 with single simple setae, outer ramus of uropod 2 reaching 3/4 of inner ramus, telson is distinctly longer than broad, bearing 0-1 inner marginal and 0-1 facial spine. Thus, the above mentioned morphological differences between both taxa, with the exception of geographical distances, remains very scarce, and further more detailed studies on new material of both taxa are necessary to determine the real relationship between *salonitanus* and *pachytelson*. However, based on geographical distances, *pachytelson* will likely remain a distinct taxon.

S. Karaman (1932, 1950a) mentioned *Niphargus orcinus*

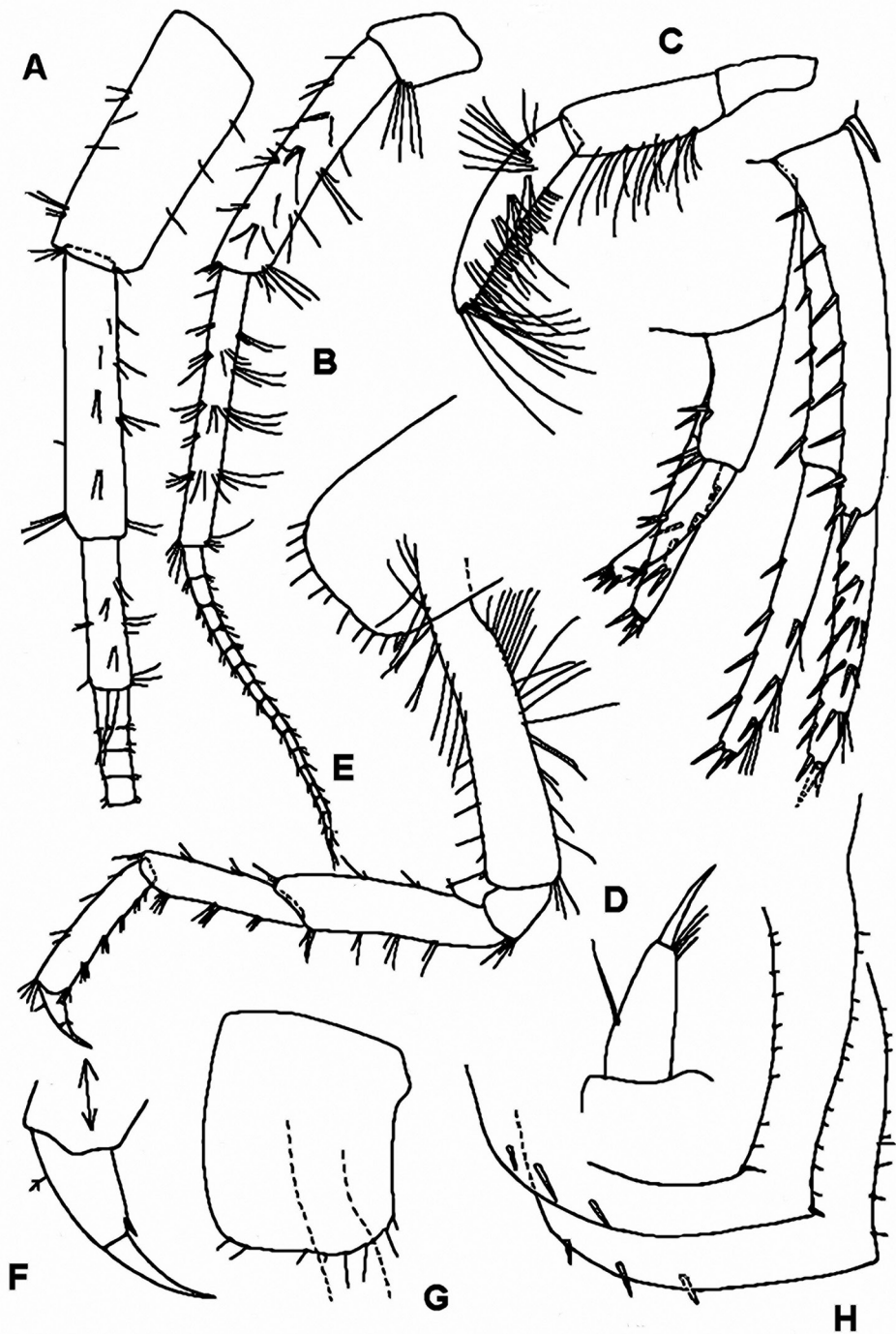


Fig. 1. *Niphargus pachytelson* Sket, 1960, "Jama pri Luknji" Cave near Novo Mesto, female 23.0 mm (holotype). **A**, antenna 1; **B**, antenna 2; **C**, mandible palpus; **D**, maxilliped palpus article 4; **E-F**, pereopod 3; **G**, coxa 4; **H**, epimeral plates 1-3; **I**, uropods 1-2.

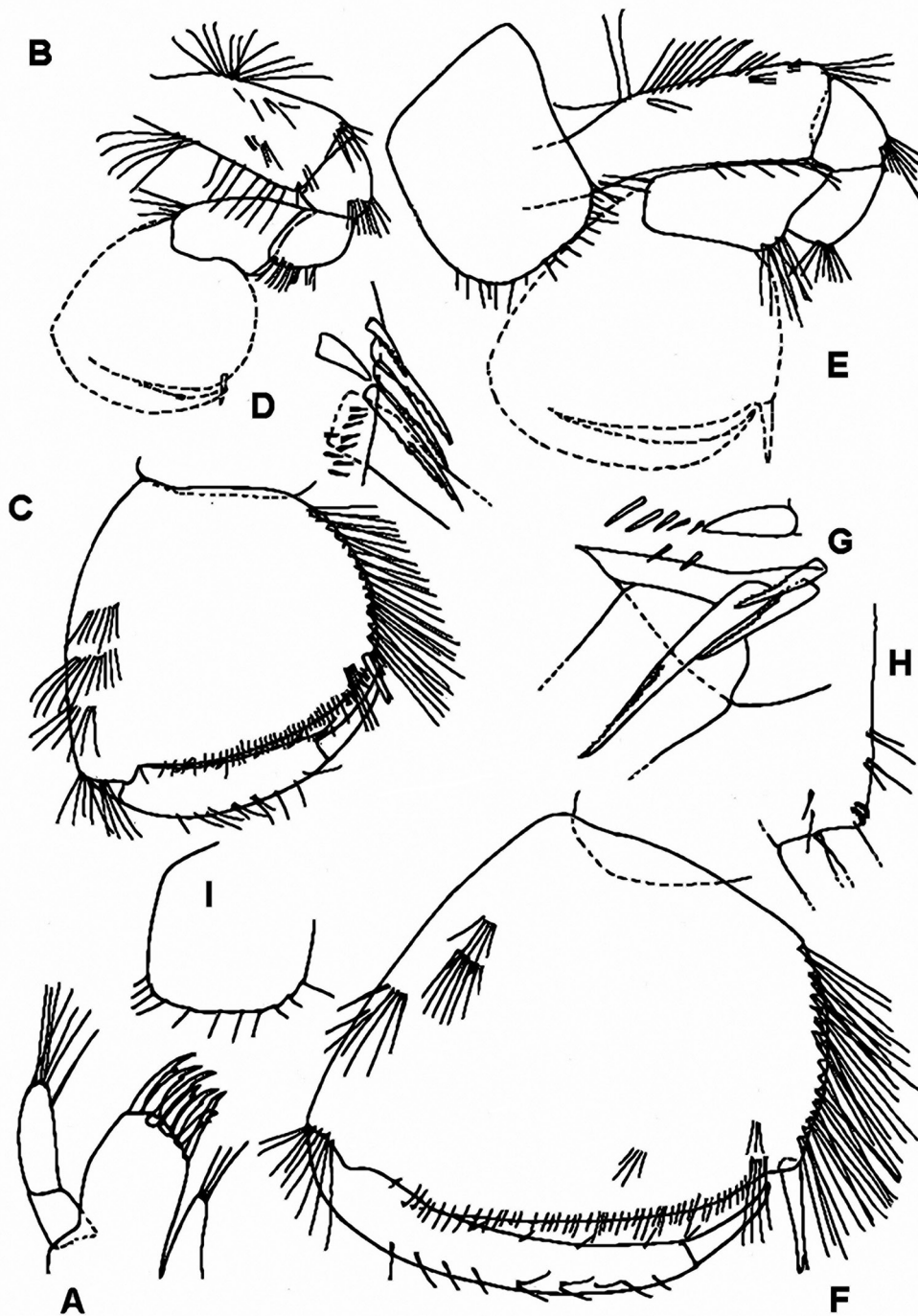


Fig. 2. *Niphargus pachytelson* Sket, 1960, "Jama pri Luknji" Cave near Novo Mesto, female 23.0 mm (holotype). **A**, maxilla 1; **B-C**, gnathopod 1; **D**, distal corner of gnathopod 1 propodus, inner face; **E-F**, gnathopod 2; **G**, distal tip of gnathopod 2 propodus, inner face; **H**, peduncle of pleopod 3; **I**, coxa 1, female 10.0 mm (paratype).

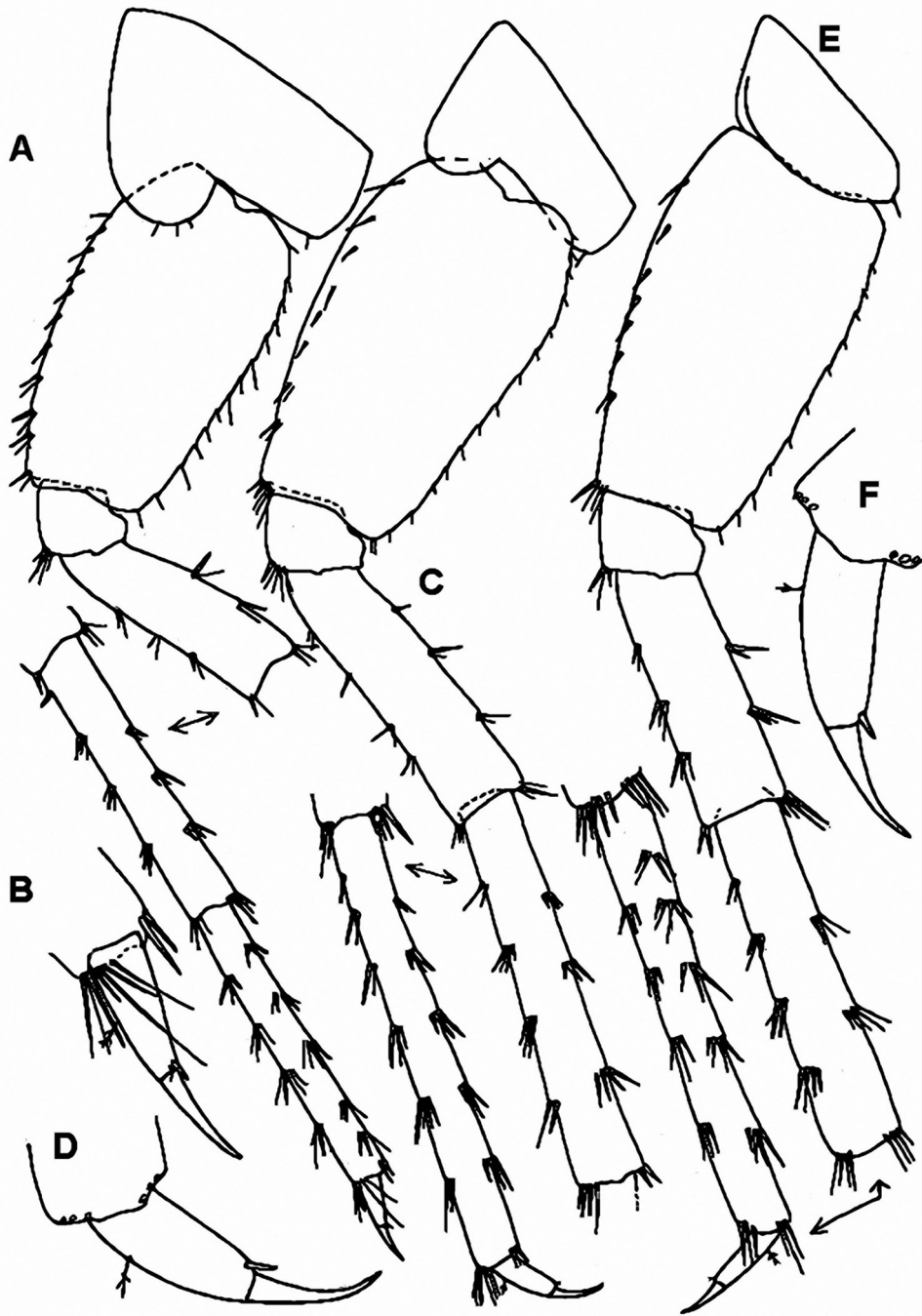


Fig. 3. *Niphargus pachytelson* Sket, 1960, "Jama pri Luknji" Cave near Novo Mesto, female 23.0 mm (holotype). **A-B**, pereopod 5; **C-D**, pereopod 6; **E-F**, pereopod 7.

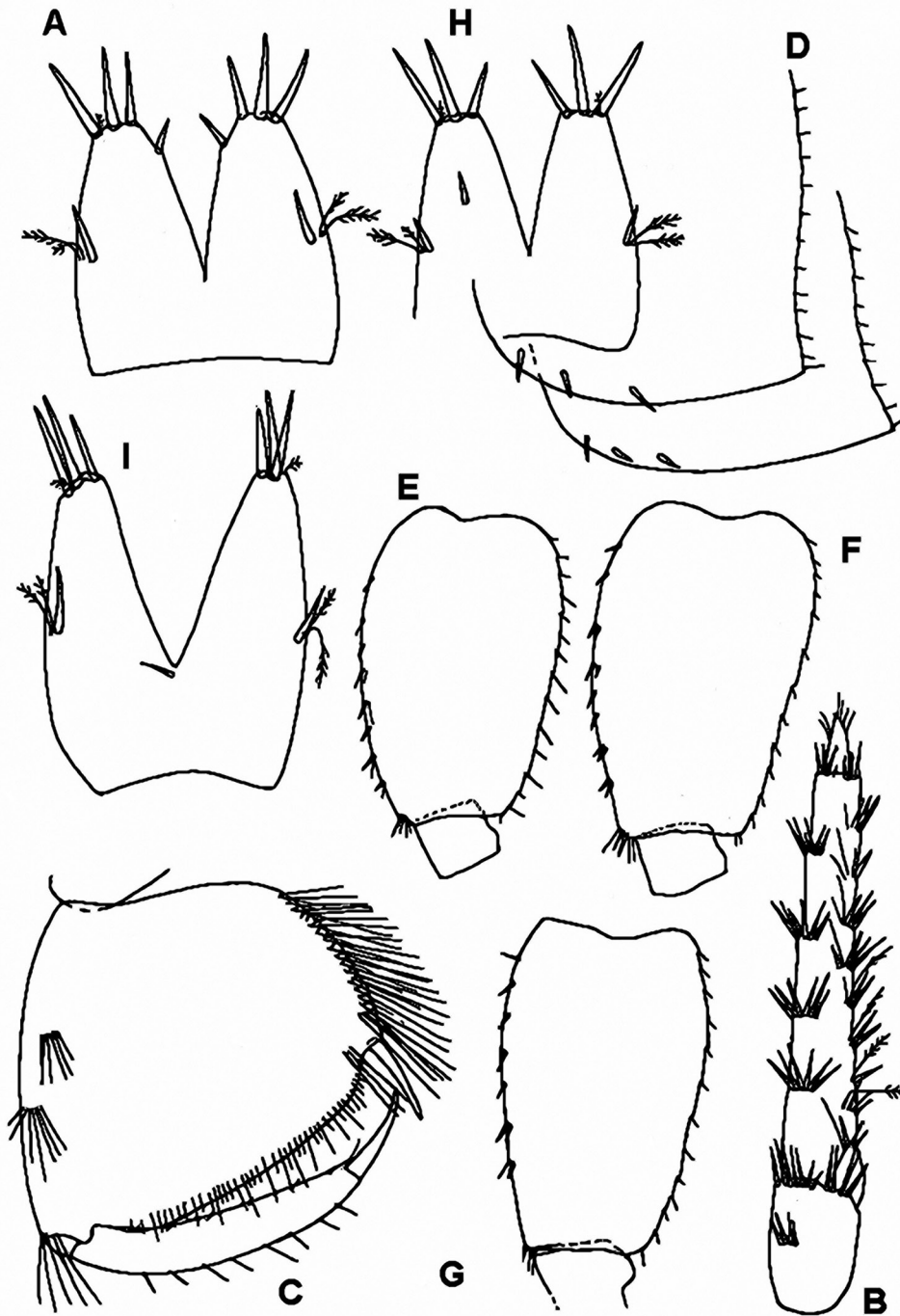


Fig. 4. *Niphargus pachytelson* Sket, 1960, "Jama pri Luknji" Cave near Novo Mesto, female 23.0 mm (holotype). **A**, telson; **B**, uropod 3; Female 19.0 mm (paratype). **C**, gnathopod 2 propodus; **D**, epimeral plates 2-3; **E**, pereopod 5 basipodit; **F**, pereopod 6 basipodit; **G**, pereopod 7 basipodit; **H**, telson; **I**, telson, female 20.0 mm.

Joseph, 1882 for the same cave, but *N. orcinus* differs from *N. pachytelson* by a different position of the corner palmar L-spines on gnathopod 2, by absence of lateral and facial spines on the telson, the presence of posterior marginal spines on metasomal segments 1-3, by strongly produced epimeral plates 1-3, etc.

Niphargus arbiter G. Karaman, 1984 known from Croatia, is also rather similar to *N. pachytelson*, but *N. arbiter* differs from *pachytelson* by more acute coxa 1, a slightly longer third peduncular article of antenna 1, a stronger ventroposterior lobe on article 2 of pereopods 5-7, and a more spinose telson, etc.

Locus typicus. “Jama pri Luknji” Cave near Novo Mesto, Slovenia.

Localities cited. Slovenia: Jama pri Luknji Cave near Novo Mesto (Sket 1960; Fišer et al. 2006; present work); Podpeška jama-Cave near Grosuplje, SE of Ljubljana (Fišer et al. 2006; present work); Tatrca Cave, Potiskavec, Dobropolje (present work).

Ecology. *Niphargus pachytelson* was found in the caves, accompanied by *Niphargus longiflagellum* S. Kar., 1950 and *N. steueri subtypicus* Sket, 1960.

***Niphargus* (*Orniphargus*) *steueri subtypicus* Sket, 1960**
(Figs 5-8)

Niphargus (*Orniphargus*) *kolombatovici subtypicus* Sket, 1960: 73, Fig. 4;

Niphargus kolombatovici subtypicus G. Karaman, 1974: 20;

Niphargus steueri subtypicus G. Karaman & Ruffo, 1986: 532; Fišer et al., 2006: 2312; Fišer et al., 2007: 303, figs. 1, 2Su, 3Su, 4Su, 5Su, 6Su, 7Su.

?*Niphargus jalzici* (part., Podpeška Jama) G. Karaman, 1998: 37.

Material examined

Slovenia:

- Jama pri Stolbah Cave near Črnomelj No. 397, (data?), several paratypes (leg. B. Sket);

- AMD/ 00649- Lukanjska Jama Cave or “Vodna Jama pod Gradom Luknja” (S. 575), Prečna, W. of Novo Mesto, July 12, 1994, 4 exp. (leg. F. Gasparo and F. Stoch).

Description

Male 11.0 mm (Jama pri Stolbah Cave): Mesosomal segments smooth; metasomal segments 1-3 with row of numerous dorsoposterior marginal spines intermixed with several single setae (Fig. 5H). Epimeral plates 1-3 with strongly produced and pointed ventroposterior corner and concave

posterior margin bearing 9-12 setae; epimeral plates 2-3 with 3-4 subventral spines each (Fig. 5H).

Urosome not laterally compressed. Urosomal segment 1 on each dorsolateral side with 4 strong spines (Fig. 5F); urosomal segment 2 on each dorsolateral side with 4 strong spines; urosomal segment 3 naked (Fig. 5F).

Urosomal segment 1 on each side with 1 strong ventroposterior spine near basis of uropod 1 peduncle (Fig. 5F).

Head slightly convex dorsally (in lateral projection), rostrum short, lateral cephalic lobes short and subrounded, ventroanterior sinus well developed, and eyes absent (Fig. 6A).

Antenna 1 long, slightly shorter than body (ratio: 90:110); peduncular articles 1-3 stout and short, progressively shorter towards article 3 (ratio: 74:59:36), articles 1 and 2 with several short facial spines each (Fig. 5A); peduncular article 3 with 1 facial spine and several short setae. Main flagellum consisting of nearly 50 articles (most of them with one short aesthetasc each) (Fig. 5B), accessory flagellum short, 2-articulated, slightly exceeding half of last peduncular article (ratio: 35:60) (Fig. 5A).

Antenna 2 slender, with long peduncle and short flagellum. Peduncular article 3 almost quadrate, with distal short spines and simple setae; peduncular article 4 shorter than article 5 (ratio: 65:91), with several single short setae and several short facial spines (Fig. 5C); peduncular article 5 slender, with numerous short single or paired setae (the longest setae reaching or slightly exceeding the width of the article itself). Flagellum much shorter than last peduncular article (ratio: 40:91), consisting of 7 stout articles scarcely setose. Antennal gland cone short (Fig. 5C).

Labrum entire, emarginated. Labium with entire outer lobes.

Mandible: molar triturative, Left mandible: incisor with 5 teeth, lacinia mobilis with 4 teeth; Right mandible: incisor with 4 teeth, lacinia mobilis with row of unequal small teeth. Mandibular palpus strong, 3-articulated: first article short and smooth; second article with nearly 18 setae; third article longer than second one (ratio: 54:43), falciform, provided with nearly 23 D setae and 7 E setae, on outer face appears one group of 5 A-setae, on inner face are implanted 4-5 groups of B-setae (2-3-3-2) (Fig. 6B).

Maxilla 1: inner plate with 1-2 setae; outer plate with 7 spines (4 spines with 1 lateral tooth, 2 spines with 2 teeth, 1 spine with 3-4 teeth); palpus 2-articulated, exceeding basis of outer plate spines and provided with 11 distal setae (Fig. 5D).

Maxilla 2: both plates with marginal setae only.

Maxilliped: inner plate short, not reaching outer tip of first palpus article, bearing 4 distal spines; outer plate not exceeding half of second palpus article and provided with row of distolateral smooth spines (Fig. 8C); palpus article 3 at outer margin with 2 bunches of setae; article 4 (dactylus) at inner margin with 4 single setae, at outer margin with one median group of 4 setae; nail much shorter than pedestal (Fig. 8B).

Coxae 1-4 with contiguous row of ventral marginal short setae. Coxa 1 longer than broad (ratio: 50:32), strongly produced ventroanteriorly into pointed tip, having concave anterior margin (Fig. 6C). Coxa 2 much longer than broad (ratio: 60:38) (Fig. 6F); coxa 3 longer than broad (ratio: 70:36) (Fig. 7A); Coxa 4 with subangular ventroposterior dilatation, longer than broad (ratio: 66:48) (Fig. 7C). Coxa 5 distinctly shorter than 4, much broader than long (high) (ratio: 53:32), with short subrounded anterior lobe (Fig. 7E). Coxa 6 bilobed, broader than long (ratio: 39:30), with short subrounded anterior lobe and nearly subrounded posterior lobe (Fig. 7G); coxa 7 entire, much broader than long (ratio: 38:20) (Fig. 7I).

Gnathopods 1-2 moderately large, of nearly subequal size, having article 6 nearly as long as the corresponding coxa. Gnathopod 1: articles 3-4 with one group of posterior marginal setae; article 5 shorter than 6 (ratio: 39:56), along anterior margin with one distal bunch of setae (Fig. 6C). Propodus (article 6) trapezoid, longer than broad (ratio: 97:75), along posterior margin with 8 transverse rows of setae (Fig. 6D); palm convex, inclined slightly over half of propodus length, defined on outer face by 1 corner S-spine accompanied closely laterally by 3 slender L-spines and 3 facial M-setae, on inner face by one short sub corner R-spine (Fig. 6E); dactylus exceeding width of propodus, bearing along outer margin a row of nearly 12 single and paired setae (Fig. 6D).

Gnathopod 2: articles 3-4 at posterior margin with one group of setae; segment 5 shorter than 6 (ratio: 43:50), along anterior margin with one median seta and one bunch of distal setae (Fig. 6F). Propodus similar to that of gnathopod 1, trapezoid, longer than broad (ratio: 85:75), along posterior margin with 10 transverse rows of setae (Fig. 6G); palm convex, inclined slightly over half of propodus-length, defined on outer face by one corner S-spine accompanied closely laterally 2-3 slender L-spines and 3 long facial M-setae (Fig. 6H). Dactylus exceeding width of propodus, bearing along outer margin a row of 11 single or paired setae (Fig. 6G).

Pereopods 3-4 relatively slender, scarcely setose except article 2 (Fig. 7A). Pereopod 3: articles 4-6 of unequal length (ratio: 58:34:45) (Fig. 7A); dactylus moderately slender, much shorter than article 6 (ratio: 23:45), along inner margin with one seta near basis of the nail, along outer margin with one median plumose seta; nail slightly shorter than pedestal (ratio: 30:35) (Fig. 7B).

Pereopod 4 like pereopod 3, dactylus at inner margin with one seta near basis of the nail, at outer margin with one median plumose seta (Fig. 7D), nail slightly shorter than pedestal (ratio: 30:35).

Pereopods 5-7 moderately long, pereopod 5 distinctly shorter than pereopods 6-7. Pereopod 5: article 2 ovoid, almost twice as long as broad (ratio: 87:45), with anterior convex margin with nearly 12 single or paired short spines, ventroanterior corner produced into a distinct short lobe (Fig. 7E); posterior margin slightly convex, with row of nearly 13

short setae; ventroposterior corner of article 2 is narrowed, without lobe. Article 4-6 slender, of unequal length (ratio: 31:63:67), articles along both margins with bunches of short spines and some distal setae (Fig. 7E). Article 2 is longer than article 6 (ratio: 87:67). Dactylus relatively slender, much shorter than article 6 (ratio: 20:67), along inner margin with one seta near basis of the nail, along outer margin with one median plumose seta; nail is shorter than pedestal (ratio: 28:36) (Fig. 7F).

Pereopod 6: article 2 nearly ovoid, much longer than broad (ratio: 93:50), along anterior convex margin with nearly 10 single or bunches of short spines, ventroanterior corner remarkably convex but not lobed (Fig. 7G); posterior convex margin of article 2 is provided with row of nearly 15 short setae. Articles 4-6 of unequal length (ratio: 40:82:98), bearing along both margins with bunches of short spines (Fig. 7G). Article 2 is shorter than article 6 (ratio: 93:98). Dactylus relatively slender, much shorter than article 6 (ratio: 28:98), along inner margin with one seta near basis of the nail, at outer margin with one median plumose seta (Fig. 7H), nail is shorter than pedestal (ratio: 32:58).

Pereopod 7: article 2 ovoid, much longer than broad (ratio: 93:56), without ventroanterior and ventroposterior lobe, along anterior convex margin with nearly 10 single or bunches of short spines (Fig. 7I), along posterior convex margin with nearly 12-13 short setae. Articles 4-6 of unequal length (ratio: 42:67:111), along both margins with bunches of short spines (Fig. 7I). Article 2 is shorter than article 6 (ratio: 93:111). Dactyls much shorter than article 6 (ratio: 31:111), along inner margin with one seta near basis of the nail, along outer margin with one median plumose seta; nail is shorter than pedestal (ratio: 37:58) (Fig. 7J).

Pleopods 1-3 with 2 retinacula each; peduncle of pleopod 3 along posterior margin with row of 5-6 setae (Fig. 5E).

Uropod 1: peduncle longer than rami, bearing dorsoexternal and dorsointernal row of spines; rami subequal, with lateral and distal bunches of short spines and single simple setae, plumose setae absent (Fig. 5F).

Uropod 2: rami subequal, with bunches of short lateral and distal spines, plumose setae absent (Fig. 5F).

Uropod 3 relatively short and stout; peduncle with several distal strong spines (Fig. 5G); inner ramus scale-like, with 1-2 distal spines and seta. Outer ramus 2-articulated: first article stout, along inner margin with 4 bunches of strong spine accompanied by single long plumose setae (Fig. 5G), along outer margin with 4 strong bunches of spines; second article very short, shorter than width of article 1, bearing 2-3 simple short setae (Fig. 5G).

Telson slightly longer than broad (ratio: 77:64, incised less than 2/3 of its length; each lobe provided with 3 distal and 0-1 inner marginal spines; a pair of moderately long plumose setae is attached near the middle of each lobe (Fig. 8A).

Coxal gills ovoid, occur on mesosomal segments 2-6.

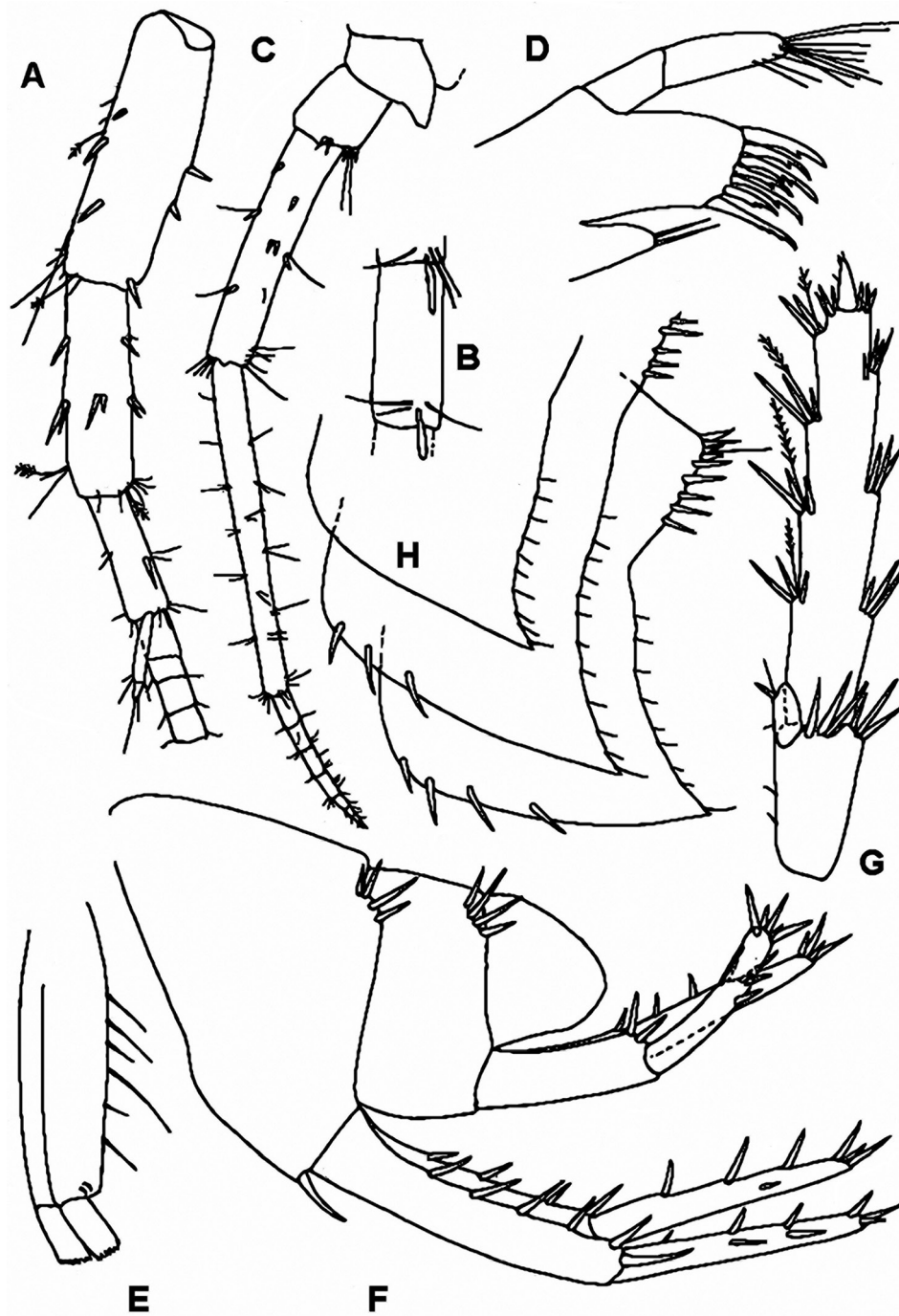


Fig. 5. *Niphargus steueri subtypicus* Sket 1960, "Jama pri Stolbah" Cave, Černomelj, male 11.0 mm (paratype). **A**, antenna 1; **B**, aesthetasc on antenna 1; **C**, antenna 2; **D**, maxilla 1; **E**, peduncle of pleopod 3; **F**, urosome with uropods 1-2; **G**, uropod 3; **H**, epimeral plates 1-3.

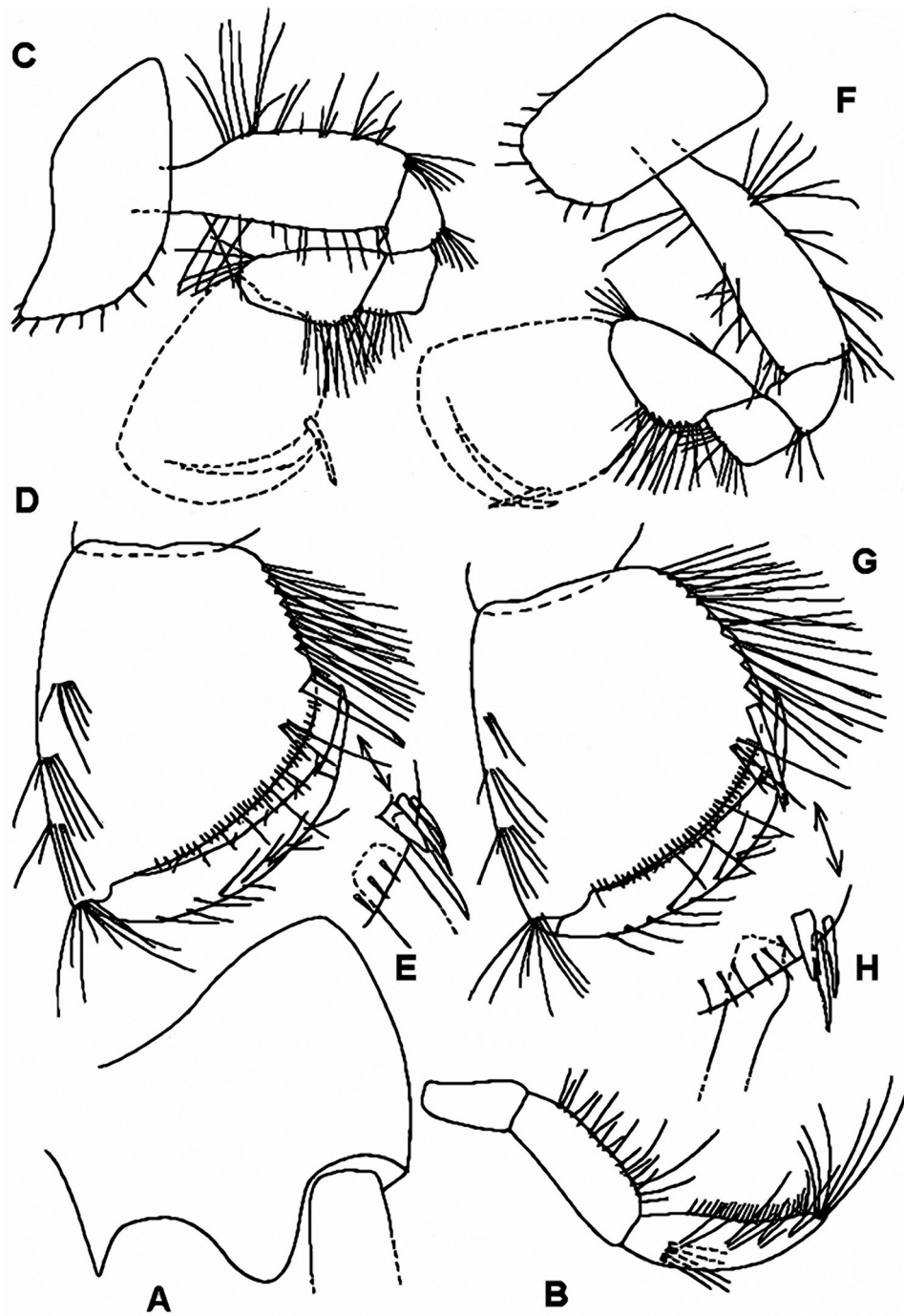


Fig. 6. *Niphargus steueri subtypicus* Sket 1960, "Jama pri Stolbah" Cave, Černomeľ, male 11.0 mm (paratype). **A**, head; **B**, mandible palpus, inner face; **C-D**, gnathopod 1; **E**, distal corner of gnathopod 1 propodus, inner face; **F-G**, gnathopod 2; **H**, distal corner of gnathopod 2 propodus, inner face.

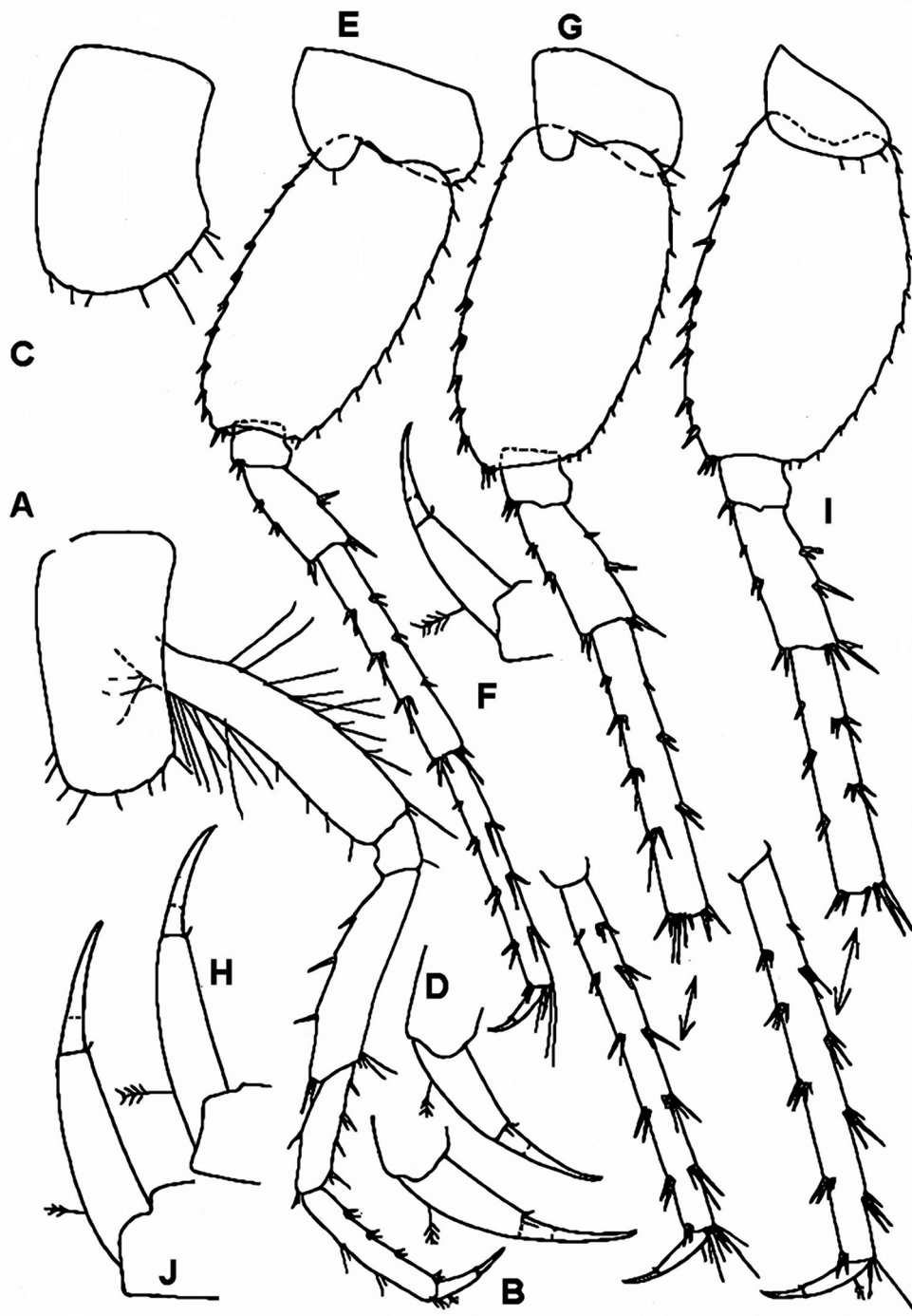


Fig. 7. *Niphargus steueri subtypicus* Sket 1960, "Jama pri Stolbah" Cave, Černomelj, male 11.0 mm (paratype). **A-B**, pereopod 3; **C**, coxa 4; **D**, pereopod 4 dactylus; **E-F**, pereopod 5; **G-H**, pereopod 6; **I-J**, pereopod 7.

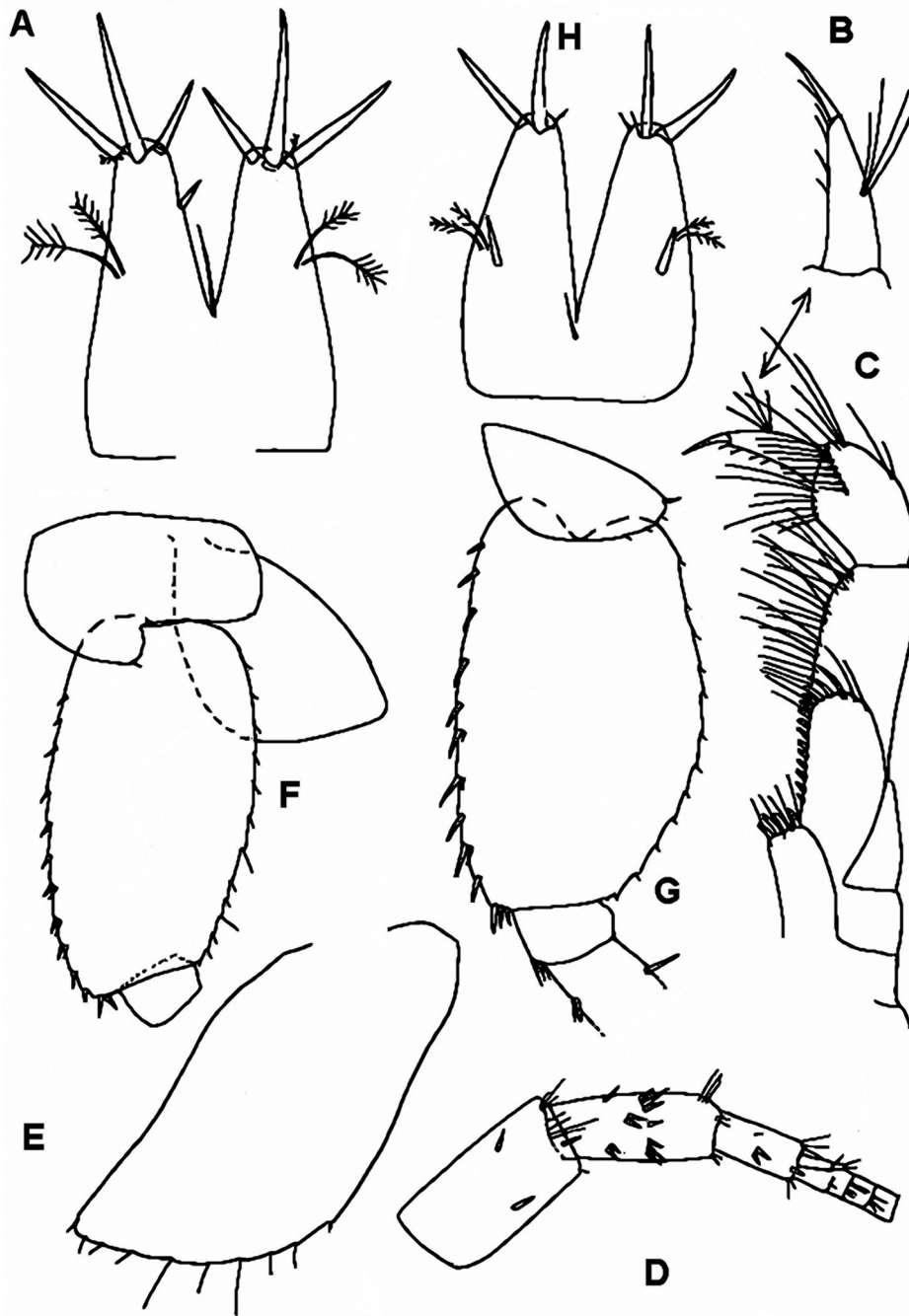


Fig. 8. *Niphargus steueri subtypicus* Sket 1960, "Jama pri Stolbah" Cave, Černomelj, male 11.0 mm (paratype). **A**, telson; **B-C**, maxilliped. Female 12.0 mm. **D**, antenna 1 (slide); **E**, coxa 1; **F**, pereopod 5 basipodit; **G**, pereopod 7 basipodit; **H**, telson.

Females similar to males.

Female 12.0 mm (Holotype). Peduncle of antenna 1 stout, articles bearing various number of short facial spines and some distal short setae (Fig. 8D, on slide). Coxa 1 with remarkably pointed ventroanterior corner and concave anterior margin (Fig. 8E). Sket (1960) mentioned that holotype is with antenna 1 bearing 40 articles in the main flagellum, maxilla 1 inner plate with 2 setae and palpus with 10 setae. Basipodit of pereopods 5-7 like these in female 11.0 mm (Fig. 8F, G), with ventroanterior short lobe.

Telson with 2 distal and 1 facial spine on each lobe (Fig. 8H).

Variability

The formula of outer marginal setae on gnathopod 1 dactylus is variable: 1-1-3-1-2-2-2-2-1 to 1-1-2-2-2-1-1-1, that of gnathopod 2 dactylus is: 2-2-2-2-1-1-1 to 1-2-2-1-2-1-1-1.

The specimens from Lukanjska Jama Cave possess a barely less pronounced coxa 1; and a head with moderately convex dorsal surface (in lateral projection).

Locus typicus. Cave "Jama pri Stolbah" near Črnomelj, Slovenia.

Localities cited. Slovenia: Jama pri Stolbah Cave near Otočec, NW of Črnomelj (Sket, 1960; Fišer et al., 2006; Fišer et al., 2007); cave near Špeharje, NE of Breg pri Sinjem Vrhu (Fiser et al., 2006). Fišer et al. (2007) mentioned also various other localities from Slovenia: Grosuplje reg. (Šimenkova Jama Cave, Stična, Grosuplje; Podpeška Jama Cave, Videm - Dobropolje, Grosuplje); Krška Jama Cave, Krka, Ivančna Gorica; Črnomelj reg. (Otoški Zdenec Spring, Otovec; Stobe Cave, Petrova Vas; Jelenja Jama Cave, Zastava; Na Trati Spring, Jelševnik; Bezgovka Cave, Krasinec; Stubica Cave, Bojanci; Kobiljača Cave, Sinji Vrh); Novo Mesto reg. (Jama pod Gradom Luknja Cave, Prečna; Rupa na Brodu Cave, Šmihel); Jelovička Jama Cave, Suhor, Kočevje

Croatia: Vrlovka špilja Cave, Kamanje, Ozalj (Fišer et al., 2006; 2007); Fišer et al., 2007 cited also: Ogulin reg. (Zala Cave, Bistrac; Privis, Generalski Stol); Jazbina Cave, Donje Dubrave; Kukuruzovića špilja Cave, Pašina Luka, Rakovica; Kusača Jama Cave, Žegar, Kaštel Žegarski.

Remarks and affinity

Fišer et al. (2007) cited ssp. *subtypicus* for numerous localities from Slovenia and Croatia, including some localities known for *N. jalzici*, indicating the similarity of ssp. *subtypicus* and *N. jalzici*.

Niphargus steueri subtypicus is very allied to the species *Niphargus jalzici* G. Karaman, 1989, known from Croatia (Jazbina, Katići) (epimeral plates, coxa 1, antenna 2, etc.).

Niphargus jalzici from type locality differs from *N. subtypicus* from type locality by a strongly convex dorsal face of the head, a more slender and less spinose peduncle of antenna 1, by a longer uropod 3, a more inclined palm of gnathopods 1-2, a longer article 6 of pereopods 5-7, etc. *N. jalzici* settled the area south of ssp. *subtypicus*.

Further statistical analysis of various populations of both species will show the limits of variability of these taxa, possible revealing overlap between their taxonomic characters, and will clarify the status of *N. jalzici* regarding ssp. *subtypicus*.

Niphargus steueri steueri Schellenberg, 1935 and *N. steueri kolombatovici* S. Kar., 1950 differ from ssp. *subtypicus* by a broader article 2 of pereopods 5-7 bearing a less convex anterior margin, by a longer and much less spinose peduncle of antenna 1, etc.

Niphargus steueri liburnicus Karaman & Sket, 1989, known from Croatia (Krk island) is also very similar to ssp. *subtypicus* (short uropod 3), but differs from ssp. *subtypicus* by the absence of numerous spines on the peduncle of antenna 1, by the straight anterior margin of coxa 1, and by the extremely produced ventroanterior lobe on article 2 of pereopod 5, etc.

Niphargus (*Orniphargus*) *steueri kolombatovici* S. Karaman, 1950

Niphargus (*Orniphargus*) *orcinus kolombatovici* S. Karaman, 1950a: 138, figs. 73-82; S. Karaman, 1956: 4;

Niphargus (*Orniphargus*) *kolombatovici* S. Karaman, 1953: 147, figs. 12-17;

Niphargus kolombatovici Straškraba 1959: 309; G. Karaman, 1974: 19; G. Karaman & Sket, 1990: 55, 64;

Niphargus kolombatovici kolombatovici G. Karaman, 1972: 5; G. Karaman, 1974: 19; Barnard JL and Barnard CM 1983: 692;

Niphargus steueri kolombatovici G. Karaman, 1984: 44, figs. XIX-XX; G. Karaman & Ruffo, 1986: 531; G. Karaman, 2012g: 27, figs. 1-8; Fišer et al., 2007: 301, pl. 2, figs. 2K, 3K, 4K1, 5K1, 7K2, 8 (map); G. Karaman, 2012a: 27, figs. 1-8;

Material examined

Bosnia and Herzegovina:

- Bilobrka špilja Cave, Bilobrci, village Vinica (Tomislavgrad reg.), 6.9.2014, 1 exp. accompanied by *N. arbiter* (leg. R. Ozimec and G. Karaman) [coordinate: X= 4826987, y= 6420960; z= 630];

- Mala Bukovička špilja Cave, Bukovica village (Tomislavgrad reg.), 5.9.2014, 1 juv. (leg. R. Ozimec) [coordinate: x= 4837278; y= 6434669, z= 987];

- Cave Peća, Bukovica village (Tomislavgrad reg.), 31.10.1999, 4 exp. (leg. T. Rađa);

- Spring "Vrilo" from Ričina Cave near Buško Blato (Tomislavgrad reg.), 13.9.2012, 3 exp. (leg. R. Ozimec);
- Ričina Cave, Buško Blato (=Buško jezero) (Tomislavgrad reg.), 14.9.2012, 1 exp. (leg. R. Ozimec).

Remarks

The specimen from Bilobrkova špilja Cave (male 14.9 mm) agrees mainly with the characters of this subspecies. Metasomal segments 1-3 along the dorsoposterior margin with a row of strong spines and single setae; urosomal segment 1 on each dorsolateral side with 4 strong spines, urosomal segment 2 with 4 dorsolateral spines on each side, urosomite 3 naked.

Antenna 1 slightly shorter than body-length (ratio: 125:149); peduncle articles of antenna 1 progressively shorter, mail flagellum with 43 articles (most of them with 1 aesthetasc); flagellum of antenna 2 much shorter than last peduncular article, consisting of 7 articles. Maxilliped palpus article 4 at inner margin with a pair of 2 setae near basis of the nail.

Coxa 1 with produced but obtuse ventroanterior corner bearing a row of 14 setae. Coxa 7 with 4 setae.

Basipodit of pereopod 5 with short ventroanterior ex-

tension but shorter than in ssp. *liburnicus* and subangular ventroposterior short lobe. Uropod 1 with subequal rami, uropod 2 with inner ramus slightly longer than outer ramus, Uropod 3 short, Lobes of telson with 3 distal and 1 facial spine.

A juvenile specimen from Mala Bukovička špilja Cave (6.2 mm) has lobes of telson with 3 distal spines, facial spines absent.

Distribution

Niphargus steueri kolombatovici was described from springs under Kozjak Mt. near Split (Croatia) by S. Karaman (1950b) and later mentioned from various localities in central and southern Croatia and Bosnia & Herzegovina (see citations under the title of this species).

Fišer et al. (2007) cited this subspecies from two localities of Tomislavgrad region (Cebara Bunar Well, and a cave near Zadružni Dom by Donji Brišnik). Our finding of this taxon in other caves of Tomislavgrad region extend the known distribution of this taxon in Bosnia and Herzegovina.

This subspecies is restricted to Dalmatia and the western part of Bosnia and Herzegovina.

Key to the subspecies of *Niphargus steueri* Schell. 1935

- | | |
|--|--|
| 1. Article 4 of maxilliped along inner margin with 4-7 single setae..... | 2 |
| -- Article 4 of maxilliped along inner margin with bunch of 1-2 distal setae..... | 3 |
| 2. Coxa 1 with strongly acute ventroanterior corner; antenna 1 peduncle stout, with various number of facial spines; coxa 7 with 3-6 setae..... | <i>subtypicus</i> Sket, 1960 |
| -- Coxa 1 with only slightly acute ventroanterior corner. Antenna 1 peduncle slender, with setae, occasionally with 1-2 facial spines only; coxa 7 with single seta..... | <i>steueri</i> Schellenberg, 1935 |
| 3. Coxa 1 with pointed ventroanterior corner and with numerous (over 8) marginal setae; article 2 of pereopod 5 without distinct ventroanterior protrusion..... | <i>kolombatovici</i> S. Karaman, 1950 |
| -- Coxa 1 with subrounded ventroanterior corner and with a scarce number of marginal setae; article 2 of pereopod 5 with strong ventroanterior protrusion..... | <i>liburnicus</i> Karaman & Sket, 1960 |

Niphargus (Orniphargus) arbiter G. Karaman, 1984

Niphargus arbiter G. Karaman, 1984: 26, figs. X-XII; G. Karaman & Ruffo, 1986: 522; G. Karaman, 1987: 30, figs. 1-3; Karaman, 1988: 28; G. Karaman & Sket, 1989: 26, 32; G. Karaman, 1993: 174, Fig. 83; Fišer et al., 2006: 2312; Trontelj et al., 2009: 7;

Niphargus (Orniphargus) croaticus (nec Jurinac) S. Karaman, 1950a: 133, figs. 52-61.

Material examined

Bosnia and Herzegovina:

- Bilobrkova špilja Cave, Bilobrci, village Vinica (Tomislavgrad reg.), 6.9.2014, 1 exp. (leg. R. Ozimec and G. Karaman) (coordinate: X= 4826987, y= 6420960; z= 630) (intermixed with *N. steueri kolomatovici* S. Kar. 1950);
- *ibid.*, 10.9.1998, 1 exp. (leg. T. Rađa);

Croatia:

- Abyss Sušik, Drežnica, Lika, 10.3. 1988, 1 exp. (leg. B. Jalžić);

- Panjkov ponor- Abyss, new part, N. Kršlja, Rakovica, 25.7.2003, 2 exp. mixed with *N. jalzici* (leg. G. Polić);
- Spring of Vitunjčica, Vitunj, Ogulin, 1.7.2004, 1 exp. (leg. R. Ozimec);
- Velika peč Cave, Blata, Mljet Island, 19.5.2003, 1 exp. (leg. G. Polić).

Remarks

The specimen from Bilobrkova špilja Cave (ovig. female, 19.0 mm) agrees mainly with known taxonomic characters of this species. Antenna 1 slightly exceeds half of the body (ratio: 12:19). Metasomal segments at the dorsoposterior margin with setae intermixed with single spines. Epimeral plates 1-3 are moderately acute. Urosomal segments 1 and 2 on each dorsolateral side with 3 spines, urosomal segment 3 naked.

Maxilliped palpus article 4 (dactylus) along ventral margin with a bunch of 2 distal setae near basis of the nail.

Gnathopod 1 propodus palm defined on outer face by 1 corner S-spine accompanied laterally by 4 slender L-spines and 3 facial M-setae, on inner face by 1 subcorner R-spine. Gnathopod 2 propodus with palm defined on outer face by one corner S-spine accompanied by 2 slender L-spines sitting behind S-spine and 3 facial M-setae, on inner face by 1 subcorner R-spine

Lobes of telson with 8 distal spines each, facial spines absent.

The specimen from Vitunj has maxilliped palpus article 4 along the ventral margin provided with one additional median seta.

Distribution

Known from various caves and subterranean waters in northwestern Dinarides, NW Croatia, Lika and Bosnia.

Niphargus arbiter was described from a cave near Pečina Selo, Otočac (Lika, Croatia (G. Karaman, 1984) and later was cited from various localities of Croatia, NE Italy (Gorizia reg.) and Bosnia and Herzegovina by various authors (see citations under the title of this species).

From Bosnia this species is known only from Lušci (W. of Sanski Most) (Trontelj et al. 2009) and a cave in Vinica (Tomislavgrad reg.) (present work). The Tomislavgrad region in Bosnia is the southernmost known locality of this species.

CONCLUSIONS

Among numerous known taxa (species and subspecies) of the genus *Niphargus* Schiödte, 1849 (Amphipoda Gammaridea, fam. Niphargidae) from the Balkan Peninsula, many taxa have been very scarcely described and figured, with many undescribed taxonomic characters. In this work, *Niphargus* (*Orniphargus*) *pachytelson* Sket 1960 is rede-

scribed from type-locality, a species that to date has been very scarcely described and figured.

The subspecies *Niphargus steueri subtypicus* has been only partially described by Sket (1960) and Fišer et al. (2007). In the present study, it is redescribed and figured based on material from type-locality and Lukanjska Jama Cave. Based on this work, its relation to *N. jalzici* is still not clear and requires more detailed examination using additional material.

Niphargus (*Orniphargus*) *steueri kolombatovici* Sket, 1960 and *N. (Orniphargus) arbiter* G. Karaman, 1984 were discovered in some new localities in Bosnia & Herzegovina and Croatia. In the present study, a key to the subspecies *Niphargus* (*Orniphargus*) *steueri* Schellenberg, 1935 is presented, and taxonomic relations of four mentioned taxa to other members of the subgenus *Orniphargus* (S. Karaman, 1950a) are discussed.

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