



ORIGINAL RESEARCH PAPER

FURTHER DATA OF NIPHARGIDAE FAMILY ON BALKAN (Contribution to the Knowledge of the Amphipoda 324)

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Key words:

Crustacea,
Amphipoda,
taxonomy,
subgenus,
Niphargus,
Orniphargus,
jasminkoi,
stygius,
subterranean,
Bosnia & Herzegovina,
Slovenia.

Ključne riječi:

Crustacea,
Amphipoda,
taxonomija,
podrod,
Niphargus,
Orniphargus,
jasminkoi,
stygius,
podzemni,
Bosna i Hercegovina,
Slovenija.

SYNOPSIS

Two species of family Niphargidae (Crustacea, Amphipoda) are studied from the subterranean waters of Bosnia & Herzegovina and Slovenia. The new species, *Niphargus (Orniphargus) jasminkoi*, sp. nov., is described and figured from the subterranean waters of Hrustovača Cave, Hrustovo, Sanski Most (Bosnia & Herzegovina). This species belongs to the subgenus *Orniphargus* S. Karaman, 1950, morphologically very close to species *Niphargus (Orniphargus) pachytelson* Sket, 1960, *N. (Orniphargus) arbiter* G. Karaman, 1984 and *N. (Orniphargus) salonitanus* S. Karaman, 1950.

The species *Niphargus (Niphargus) stygius* (Schiödte, 1847), known from various localities, is redescribed from Lubniška jama-Cave near Lubnica, Škofja Loka reg., Slovenia, and taxonomic characters of this species regarding similar species *N. (Niphargus) valvasori* S. Karaman 1952, are discussed.

The nominal subgenus *Niphargus* Schiödte, 1849 with typus subgeneris *Gammarus stygius* Schiödte, 1847, is cited.

SINOPSIS

NOVI PODACI O FAMILIJI NIPHARGIDAE NA BALKANU (Prilog poznavanju Amphipoda 324)

Proučavali smo dvije vrste familije Niphargidae (Crustacea, Amphipoda) iz podzemnih voda Bosne i Hercegovine i Slovenije. Nova vrsta, *Niphargus (Orniphargus) jasminkoi*, sp. nov., je opisana iz podzemnih voda Hrustovača pećine, Hrustovo, Sanski most (Bosna i Hercegovina). Ova vrsta pripada podrodu *Orniphargus* S. Karaman, 1950, i morfološki je veoma slična vrstama *Niphargus (Orniphargus) pachytelson* Sket, 1960, *N. (Orniphargus) arbiter* G. Karaman, 1984 i *N. (Orniphargus) salonitanus* S. Karaman, 1950.

Vrstu *Niphargus (Niphargus) stygius* (Schiödte, 1847), poznatu sa različitih lokaliteta, smo ponovo opisali iz Lubniške jame, blizu Lubnice, Škofja Loka, Slovenija, i taksonomske odlike ove vrste u odnosu na sličnu vrstu *N. (Niphargus) valvasori* S. Karaman 1952, smo razmatrali.

Nominalni podrod *Niphargus* Schiödte, 1849 sa typus subgeneris *Gammarus stygius* Schiödte, 1847 je citiran.

INTRODUCTION

The subterranean fauna of family Niphargidae (Crustacea, Amphipoda) on Balkan peninsula has been studied by various scientists and numerous taxa of genus *Niphargus* have been discovered and described (Absolon, Schäferna, S. Karaman, Dancau, Fišer, Schellenberg, G. Karaman, Sket, Delić, etc.). Species richness of Niphargidae peaks along the Western Balkan, most likely due to vivid geologic history and habitat heterogeneity (Karaman & Sket, 2019; Borko et al., 2021; Borko et al., 2022).

Despite intense past investigations, this fauna remained only partially known, and new taxa and new localities of already known taxa, are publishing every year. During our recent investigations, a new species of subgenus *Orniphargus* from Bosnia & Herzegovina, *Niphargus (Orniphargus) jasminkoi*, sp. nov., has been discovered, described and figured here.

Niphargus (Niphargus) stygius (Schiödte, 1847) known from Postojna Cave (Slovenia) as type-locality, later cited by various authors from other localities of Slovenia (Schellenberg, 1936; Karaman S., 1950; Sket, 1960; Karaman, G., 1974; Delić et al., 2017), was described and figured from locus typicus more in detail by Karaman, S. (1952), Sket (1974) and Karaman, G. (1993). Discovery other new taxa by various authors, very similar to *N. stygius*, request detailed redescription of *N. stygius* from other localities, to understand the limits of morphological variability of this species regarding other similar taxa in the vicinity. For this reason, we redescribed the population of *N. stygius* from Lubniška jama-Cave near Škofja Loka, provided with some important morphological characters similar to these of *N. stygius*, and some other characters to *N. valvasori*, indicating the need for further studies of these two taxa from other new localities, to resolve the taxonomical status of *N. valvasori*, because some authors consider *N. valvasori* as synonym of *N. stygius*.

MATERIAL AND METHODS

The collected material was preserved in the 70% ethanol. The specimens were dissected using a WILD M20 microscope and drawn using camera lucida attachment. All body-parts were temporarily submersed in the mixture of glycerin and water for study and drawing. The body-length of examined specimens are measured from tip of head to end of telson using camera lucida. The appendages were transferred to Liquid of Faure on permanent slides. All illustrations were inked manually.

Some morphological terminology and setal formulae follow Karaman's terminology (Karaman, G. 1969; 2012) regarding the last mandibular palpus article [A= A-setae on outer face; B= B-setae on inner face; D= lateral marginal D-setae; E= distal long E-setae] and propodus of gnathopods 1 and 2 [S= corner S-spine; L= lateral slender serrate L-spines; M= facial corner M-setae; R= subcorner R-spine on inner face]. Terms "setae" and "spines" are used based on its shape, not function.

The research in this work is based on the classic morphological, ecological and zoogeographical studies.

RESULTS AND DISCUSSION

TAXONOMICAL PART

Family NIPHARGIDAE
NIPHARGUS (ORNIPHARGUS)
***JASMINKOI*, sp. nov.**

Figures 1-7

MATERIAL EXAMINED:

S-7226= Hrustovača Cave, Hrustovo, Sanski Most, Bosnia & Herzegovina, 6.2.2011, one exp. (leg. Jasna Friščić & Ivan Napotnik); S-7227= ibid., 15.1.2012, 3 exp. (leg. Jasna Friščić & Ivan Napotnik).

DIAGNOSIS:

Body moderately strong, metasomal segments 1-3 with dorsoposterior row of short setae; urosomal segments 1-2 with dorsolateral spines, urosomal segment 3 naked. Antenna 1

peduncular article 3 elongated, but shorter than article 2; accessory flagellum short. Antenna 2 flagellum slender, longer than last peduncular article. Maxilla 1 inner plate and palpus with elevated number of setae. Coxae relatively long, coxa 1 with subangular ventroanterior corner, coxa 4 with lobe. Gnathopods 1-2 propodus trapezoid, inclined, bearing more or less lateral L-spines, not sitting behind S-spine. Pereopods 3-7 dactylus short, at inner margin with one spine; pereopods 5-7 article 2 longer than broad, without lobe. Pleopods with 2 retinacula. Uropods 1-2 without plumose setae. Uropod 1 peduncle with dorsointernal row of spines, rami equally long. Uropod 3 short and strong. Telson incised up to 2/3 of telson-length.

DESCRIPTION:

MALE 17.0 mm (holotype)

Body strong, mesosomal segments 5-7 with 2-4 short dorsoposterior marginal setae, metasomal segments 1-3 with dorsoposterior marginal row of 12-14 short setae (fig. 4E); urosomal segment 1 on each dorsolateral side with 2 spines, urosomal segment 2 on each dorsolateral side with 3 spines; urosomal segment 3 naked (fig. 1F). Urosomal segment 1 at each ventroposterior corner with one spine near basis of uropod 1 peduncle (fig. 1F).

Epimeral plate 1 distinctly angular, with well marked minute ventroposterior tooth and convex posterior margin bearing 6-7 setae, ventral margin slightly concave in the middle. Epimeral plates 2-3 poorly pointed, posterior vertical margin with 6-7 setae, ventral margin convex, with 3 submarginal spines in anterior part (fig. 4E).

Head with short rostrum, short subrounded lateral cephalic lobes and broadly excavated ventroanterior margin, eyes absent (fig. 1A).

Antenna 1 slender and long, slightly exceeding half of the body-length. Peduncular articles 1-3 elongated, progressively shorter (ratio: 70:60:38), scarcely setose, setae short (fig. 1B); main flagellum consisting of 43 articles, scarcely setose (many articles with one short aesthetasc). Accessory flagellum 2-articulated (fig. 1B), much shorter than last peduncular article (ratio: 15:38).

Antenna 2 slender; peduncular article 3 short, with distoventral bunch of setae nearly as long as diameter of article; peduncular articles 4-5 of nearly identical length but unequal diameter (fig. 1C); article 4 at ventral margin with 2 bunches of setae (the longest setae longer than the diameter of the article itself), at dorsal margin with 5 bunches of short setae; article 5 with 5 ventral bunches of long setae (the longest setae twice as long as diameter of article), and 5 dorsal bunches of short setae; flagellum nearly as long as the last peduncular article, consisting of 13 slender articles scarcely setose (fig. 1C). Antennal gland cone short (fig. 1C).

Labrum broader than long, distal margin convex (fig. 2A). Labium much broader than long, outer lobes subrounded, inner lobes short (fig. 1D).

Mandibles asymmetric with respect to each other. Right mandible with 4-toothed incisor and serrate bifurcate lacinia mobilis accompanied by 6 rakers (fig. 2B). Left mandible with 5-toothed incisor and 4-toothed lacinia mobilis, accompanied by 6 rakers (fig. 2C). Palpus of both mandibles similar, 3-articulated: first article naked; second article with 14 strong setae (fig. 2D); third article subfalciform, slightly longer than second one (ratio: 80:70), with 5-7 proximal marginal stronger setae and nearly 25 mediodistal D-setae, at tip 7-9 long E-setae; on outer face with transverse row of 9 A-setae, on inner face 3 groups of 8 B-setae (3-3-2) (fig. 2E).

Maxilla 1: inner plate with 8-9 setae, outer plate with 7 spines (5-6 spines with one lateral tooth, 1-2 spines with 2 teeth), palpus 2-articulated, short, not reaching tip of outer plate-spines, bearing 9 longer setae (fig. 1E).

Maxilla 2 both plates slightly narrowed, with bunches of numerous distal setae (fig. 2F).

Maxilliped: inner plate not reaching outer distal tip of the first palpus article, with 4 distal spines mixed with several setae (fig. 2G); outer plate not exceeding half of the palpus article 2 and provided along mesial margin with 6-8 short spines and several distolateral setae; palpus article 3 outer margin with distal bunch of setae, inner margin with numerous

setae; article 4 nail shorter than pedestal, outer margin with one median seta, inner margin with 1-2 setae near basis of the nail.

Coxae moderately short. Coxa 1 slightly longer than broad (ratio: 43:31), with subangular ventroanterior corner and 7 distal setae (fig. 3A). Coxa 2 longer than broad (ratio: 54:40), ventral convex margin with 8 setae (fig. 3D). Coxa 3 slightly larger than 2, longer than broad (ratio: 65:41), almost straight ventral margin with 9 setae (fig. 4A). Coxa 4 longer than broad (ratio: 61:49), ventroposterior lobe distinctly developed, ventral convex margin provided with 11 setae (fig. 4C).

Coxa 5 remarkably shorter than 4, bilobed, broader than long (ratio: 54:37), anterior lobe not produced, ventroposterior margin with 2 short setae (fig. 5A).

Coxa 6 smaller than 5, bilobed, broader than long (ratio: 45:31), anterior lobe subrounded, ventroposterior margin with one seta (fig. 5C). Coxa 7 entire, broader than long (ratio: 47:19), posterior margin with one short seta (fig. 5E).

Gnathopods 1-2 moderately large. Gnathopod 1 slightly smaller than gnathopod 2; article 2 with numerous shorter and longer setae along the anterior and posterior margin; article 3 with distoposterior bunch of setae (fig. 3A); article 5 shorter than propodus (article 6) (ratio: 30:48), with distoanterior bunch of setae and numerous posterior long setae. Propodus trapezoid, as long as broad (fig. 3B), posterior margin with 11 transverse rows of setae, anterior margin with 2 medial and one distal group of setae. Palm inclined slightly over one half of propodus length (ratio: 45:35), convex, defined on outer face by corner S-spine accompanied laterally by 3 L-spines and 3-4 facial M-setae, on inner face by one subcorner R-spine (fig. 3C); dactylus reaching posterior margin of propodus, outer margin with a row of 10 single setae, inner margin with nearly 11 short setae (fig. 3B).

Gnathopod 2: article 2 with a row of shorter anterior marginal setae and posterior numerous longer setae; article 3 with distoposterior bunch of setae; article 5 shorter than propodus (ratio: 35:56), with one distoanterior bunch of setae and numerous posterior marginal setae (fig.

3D). Propodus trapezoid, hardly broader than long (ratio: 108:103), posterior margin with 14 transverse rows of setae, anterior margin with 2 groups of setae (fig. 3E). Palm convex, inclined almost 2/3 of propodus length, defined on outer face by corner S-spine accompanied by 3-4 slender L-spines sitting only partially behind corner S-spine (fig. 3F), on inner face by one subcorner R-spine. Dactylus not reaching posterior margin of propodus, outer margin with row of 10 single setae, inner margin with nearly 10 short setae (fig. 3E).

Pereopods 3-4 moderately slender. Pereopod 3 hardly longer than pereopod 4, article 2 with numerous proximal long setae at anterior and posterior margin, and shorter setae in distal part of both margins; article 3 with distoposterior bunch of setae (fig. 4A). Articles 4-6 of unequal lengths (ratio: 50:32:40); article 4 at both margins with 4-5 single or groups of setae not exceeding the diameter of the article itself; article 5 with 2 anterior marginal groups of setae and 4 posterior groups of single spines mixed with short setae; article 6 with 3 anterior marginal seta and a distal bunch of setae, at the posterior margin with 6 single spines mixed with single short setae. Dactylus much shorter than article 6 (ratio: 18:40), inner margin with one slender seta like-spine, outer margin with one median plumose seta (fig. 4B), nail shorter than pedestal (ratio: 24:40).

Pereopod 4: article 2 with numerous long proximal setae at anterior and posterior margins and shorter setae in the distal part of anterior and posterior margins; article 3 with a distoposterior group of setae. Articles 4-6 of unequal lengths (ratio: 43:31:37), article 4 with 4 single short anterior marginal setae, posterior margin with 6 groups of short setae mixed often with single short spine (fig. 4C). Article 5 with 2 anterior marginal groups of short setae and 3 posterior marginal groups of single spines mixed with short setae; article 6 with 3 groups of anterior marginal groups of short setae, posterior margin with 5 single spines mixed often with one short seta. Dactylus much shorter than article 6 (ratio: 17:37), inner margin with one slender spine-like seta, outer margin with one median plumose seta (fig. 4D);

nail shorter than pedestal (ratio: 24:40).

Pereopods 5-7 moderately slender. Pereopod 5 remarkably shorter than pereopods 6-7, article 2 dilated, longer than broad (ratio: 71:47), poorly tapering ventrally, anterior margin remarkably convex with 9 single spines, sometimes mixed with one short seta, posterior margin slightly convex with nearly 15 short setae, ventroposterior lobe not developed, ventroanterior tip slightly marked (fig. 5A). Articles 4-6 of different lengths (ratio: 41:62:62). Article 4 anterior margin with 3-4 groups of short spines and setae, posterior margin with 3 groups of single or paired spines mixed with one short seta; article 5 with 6 groups of short anterior marginal spines and 3 single posterior short setae and distoposterior distal group of short spines and setae; article 6 with 5 anterior marginal groups of short spines mixed with single short setae and posterior distal groups of spines and setae. Article 2 longer than article 6 (ratio: 71:62). Dactylus much shorter than article 6 (ratio: 22:62), at inner margin with one spine-like seta, at outer margin with one median plumose seta (fig. 5B), nail shorter than pedestal (ratio: 24:47).

Pereopod 6: article 2 dilated, tapering ventrally, longer than broad (ratio: 77:52), anterior margin remarkably convex, with 7 groups of short single spines and short setae, posterior margin slightly convex, with 17 short setae, ventroposterior lobe absent (fig. 5C). Articles 4-6 of unequal lengths (ratio: 55:74:93), all articles along both margins with several bunches of short spines mixed often with single short setae. Article 2 distinctly shorter than article 6 (ratio: 77:93). Dactylus much shorter than article 6 (ratio: 24:93), inner margin with a spine-like seta (fig. 5D), outer margin with one median seta; nail shorter than pedestal (ratio: 28:51).

Pereopod 7: article 2 longer than broad (ratio: 75:50), tapering ventrally; anterior margin slightly convex, with 7-8 single spines, posterior margin slightly convex, with 13 short setae, ventroposterior lobe not developed (fig. 5E). Articles 4-6 of unequal lengths (ratio: 48:67:89); anterior margin of articles 4-5 with 4 bunches of short spines mixed often

with single short seta, posterior margin with 3 bunches of short spines. Article 6 along both margins with 4 bunches of short spines (spines shorter than diameter of articles). Article 2 shorter than article 6 (ratio: 75:89). Dactylus remarkably shorter than article 6 (ratio: 26:89), inner margin with one spine-like seta (fig. 5F), outer margin with one median plumose seta; nail shorter than pedestal (ratio: 28:51).

Pleopods with 2 retinacula. Pleopod 1 peduncle with 3 anterior marginal setae (fig. 4F); peduncle of pleopod 2 with one distoanterior seta (fig. 4G); pleopod 3 peduncle at posterior margin with 3 marginal setae and distal spine (fig. 4H).

Uropods 1-2 without plumose setae. Uropod 1 peduncle nearly as long as rami, bearing distoexternal and distointernal row of spines (fig. 1F); both rami of equal length. Outer margin of inner ramus with 3 strong single spines, inner (mesial) margin with one median spine and 2 groups of 2-3 short simple setae in distal part, tip with 5 short spines. Outer ramus with 2 outer marginal spines and one short simple seta, inner (mesial) margin with 4 single spines, tip with 5 short spines.

Uropod 2: peduncle with 4-5 distal spines; inner ramus longer than peduncle, outer margin with 4 single spines (not figured), inner (mesial) margin with 2 median groups of spines and one short simple seta, at tip appear 5 spines. Outer ramus slightly curved, remarkably shorter than inner one, with 2 lateral and 5 distal short spines (fig. 1F).

Uropod 3 strong, not produced; peduncle longer than broad, with 6-7 distal and one inner (mesial) spine; inner ramus short, scale-like, shorter than peduncle, bearing distal spine and plumose setae (fig. 2H). Outer ramus much longer than peduncle (ratio: 129:40), outer margin with 5 bunches of spines (shorter than diameter of article), inner (mesial) margin with nearly 9 bunches of spines mixed with 1-2 longer plumose setae; second article shorter than diameter of first article, with several distal and 2 lateral short simple setae.

Telson as long as broad, incised slightly less than 2/3 of telson length, obtuse distally, each lobe with 4 distal spines (the longest

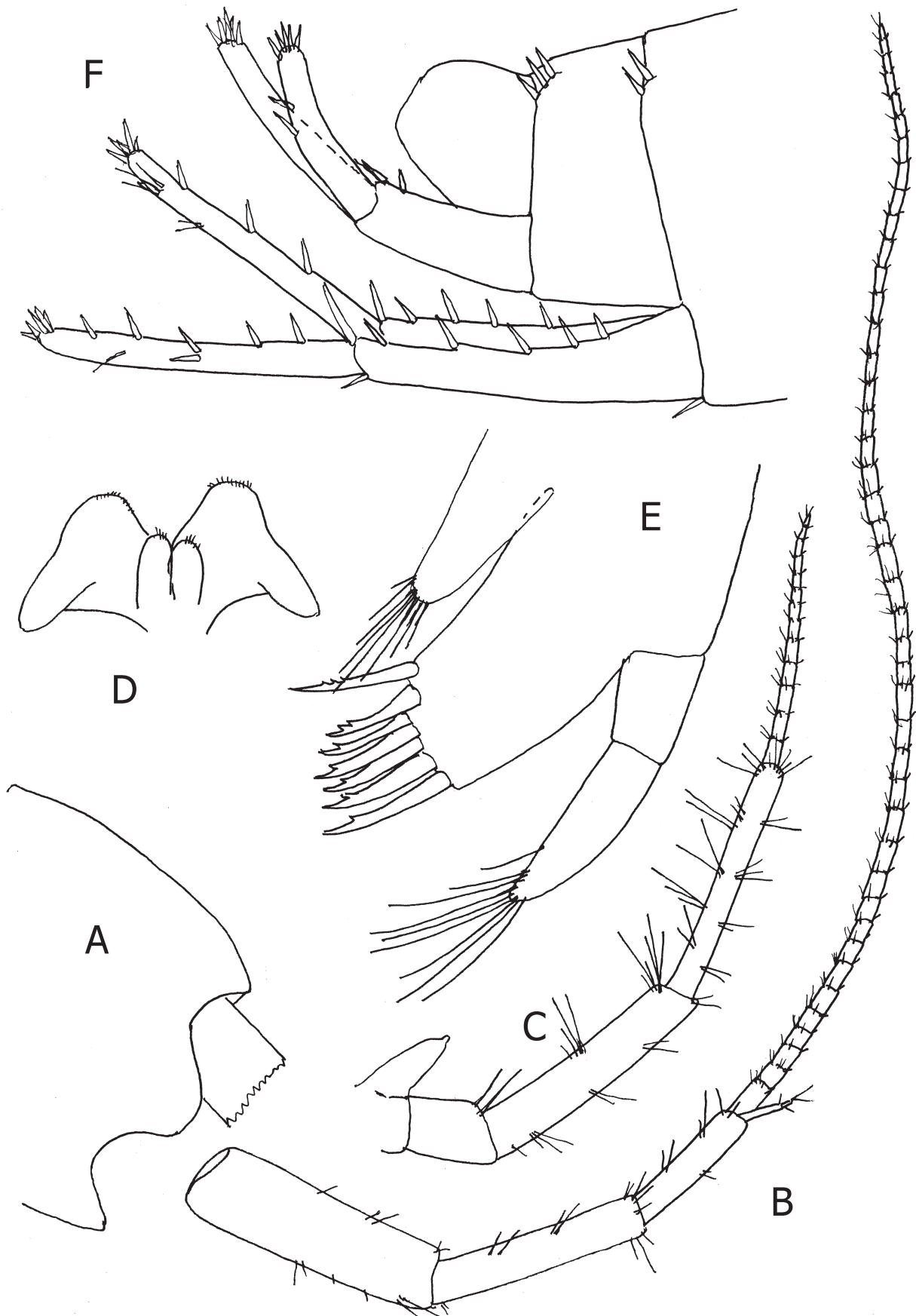


Fig. 1. *Niphargus (Orniphargus) jasminkoi*, sp. nov., Hrustovača Cave, Hrustovo, male 17.0 m: A= head; B= antenna 1; C= antenna 2; D= labium; E= maxilla 1; F= urosome with uropods 1-2.

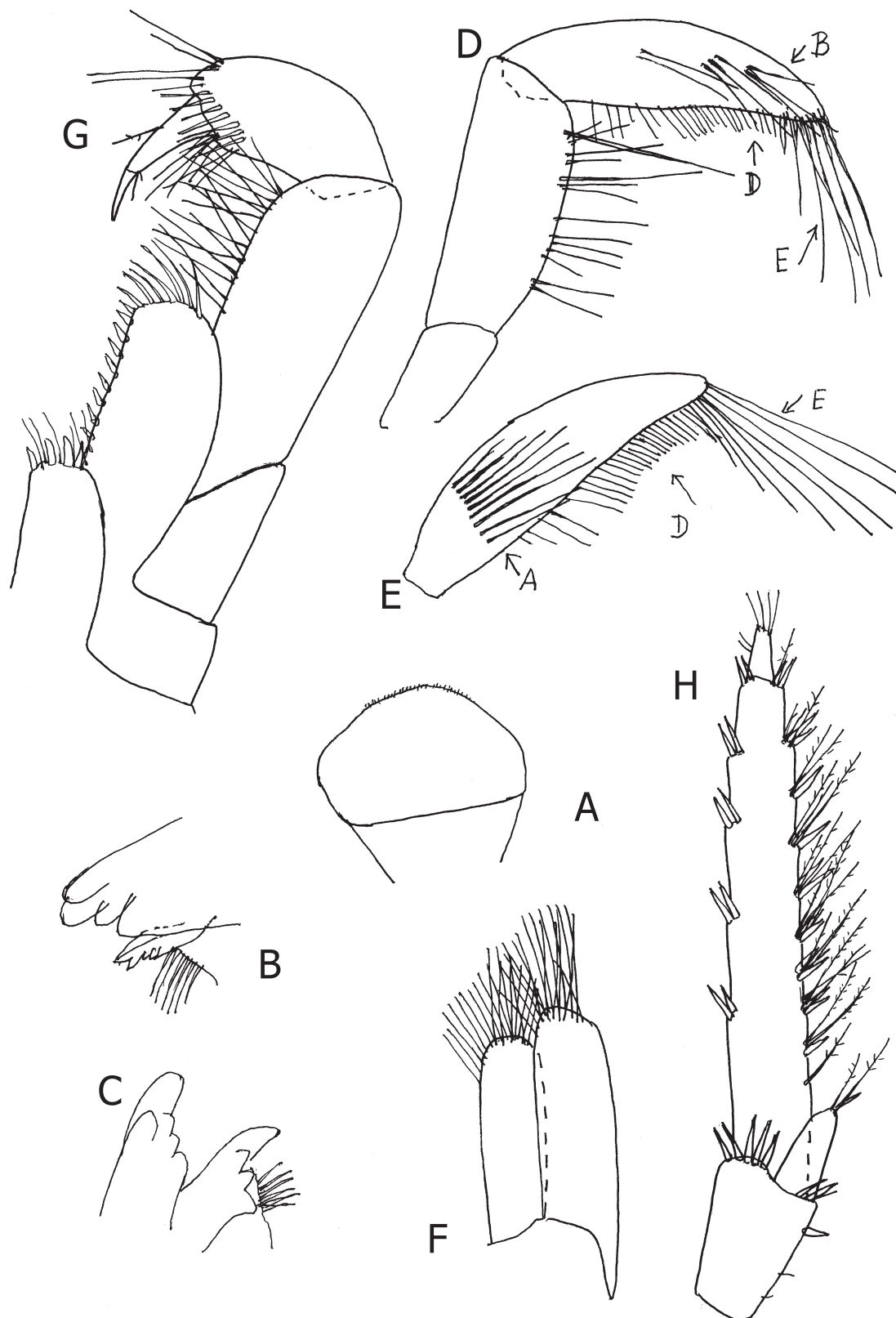


Fig. 2. *Niphargus (Orniphargus) jasminkoi*, sp. nov., Hrustovača Cave, Hrustovo, male 17.0 m: A= labrum; B= right mandible with incisor, lacinia mobilis and rakers; C= left mandible with incisor, lacinia mobilis and rakers; D= mandibular palpus, inner face (B=facial B-setae; D= marginal D-setae); E= distal E-setae; E= mandibular palpus distal article, outer face (A= facial A-setae; D= marginal D-setae; E= distal E-setae); F= maxilla 2; G= maxilliped; H= uropod 3.

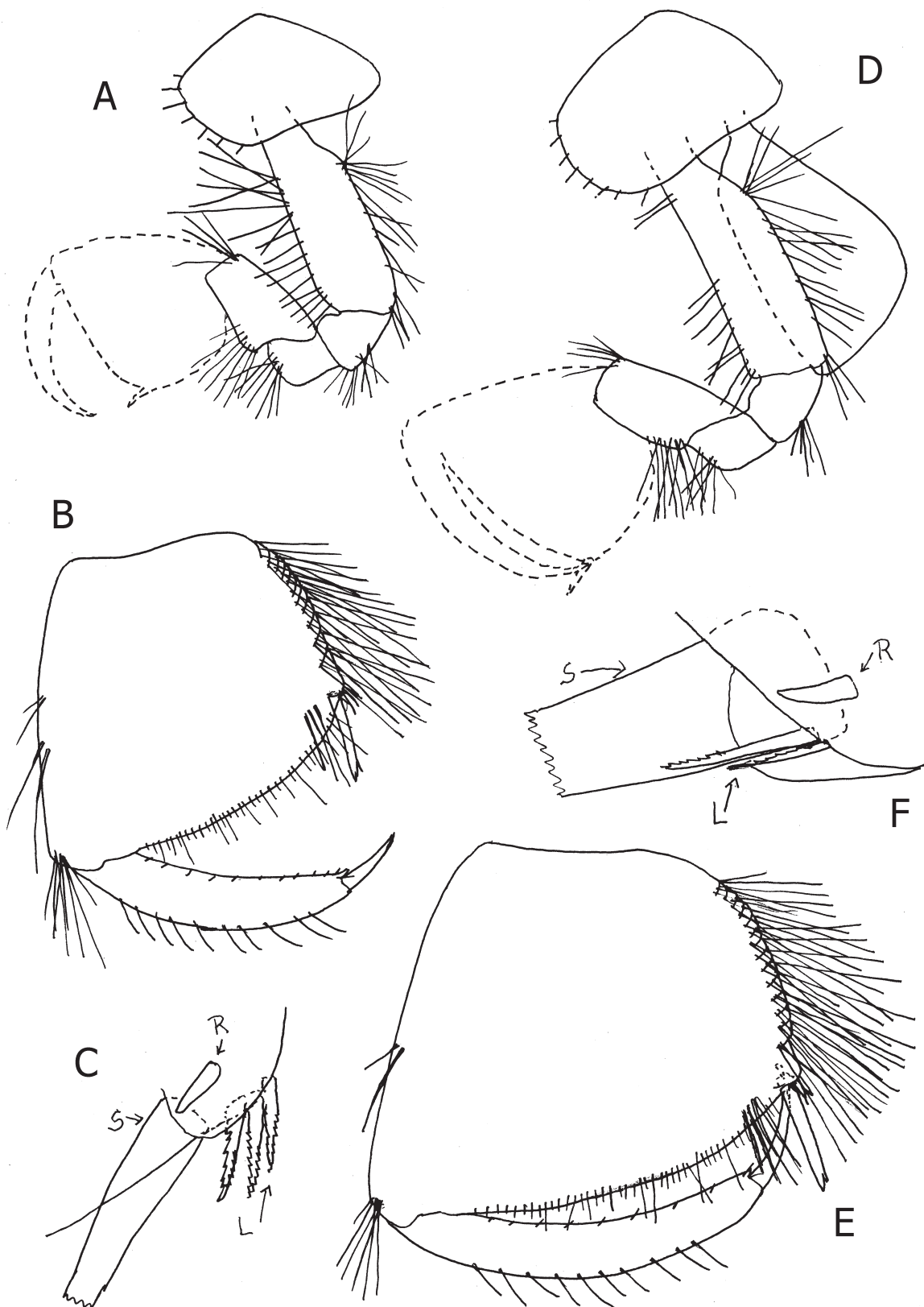


Fig. 3. *Niphargus (Orniphargus) jasminkoi*, sp. nov., Hrustovača Cave, Hrustovo, male 17.0 m: A-B= gnathopod 1, outer face; C= distal corner of gnathopod 1-propodus, inner face [S= corner S-spine; L= lateral L-spines; R= subcorner R-spine]; D-E= gnathopod 2, outer face; F= distal corner of gnathopod 2-propodus, inner face (S= corner S-spine; L= lateral L-spines; R= subcorner R-spine).

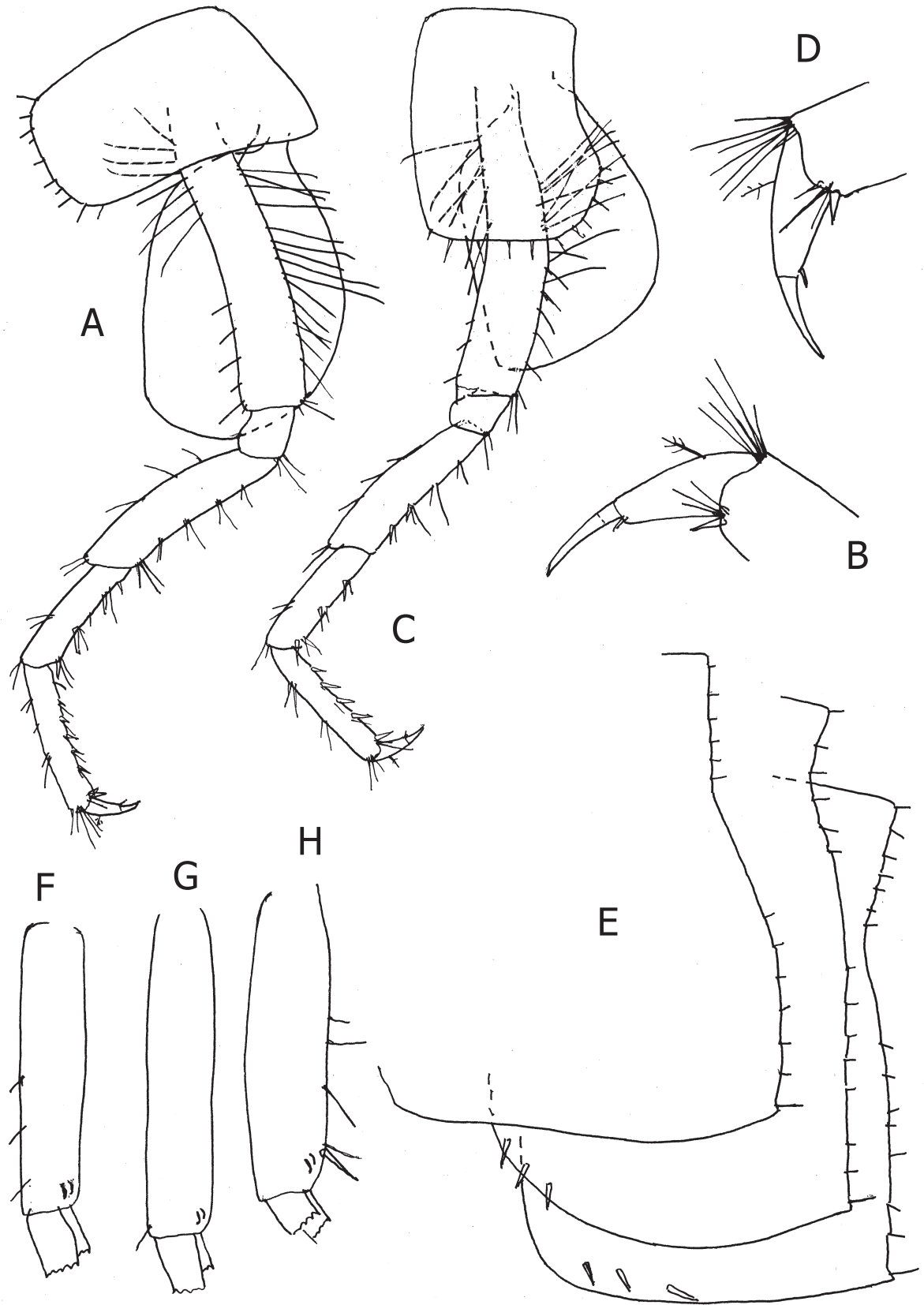


Fig. 4. *Niphargus (Orniphargus) jasminkoi*, sp. nov., Hrustovača Cave, Hrustovo, male 17.0 m: A-B= pereopod 3; C-D= pereopod 4; E= epimeral plates 1-3; F= pleopod 1-peduncle; G= pleopod 2-peduncle; H= pleopod 3-peduncle.

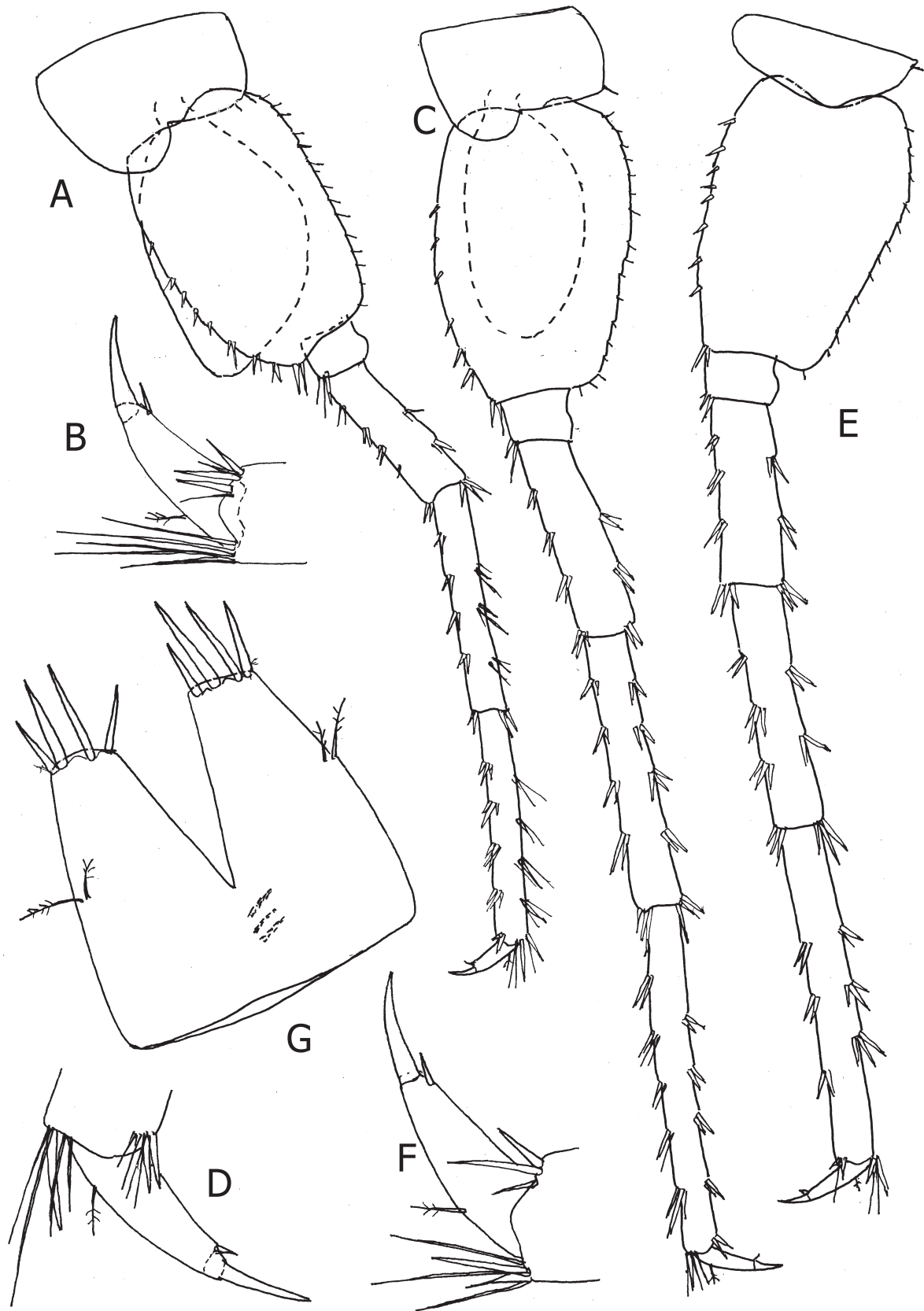


Fig. 5. *Niphargus (Orniphargus) jasminkoi*, sp. nov., Hrustovača Cave, Hrustovo, male 17.0 m: A-B= pereopod 5; C-D= pereopod 6; E-F= pereopod 7; G= telson.

spine almost 1/3 of telson length); a pair of short plumose setae attached near the middle of external margin; marginal and facial spines absent (fig. 5G).

Coxal gills on gnathopod 2 and pereopods 3-6 broad, nearly reaching ventral tip of the corresponding pereopod article 2 (figs. 3D, 4A, 4C, 5A, 5C).

FEMALE 15.6 mm with oostegites (paratype):

Body moderately stout, mesosomal segments 5-7 with 4-6 short dorsoposterior marginal setae; metasomal segments 1-3 with a row of 15 dorsoposterior marginal setae, spines absent (fig. 6F). Urosomal segment 1 at each dorsolateral side with 3 spines; urosomal segment 2 on each dorsolateral side 3 spines, urosomal segment 3 naked. Ventroposterior corner of urosomal segment 1 with one spine near basis of uropod 1-peduncle (fig. 7H).

Epimeral plates 1-3 similar to those in male: epimeral plate 1 with convex posterior margin bearing 6-7 long marginal setae and straight ventroposterior corner marked with minute tooth. Epimeral plate 2 with minutely toothed ventroposterior corner and straight posterior margin bearing 7-8 short setae, ventral margin with 2 spines; epimeral plate 3 poorly pointed, slightly concave posterior margin bearing nearly 10 short setae (fig. 5F), ventral margin with 3 spines.

Head as in male. Antenna 1 as in male, scarcely setose; peduncular articles 1-3 progressively shorter (ratio: 50:39:26), peduncular article 3 elongated (fig. 6A); flagellum slender, consisting of 39 articles scarcely setose, many articles with one short aesthetasc.

Antenna 2 slender, setose as in male, peduncular articles 4-5 of the same lengths; flagellum slender, consisting of 15 articles; antennal gland cone short.

Mouthparts as in male. Mandibular palpus article 2 with 20 setae; palpus article 3 with 24 marginal D-setae and 6-7 distal E-setae, on outer face with transverse row of 8 A-setae, on inner face 4 groups of B-setae (2-4-2-2).

Maxilla 1: inner plate with 6-7 setae, outer plate with 7 spines (5 spines with one tooth, 2

spines with 2-3 teeth), palpus with 2 articles, not reaching distal tip of outer plate-spines, with 8-9 distal setae.

Maxilliped inner plate with 4 distal spines, outer plate with 11 spines and 7 distal strong setae, palpus article 4 with 1-2 setae near basis of the nail.

Coxae rather similar to these in male. Coxa 1 longer than broad (ratio: 38:28), with subangular ventroanterior corner and 9 marginal setae (fig. 7A). Coxa 2 longer than broad (ratio: 52:33), with 8 marginal setae (fig. 7B). Coxa 3 much longer than broad (ratio: 62:35) with 8 marginal setae (fig. 7C); coxa 4 longer than broad (ratio: 64:43), with 10 marginal setae, ventroposterior lobe developed (fig. 7D).

Coxae 5-7 similar to these in male. Coxa 5 remarkably shorter than coxa 4, broader than long (ratio: 49:37), bilobed, both lobes with one short seta (fig. 7E); coxa 6 broader than long (ratio: 44:31) with one ventroposterior seta (fig. 7F). Coxa 7 shallow, entire, much broader than long (ratio: 42:17), with one posterior seta (fig. 7G).

Gnathopods 1-2 moderately large, articles 2-5 like these in male. Gnathopod 1 propodus trapezoid, as long as broad, posterior margin with 10 transverse rows of setae (fig. 6B); palm inclined nearly half of propodus-length, convex, defined on outer face by one corner S-spine accompanied laterally by 3 slender serrate L-spines and 4 facial corner M-setae, at inner face by one subcorner R-spine (fig. 6C). Dactylus reaching posterior margin of propodus, outer margin with 9 single setae, inner margin with 9 short setae (fig. 6B).

Gnathopod 2 remarkably larger than gnathopod 1. Propodus trapezoid, as long as broad, posterior margin with 13 transverse rows of setae (fig. 6D). Palm convex, inclined rather over one half of the propodus length, defined on outer face by one corner S-spine accompanied laterally by 2 slender L-spines and 3-4 facial corner M-setae (fig. 6E). Dactylus reaching posterior margin of propodus, with 9 outer marginal single setae, and nearly 8 inner marginal short setae (fig. 6D).

Pereopods 3-4 rather similar to these in male. Pereopod 3: articles 4-6 of different lengths

(ratio: 50:36:36), pilosity and other articles like these in male. Pereopod 4: articles 4-6 of different length (ratio: 41:34:34), pilosity and other articles like these in male.

Pereopod 5 shorter than pereopods 6-7, article 2 longer than broad (ratio: 70:44), dilated, anterior margin convex, not produced ventrally, with nearly 10 short spines, posterior margin slightly convex, with 16 short setae, ventroposterior lobe absent (fig. 7E). Articles 4-6 of unequal lengths (ratio: 40:50:55), along both margins with bunches of short spines mixed often with single seta as long as or longer than spines. Article 2 longer than article 6 (ratio: 70:55). Dactylus much shorter than article 6 (ratio: 14:55), inner margin with one slender spine near basis of the nail, outer margin with one median plumose seta, nail shorter than pedestal (ratio: 8:14).

Pereopod 6: article 2 longer than broad (ratio: 76:48), anterior margin convex, with 9 single spines, posterior margin poorly convex, with 15 short setae, ventroposterior lobe absent (fig. 7F). Articles 4-6 of different lengths (ratio: 50:57:71), both margins with bunches of short spines often mixed with short setae. Article 2 poorly longer than article 6 (ratio: 76:71). Dactylus much shorter than article 6 (ratio: 19:71), inner margin with one slender spine near basis of the nail, outer margin with one median plumose seta; nail shorter than pedestal (ratio: 13:22).

Pereopod 7: article 2 dilated, longer than broad (ratio: 71:49), anterior margin convex, with 7 single spines, posterior margin remarkably convex, with 13 short setae, ventroposterior lobe absent (fig. 7G). Articles 4-6 of different lengths (ratio: 48:65:89), anterior and posterior margin with spines often mixed with single short setae. Article 6 longer than article 2 (ratio: 89:71). Dactylus like that in male, much shorter than article 6 (ratio: 23:89), inner margin with spine near basis of nail, outer margin with one median plumose seta; nail shorter than pedestal (ratio: 13:20).

Pleopods 1-3 with 2 retinacula. Pleopod 1 peduncle with 3 anterior marginal simple setae and 4 lateral slender setae, posterior margin with one seta (fig. 6G). Pleopod 2 peduncle

with 3 distoanterior short setae and 2 slender lateral setae (fig. 6H); peduncle of pleopod 3 with strong distoposterior spine and 3 groups of 1-2 setae (fig. 6 I).

Uropods 1-2 without plumose setae. Uropod 1: peduncle shorter than inner ramus, with dorsoexternal and dorsointernal row of strong spines (fig. 7H); inner ramus only slightly longer than outer one (ratio: 80:73), bearing 4 lateral and 4 distal spines, mixed with one subdistal bunch of 2 simple setae; outer ramus with 7 simple or paired lateral spines and 4 distal spines; 2 short simple lateral setae appear at medial part of ramus.

Uropod 2 peduncle with 2 distal spines; inner ramus distinctly longer than outer one, with 4 lateral and 4 distal spines; inner ramus with 3 lateral and 4 distal spines (fig. 7 I). Uropod 3 missing.

Telson as long as broad, incised 2/3 of telson-length, each lobe with 3-4 distal spines and one pair of short plumose setae sitting medially at outer margin (fig. 7J), lateral and facial spines absent.

Coxal gills like these in male. Oostegites ovoid, with marginal setae.

VARIABILITY

Position of L-spines on propodus of gnathopod 2 is rather variable: in the studied male L-spine is very close to S-spine, in female is distinctly in lateral position regarding S-spine. Females with inner ramus of uropod 1 slightly longer than outer one. Coxa 1 always with subangular ventroanterior corner. Telson without facial spines. Maxilliped palpus article 4 with 2-4 setae at inner margin near basis of the nail.

HOLOTYPE: male 17.0 mm No.S-7227; paratype female 15.6 mm No. S-7226. Holotype and paratypes are deposited in KARAMAN's Collection in Podgorica, Montenegro.

DISTRIBUTION: Bosnia and Herzegovina, known only from the type locality.

REMARKS AND AFFINITIES

Based on several characters (short uropod 3

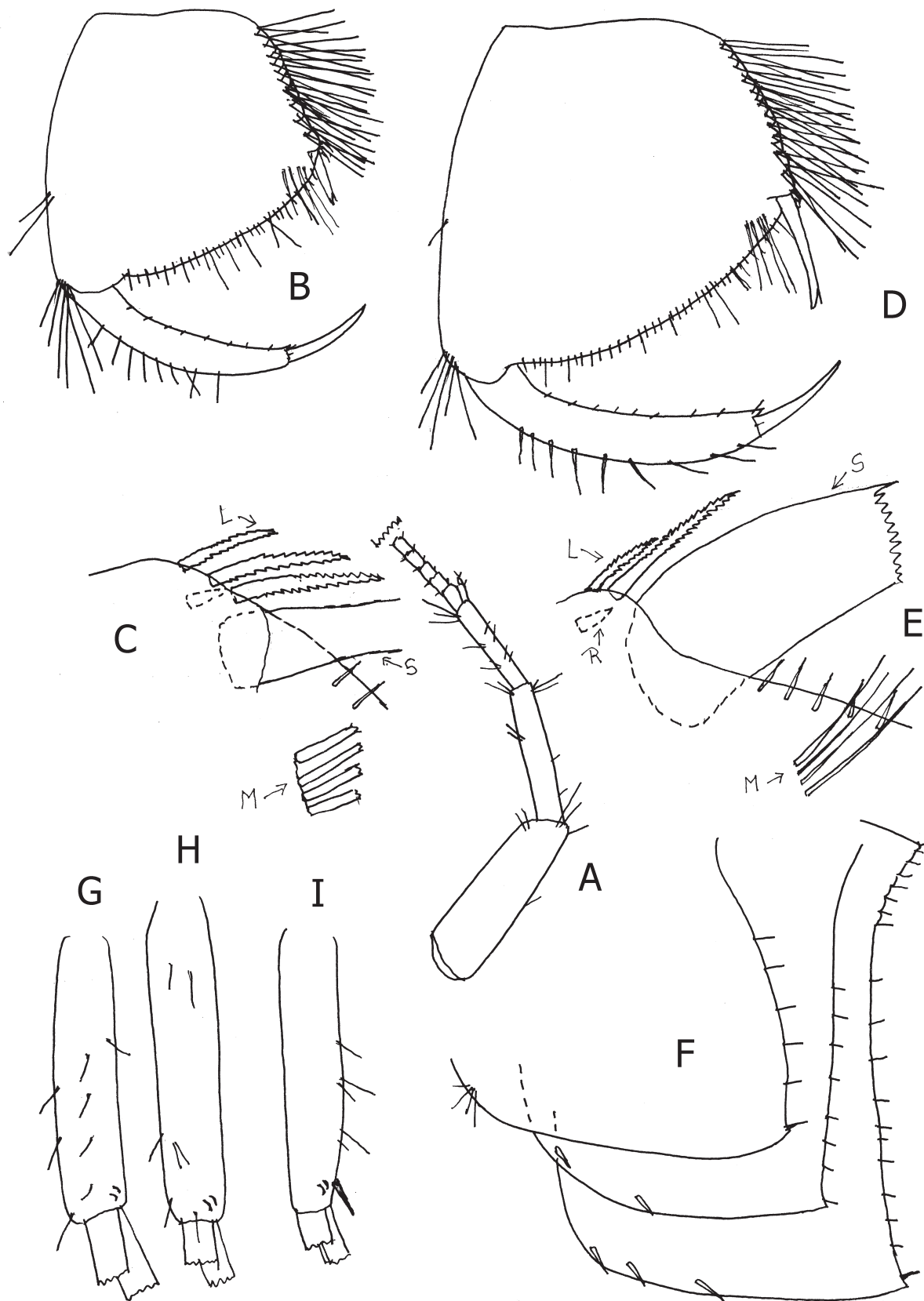


Fig. 6. *Niphargus (Orniphargus) jasminkoi*, sp. nov., Hrustovača Cave, Hrustovo, female 15.6 m: A= antenna 1 peduncle; B= gnathopod 1 propodus, outer face; C= distal corner of gnathopod 1 propodus, outer face (S= corner S-spine; L= lateral L-spines; R= subcorner R-spine; M= facial M-setae); D= gnathopod 2 propodus; E= distal corner of gnathopod 2 propodus, outer face (S= corner S-spine; L= lateral L-spines; R= subcorner R-spine; M= facial M-setae); F= epimeral plates 1-3; G= pleopod 1 peduncle; H= pleopod 2 peduncle; I= pleopod 3 peduncle.

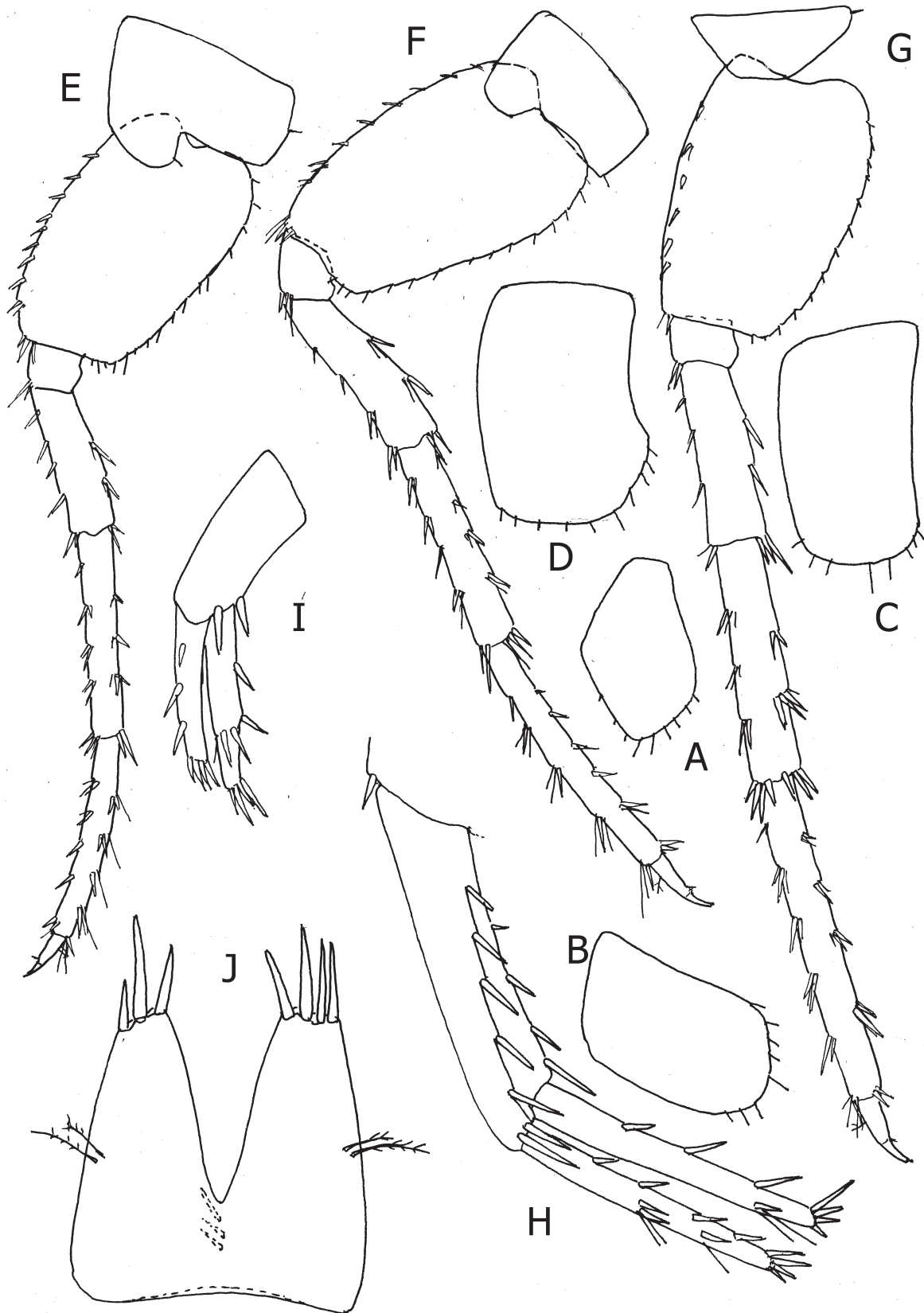


Fig. 7. *Niphargus (Orniphargus) jasminkoi*, sp. nov., Hrustovača Cave, Hrustovo, female 15.6 m: A= coxa 1; B= coxa 2; C= coxa 3; D= coxa 4; E= pereopod 5; F= pereopod 6; G= pereopod 7; H= uropod 1; I= uropod 2; J= telson.

in male, uropod 1 peduncle with dorsointernal row of spines, equal rami of uropod 1 in male, numerous dorsoposterior marginal setae on metasomal segments, several outer marginal setae on dactylus of gnathopods 1-2, relatively very small sexual differences), specimens from Hrustovača belong to the subgenus *Orniphargus* S. Kar. 1950a, 1950b (typus subgeneris: *Niphargus orcinus* Joseph, 1869).

Among numerous known species of this subgenus, the specimens from Hrustovača Cave are rather similar to *Niphargus pachytelson* Sket 1960 [locus typicus: Jama pri Luknji Cave near Novo Mesto, Slovenia]. As the original description of this species was very short, later G. Karaman (2015) redescribed and figured this species based on holotype and paratypes from Luknja Cave, Podpeška jama Cave and Tatrc (Potiskavec, Dobropolje, Suha Krajina). Fišer et al. (2017a; 2017b) and Kralj-Fišer et al. (2020) mentioned this species again for Podpeška jama Cave, all in Slovenia.

Based on these data, *N. jasminkoi* differs distinctly from *N. pachytelson* by elevated number of setae on inner plate and palpus of maxilla 1, by different position of L-spines on gnathopod 2-propodus, less convex lateral margin of gnathopod 1-propodus, distinct ventroposterior lobe on coxa 4, absence of facial spines on telson (0-1 spine in specimens from Podpeška jama Cave), rather less spinose uropod 3, etc.

N. jasminkoi is also very close to *Niphargus arbiter* G. Karaman 1984 [locus typicus: Cave near Pečina Selo (Otočac, Lika, Croatia), later discovered in various other localities of Croatia. *N. jasminkoi* differs from *N. arbiter* by lower number of spines on lobes of telson, presence of numerous setae along dorsoposterior margin of metasomal segments 1-3, by different position of L-spines on propodus of gnathopod 2, by higher number of setae on inner plate and palpus of maxilla 1, etc.

Niphargus salonitanus S. Karaman 1950 [locus typicus: Solin, springs (Split region, Croatia)], known from various localities in Dalmatia is rather similar to herein described species, but *N. jasminkoi* differs from it by subangular coxa

1, by elevated number of setae on inner plate and palpus of maxilla 1, by less inclined palm of gnathopod 2-propodus, by different position of L-spines on gnathopod 2-propodus, by less number of L-spines on gnathopod 1-propodus, by unlobed and rather less broad article 2 of pereopods 5-7, by less incised telson bearing 4 distal spines on each lobe, etc.

Delić et al. (2017b) described several new species of *Niphargus arbiter-salonitanus* group based on molecular/genetic differences, without detailed morphological description and figures of these new species, making by this way one confusion regarding further morphological recognition of single taxa of subgenus *Orniphargus*.

In the present situation when exists numerous known taxa of subgenus *Orniphargus*, very problematic is to undervalue importance of detailed morphological description and drawing of single taxa, because the present taxonomy is still based mainly on morphological characters. It is necessary to make detailed description of each new species, even in the case that this new species “is similar to species X” or “new species belong to certain group of species”, because author can overlook some morphological characters visible to other scientists, and made impossibility to other scientist to value the validity of this new taxon based on morphological characters.

NIPHARGUS (NIPHARGUS) STYGIUS **(Schiödte, 1847)**

Figures 8-14

Shortened synonymy:

Gammarus stygius Schiödte, 1847: 75;

Niphargus stygius (part). G. Karaman, 1993: 263, figs. 128, 129;

Niphargus stygius Schiödte, 1849: 26, pl. 3, figs. 1-16; Sket, 1974: 92, figs. 1-53; Delić et al., 2017a, S. 1: 8; Delić et al., 2017b: S8;

Niphargus (Stygoniphargus) stygius stygius S. Karaman, 1952: 6, pl. 1, figs. 1-4; pl. 2, figs. 5-10; pl. 3, figs. 11-16; S. Karaman, 1954: 162, figs. 1-8, 44.

LOCUS TYPICUS: Postojna Cave, Slovenia.

MATERIAL EXAMINED:

S-7412= Lubniška jama Cave, Lubnik (Škofja Loka reg., Slovenia), 1.8.1993, 3 exp. (leg. E. Broder & F. Stoch);

S-6220= Postojna Cave, Postojna, Tartaro Basso, 8.6.1933, 6 exp. (leg. D'Ancona) (Slovenia);

S-4878= Križna jama Cave, 7.2.1930, 4 exp. (leg. ?) (Slovenia);

S-769= Jama Pod Smoganica Cave, Most na Soči, 3 exp., leg. ?? (Slovenia);

S-4306= Grotta azzura di Samatorza Cave (267 VG) near Trieste (leg. F. Stoch) (Italy).

DESCRIPTION:

MALE 19 mm from Lubniška Jama Cave:

Body slender, metasomal segments 1-3 with 4-5 dorsoposterior marginal short setae each (fig. 10E). Urosomal segment 1 on each dorsolateral side with one seta; urosomal segment 2 on each dorsolateral side with 4 spines; urosomal segment 3 naked. Urosomal segment 1 at each ventroposterior corner with one short spine near basis of uropod 1 peduncle (fig. 8F).

Epimeral plates 1-3 with marked ventroposterior corner and convex posterior margin, bearing 6 short setae on epimeral plate 1, 7-8 setae on epimeral plate 2, and 12 short setae on epimeral plate 3; plates 2-3 with 3 subventral spines each (fig. 10E). Epimeral plate 1 ventral margin slightly concave in the middle, plates 2-3 with convex ventral margin.

Head with short rostrum and short subrounded lateral cephalic lobes, eyes absent (fig. 8A).

Antenna 1 shorter than one half of the body (ratio: 91:190), peduncular articles 1-3 progressively shorter (ratio: 101:77:38), scarcely setose, peduncular article 3 not elongated (fig. 8B). Main flagellum consists of 24 articles (most of them with one short aesthetasc); accessory flagellum short, 2-articulated, almost reaching one half of the peduncular article 3 (fig. 8B).

Antenna 2 relatively slender, peduncular article 5 slightly shorter than article 4, both articles with bunches of setae often longer than

diameter of articles themselves (fig. 8C); flagellum moderately slender, rather longer than last peduncular article and consisting of 12 articles. Antennal gland cone short (fig. 8C).

Mouthparts basic. Labrum with convex distal margin; labium with well developed inner lobes.

Mandibles with tritulative molar. Left mandible: incisor with 5 teeth, lacinia mobilis with 4 strong teeth and 7 rakers. Right mandible: incisor with 4 teeth, lacinia mobilis slender, bifurcate, with several small teeth and 5 rakers. Mandibular palpus 3-articulate: article 1 naked, article 2 with 13-16 marginal and 5 facial setae (fig. 12B); article 3 subfalciform, slightly longer than article 2 (ratio: 82:71), bearing one group of 9 A setae (fig. 12C), 4 groups of B setae (2-2-4-4), 30-32 D setae and 8-9 E setae (fig. 12B).

Maxilla 1: inner plate with 3-4 setae, outer plate with 7 spines (6 spines with one lateral tooth, one spine with 2 lateral teeth; palpus short, not reaching the tip of outer plate-spines, bearing 8-9 setae (fig. 11A).

Maxilla 2 longer than broad, plates poorly unequal, with distomarginal setae, inner plate with distolateral setae also (fig. 12A).

Maxilliped: inner plate not reaching outer tip of the first palpus article, bearing 3 (left) or 4 (right) distal spines; outer plate reaching nearly one half of the second palpus article, bearing a row of smooth marginal (mesial) spines (nearly 14) and 3-4 distal setae (fig. 8D), article 3 with median and distal bunch of setae along outer margin; article 4 (dactylus) with bunch of 2 setae at inner margin near the basis of the nail (fig. 8E).

Coxae moderately short. Coxa 1 broader than long (ratio: 56:40), with subrounded ventroanterior corner and 13 marginal setae (fig. 9A); coxa 2 slightly broader than long (ratio: 65:60), with 14 marginal setae (fig. 9D); coxa 3 nearly as long as broad, with 14 marginal setae (fig. 10A). Coxa 4 nearly as long as broad, unlobed, with 11 marginal setae (fig. 10C).

Coxae 5-7 shallow. Coxa 5 bilobed, much broader than long (ratio: 74:40), with subrounded anterior lobe (fig. 11B). Coxa 6 bilobed, broader than long (ratio: 62:37) (fig.

11D); coxa 7 entire, much broader than long (ratio: 56:23) (fig. 11F).

Gnathopods 1-2 nearly as large as corresponding coxae. Gnathopod 1 remarkably smaller than gnathopod 2, article 2 along anterior margin with a row of long setae, posterior margin with bunches of long setae; article 3 with a distoposterior bunch of setae (fig. 9A). Article 5 slightly shorter than propodus (ratio: 42:49), anterior margin with a distal bunch of setae. Propodus slightly broader than long (ratio: 90:84), posterior margin with 9 transverse rows of setae (fig. 9B). Palm inclined hardly over one half of the propodus-length, convex, defined on outer face by one strong S-spine accompanied laterally by 4 slender serrate L-spines, 8-9 corner facial M-setae, and on inner face by one subcorner R-spine (fig. 9C). Dactylus reaching posterior margin of propodus, with several groups of setae along outer margin (1-4-3-2-2 to 3-5-3-1-1), inner margin with a row of short simple setae (fig. 9B).

Gnathopod 2: article 2 with a row of long setae along anterior margin and bunches of long setae at the proximal posterior margin; article 3 with a bunch of distoposterior setae (fig. 9D). Article 5 shorter than propodus (ratio: 43:54), anterior margin with a distal bunch of setae. Propodus trapezoid, hardly broader than long (ratio: 108:104), posterior margin with 13 transverse rows of setae (fig. 9E). Palm inclined slightly over one half of the propodus-length, convex, defined on outer face by one corner S-spine, accompanied laterally by 4 serrate L-spines and 8 facial M-setae, and on inner face by one subcorner R-spine (fig. 9F). Dactylus reaching posterior margin of propodus, outer margin with a row of setae (2-3-2-1-1-1 or 1-3-4-3-1-1), inner margin with a row of very short setae (fig. 9E).

Pereopods 3 and 4 moderately slender. Pereopod 3: article 2 with several long proximal setae and a row of short setae in distal part. Articles 4-6 of different lengths (ratio: 65:43:44); article 4 anterior margin with 3 bunches of short setae, posterior margin with 5 groups of setae not exceeding the diameter of the article itself (fig. 10A); article 5 anterior

margin with 2 bunches of setae, posterior margin with 4 groups of short setae mixed with single spines. Article 6 anterior margin with 3 groups of setae, posterior margin with 5 single short spines mixed with groups of short setae. Dactylus strong, much shorter than article 6 (ratio: 22:44), inner margin with one spine near the basis of the nail, outer margin with one median plumose seta; nail shorter than pedestal (ratio: 29:35) (fig. 10B).

Pereopod 4 similar to pereopod 3, especially its pilosity (fig. 10C). Articles 4-6 of different lengths (ratio: 55:40:45). Dactylus much shorter than article 6 (ratio: 19:45), inner margin with a spine near the basis of the nail, outer margin with one median plumose seta (fig. 10D); nail shorter than pedestal (ratio: 28:35).

Pereopods 5-7 moderately strong. Pereopod 5 remarkably shorter than pereopods 6-7, article 2 dilated, without distinct ventroposterior lobe, longer than broad (ratio: 75:50), anterior margin with a row of 7 single or groups of very short setae, posterior margin with nearly 16 short setae (fig. 11B). Articles 4-6 of different lengths (ratio: 48:52:52); article 2 at both margins with 3-4 groups of short setae and single short spine; article 5 along both margins with 5 groups of short setae or single spines; article 6 at anterior margin with 4 groups of short setae and single short spines, posterior margin with 4 groups of short setae. Article 2 remarkably longer than article 6 (ratio: 75:52). Dactylus much shorter than article 6 (ratio: 20:52), inner margin with a spine near the basis of the nail, accompanied by a short seta, outer margin with one median plumose seta (fig. 11C), nail shorter than pedestal (ratio: 29:36).

Pereopod 6: article 2 much longer than broad (ratio: 90:55), anterior margin poorly convex with row of 9 slender spines or spine-like setae, posterior margin nearly straight, with 14 short setae, ventroposterior lobe not developed (fig. 11D). Articles 4-6 of different lengths (ratio: 58:76:80); article 4 anterior margin with 3 bunches of short setae, posterior margin with 3 single spines; article 5 both margins with 4-5 groups of short setae often mixed with one short spine; article 6 both margins with 4 groups of short spines and short setae. Article

2 longer than article 6 (ratio: 90:80). Dactylus strong, shorter than article 6 (ratio: 25:80), inner margin with one spine near basis of the nail accompanied by short seta, outer margin with one median plumose seta (fig. 11E); nail shorter than pedestal (ratio: 30:50).

Pereopod 7: article 2 much longer than broad (ratio: 93:55), anterior margin with a row of 7 spine-like setae, posterior margin slightly convex and with 14 short setae. Articles 4-6 of unequal length (ratio: 54:75:90), with several bunches of short setae and short spines never exceeding diameter of articles themselves (fig. 11F). Article 2 hardly longer than article 6 (ratio: 93:90). Dactylus short and strong, much shorter than article 6 (ratio: 28:90), inner margin with one spine near basis of the nail, mixed with one short seta, outer margin with one median plumose seta (fig. 11G); nail shorter than pedestal (ratio: 31:60).

Pleopods 1-3 with 2 retinacula, occasionally 3 (2-2, 2-2, 2-3) respectively. Peduncle of pleopod 1 with 3 distoanterior marginal setae (fig. 12D); pleopod 2-peduncle with only one distoanterior seta (fig. 12E); pleopod 3 peduncle with 3-4 posterior median marginal setae, lateral setae absent (fig. 12F).

Uropod 1 long, peduncle with dorsoexternal row of spines and dorsointernal row of setae (except distal spine) (fig. 8F); inner ramus long, but slightly shorter than peduncle, provided with a row of short simple setae, as well as with 3 bunches of short simple setae in the distal part of ramus; 4-5 short spines are attached on the tip of the ramus. Outer ramus reaching only half of the inner ramus-length, provided laterally with 2 spines and 3 bunches of short simple setae, distally with a bunch of 5 short spines.

Uropod 2 peduncle with a row of lateral spines. Outer ramus distinctly shorter than inner ramus, with 4 lateral single short spines and 5 distal short spines; inner ramus with 5 lateral spines and 4-5 distal short spines (fig. 8F).

Uropod 3 very long: peduncle longer than broad (ratio: 51:23), inner ramus shorter than peduncle, with 2 lateral spines and setae, at top with 6 short setae (fig. 10F). Outer ramus

2-articulated, both articles narrow and of nearly equal length; along outer margin of the first article 4 bunches of very short spines and setae, along its inner margin with 5 groups of short spines mixed with single long plumose setae; the second article with 4-5 bunches of very short simple setae (setae not exceeding diameter of article itself) along both margins; 7-8 short simple setae at the tip of the article (fig. 10G).

Telson nearly as long as broad, gapping, incised 5/7 of telson length; each lobe with 2-3 outer marginal strong spines and 3 distal spines; a pair of short plumose sensitive setae appears at the middle of outer margin; facial spines absent (fig. 12G).

Coxal gills relatively large, on gnathopod 2 and pereopods 3-5 slightly exceeding ventral tip of corresponding article 2 (fig. 9D, 10A, C, 11B); gills on pereopod 6 more narrow, poorly curved (fig. 11D).

FEMALE 15.1 mm from Lubniška Jama Cave (with numerous eggs): Mostly like the male. Metasomal segments like these in male. Urosomal segment 1 on each dorsolateral side with one seta, at each ventroposterior corner with one spine near basis of uropod 1 peduncle; urosomal segment 2 on each dorsolateral side with 4 spines; urosomal segment 3 naked (fig. 14F).

Epimeral plates 1-3 slightly more angular than those in males, plate 3 with distinct ventroposterior corner. Ventral margin of epimeral plate 1 slightly concave in the middle, along posterior convex margin with nearly 5 short setae; epimeral plate 2 with convex ventral margin bearing 3 submarginal spines and less convex posterior margin provided with nearly 11 short setae. Epimeral plate 3 with convex ventral margin bearing 3 subventral spines; posterior margin almost straight in distal part and hardly convex in proximal part, bearing 11 short setae (fig. 12 I).

Antenna 1 peduncular articles 1-3 progressively shorter (ratio: 70:52:25); main flagellum consists of 27 articles (most of them with one aesthetasc); accessory flagellum 2-articulate, short, not exceeding half of

the length of the last peduncular article (fig. 13A). Antenna 2 like that in male, with main flagellum consisting of 12 articles, antennal gland cone short.

Mouthparts: labrum, labium, maxilla 2 and maxilliped like these in males, inner plate of left maxilliped with 3 distal spines, on right maxilliped with 4 distal spines.

Maxilla 1 inner plate with 4 distal setae, outer plate with 7 spines bearing lateral teeth (3 spines with one tooth, 3 spines with 2 teeth, one spine with 3 teeth); palpus short, with 9 distal setae.

Coxae rather longer than those in male. Coxa 1 broader than long (ratio: 65:50), with subrounded ventroanterior corner and provided with 13 marginal setae (fig. 14A). Coxa 2 longer than broad (ratio: 79:63), strongly convex ventral margin bearing 14 unequally long setae (fig. 14B). Coxa 3 longer than broad (ratio: 91:74), almost straight ventral margin provided with nearly 14 unequally long setae (fig. 14C). Coxa 4 longer than broad (ratio: 93:78), ventral margin almost straight in the middle, provided with 14 setae, ventro-posterior lobe not developed (fig. 14D).

Coxae 5-7 shallow, coxae 5-6 bilobed, like those in male. Coxa 7 entire, much broader than long (ratio: 56:23) (fig. 14E).

Gnathopods 1-2 articles 2-4 rather similar to these in males. Gnathopod 1: article 5 shorter than propodus (ratio: 61:73), with distoanterior bunch of setae (fig. 13B). Propodus trapezoid, nearly as large as the corresponding coxa, slightly longer than broad (ratio: 74:69), posterior margin with 9 transverse rows of setae. Palm convex, with numerous long and short setae, inclined hardly over one half of the propodus-length, defined on outer face by strong corner S-spine accompanied laterally by 4 serrate L-spines and 9 facial corner M-setae, on inner face by one subcorner R-spine (fig. 13B). Dactylus reaching posterior margin of propodus, outer margin with row of 9 setae (3-3-1-2), along inner margin with row of very short single setae.

Gnathopod 2: article 5 shorter than propodus (ratio: 69:80), anterior margin with one distal bunch of setae. Propodus trapezoid, remarkably

larger than that of gnathopod 1, nearly as large as the corresponding coxa, posterior margin with 11 transverse rows of setae (fig. 13C). Palm slightly convex, inclined slightly over one half of the propodus-length, bearing numerous short and long setae, defined on outer face by one corner S-spine accompanied laterally by 3 slender L-spines and 7 corner M-setae, on inner face by one R-spine. Dactylus reaching posterior margin of propodus, outer margin with row of 11 single or groups of setae (1-3-3-2-1-1), inner margin with row of very short single setae.

P3-P6 like these in males. Pereopod 7: article 2 longer than broad (ratio: 96:58) anterior margin with 7-8 single or groups of spine-like setae, posterior slightly convex margin with nearly 13 short setae, ventroposterior lobe not distinctly developed. Articles 4-6 of different length (ratio: 55:70:87), articles along both margins with bunches of spines (fig. 14E). Article 2 slightly longer than article 6 (ratio: 96:87). Dactylus much shorter than article 6 (ratio: 30:87), inner margin with one spine accompanied by one short seta near the basis of the nail; outer margin with one median plumose seta; nail shorter than pedestal (ratio: 10:20) (fig. 14E).

Pleopods 1-3 with 2 retinacula. Pleopod 1-peduncle with 4 distoanterior simple setae (fig. 13D); pleopod 2-peduncle with 2 distoanterior simple setae (fig. 13E); pleopod 3-peduncle with 3 single simple setae along posterior margin (fig. 13F); lateral setae absent.

Uropod 1: peduncle with dorsoexternal row of spines and dorsointernal row of setae (except distal spine) (fig. 14F); inner ramus shorter than peduncle (ratio: 70:117), with 4 lateral spines and 2 bunches of simple setae, on the tip of the ramus 4-5 short distal spines. Outer ramus shorter than inner ramus (ratio: 60:70), with nearly 5 lateral spines and 2 bunches of simple setae; at tip with 5 short distal spines.

Uropod 2: peduncle with nearly 2 lateral and 3-4 distal spines; inner ramus with 4 lateral spines and one simple seta, at the tip 5 distal short spines; outer ramus hardly shorter than inner ramus, bearing 3 lateral single spines and 5 distal short spines (fig. 14F).

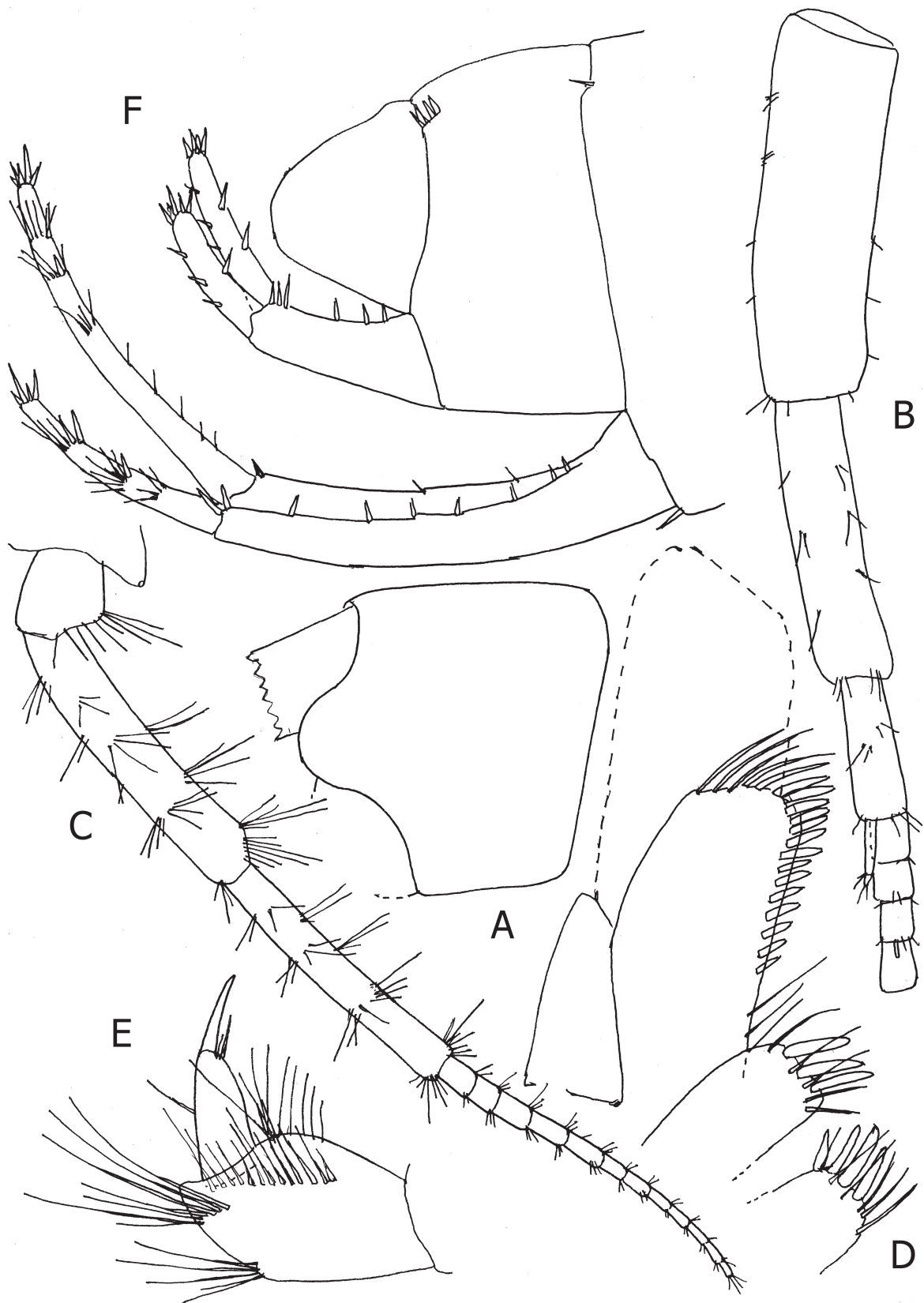


Fig. 8. *Niphargus (Niphargus) stygius* (Schiodte, 1847), Lubniška jama Cave, Lubnica (Škofja Loka), male 19.0 mm: A= head; B= antenna 1; C= antenna 2; D= maxilliped; E= maxilliped palpus; F= urosome with uropods 1-2.

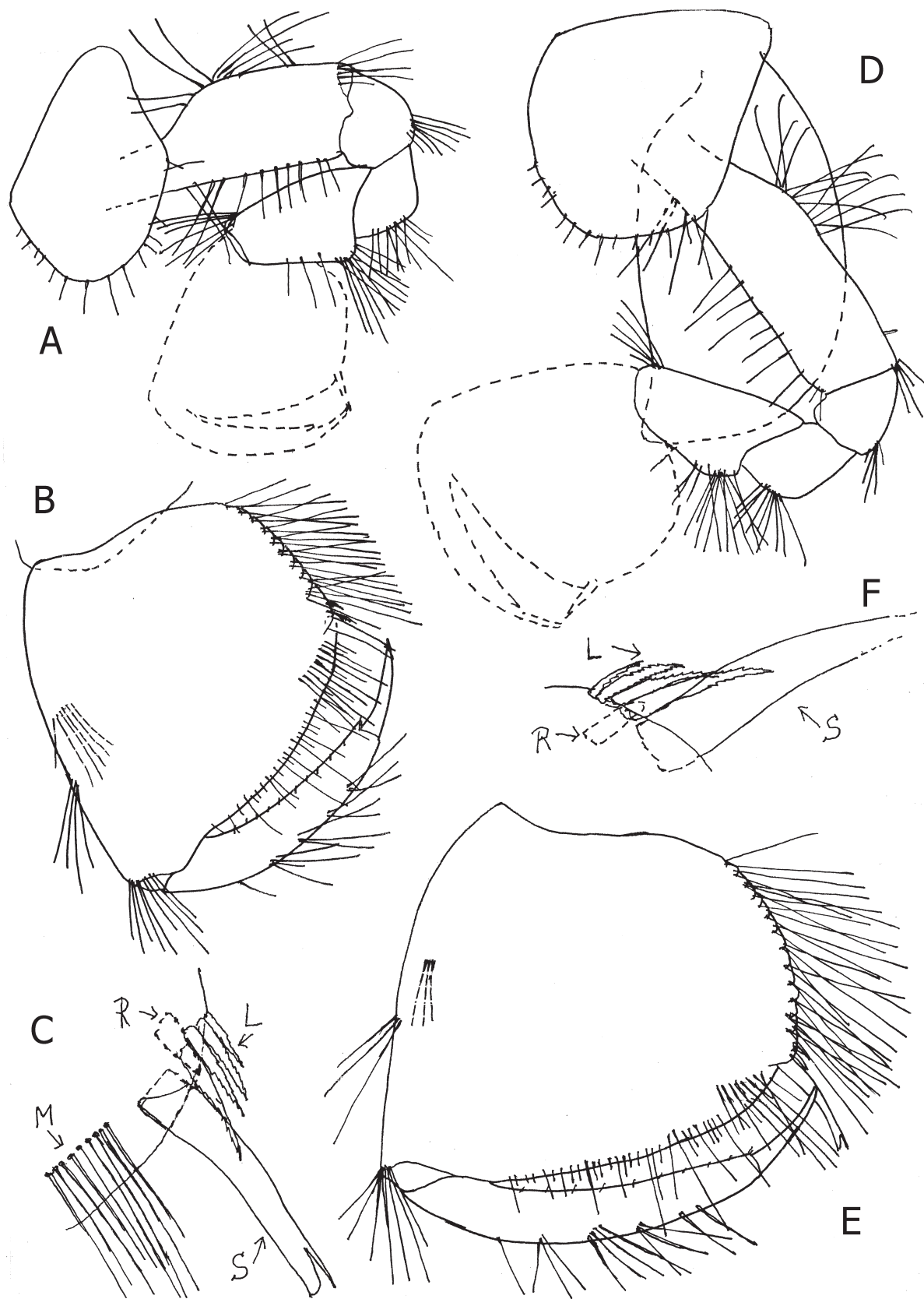


Fig. 9. *Niphargus (Niphargus) stygius* (Schiodte, 1847), Lubniška jama Cave, Lubnica (Škofja Loka), male 19.0 m: A-B= gnathopod 1, outer face; C= distal tip of gnathopod 1 propodus, outer face [S= corner S-spine; L= lateral L-spines; R= subcorner R-spine on inner face; M= facial M-setae]; D-E= gnathopod 2, outer face; F= distal tip of gnathopod 2 propodus, outer face [S= corner S-spine; L= lateral L-spines; R= subcorner R-spine on inner face; facial M-setae omitted]

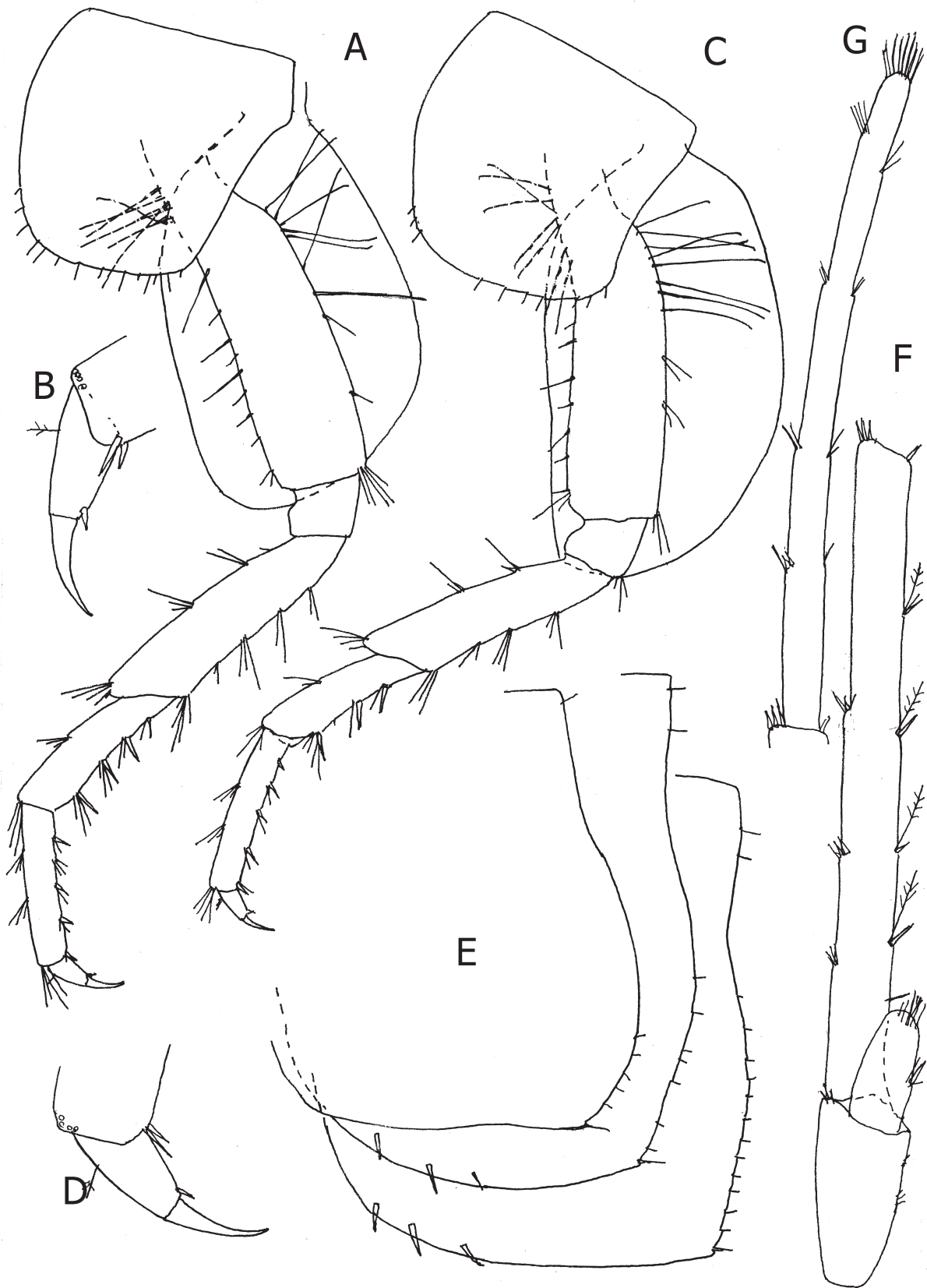


Fig. 10. *Niphargus (Niphargus) stygius* (Schiodte, 1847), Lubniška jama Cave, Lubnica (Škofja Loka), male 19.0 m: A-B= pereopod 3; C-D= pereopod 4; E= epimeral plates 1-3; F-G= uropod 3.

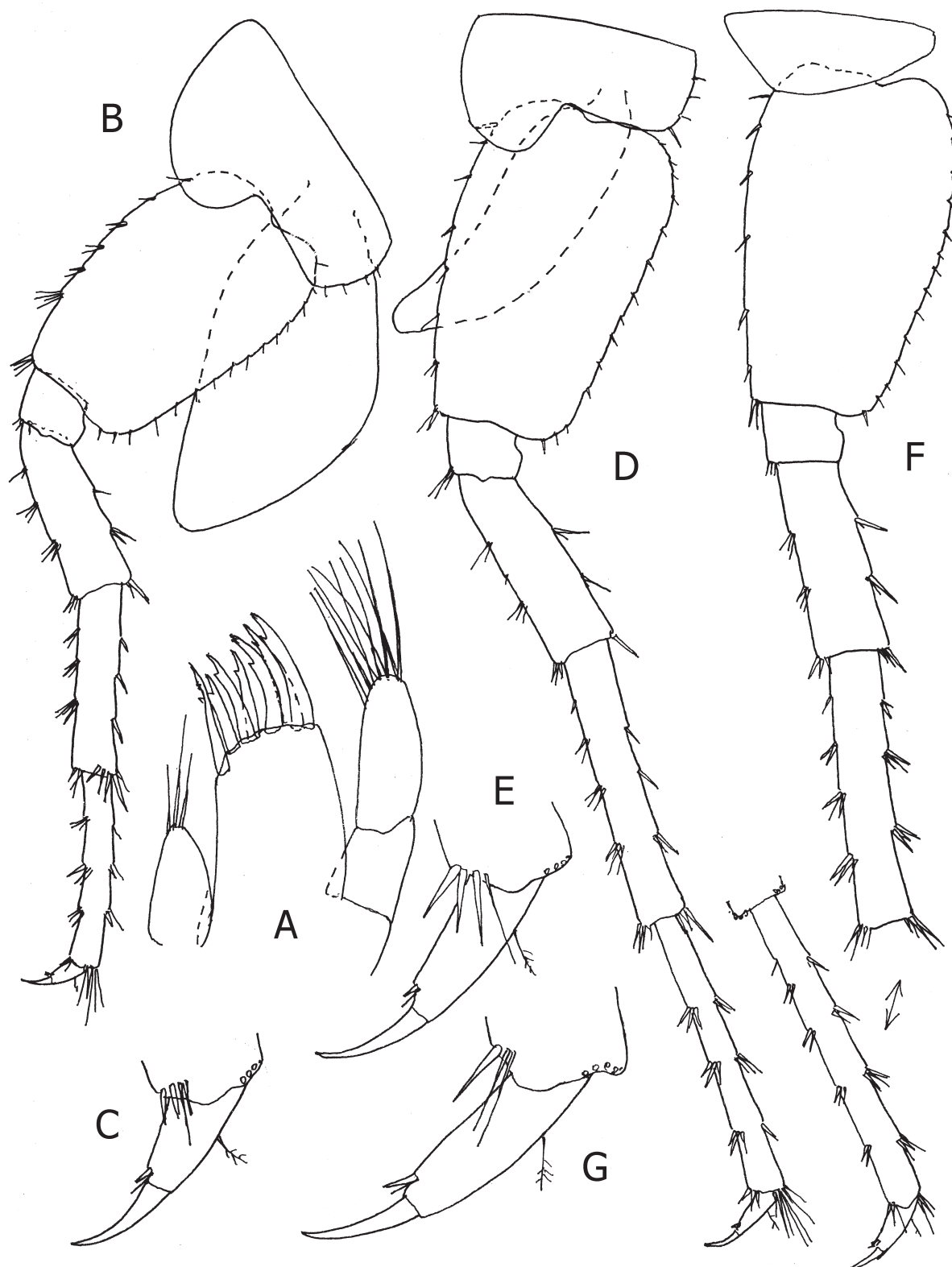


Fig. 11. *Niphargus (Niphargus) stygius* (Schiodte, 1847), Lubniška jama Cave, Lubnica (Škofja Loka), male 19.0 m: A= maxilla 1; B-C= pereopod 5; D-E= pereopod 6; F-G= pereopod 7.

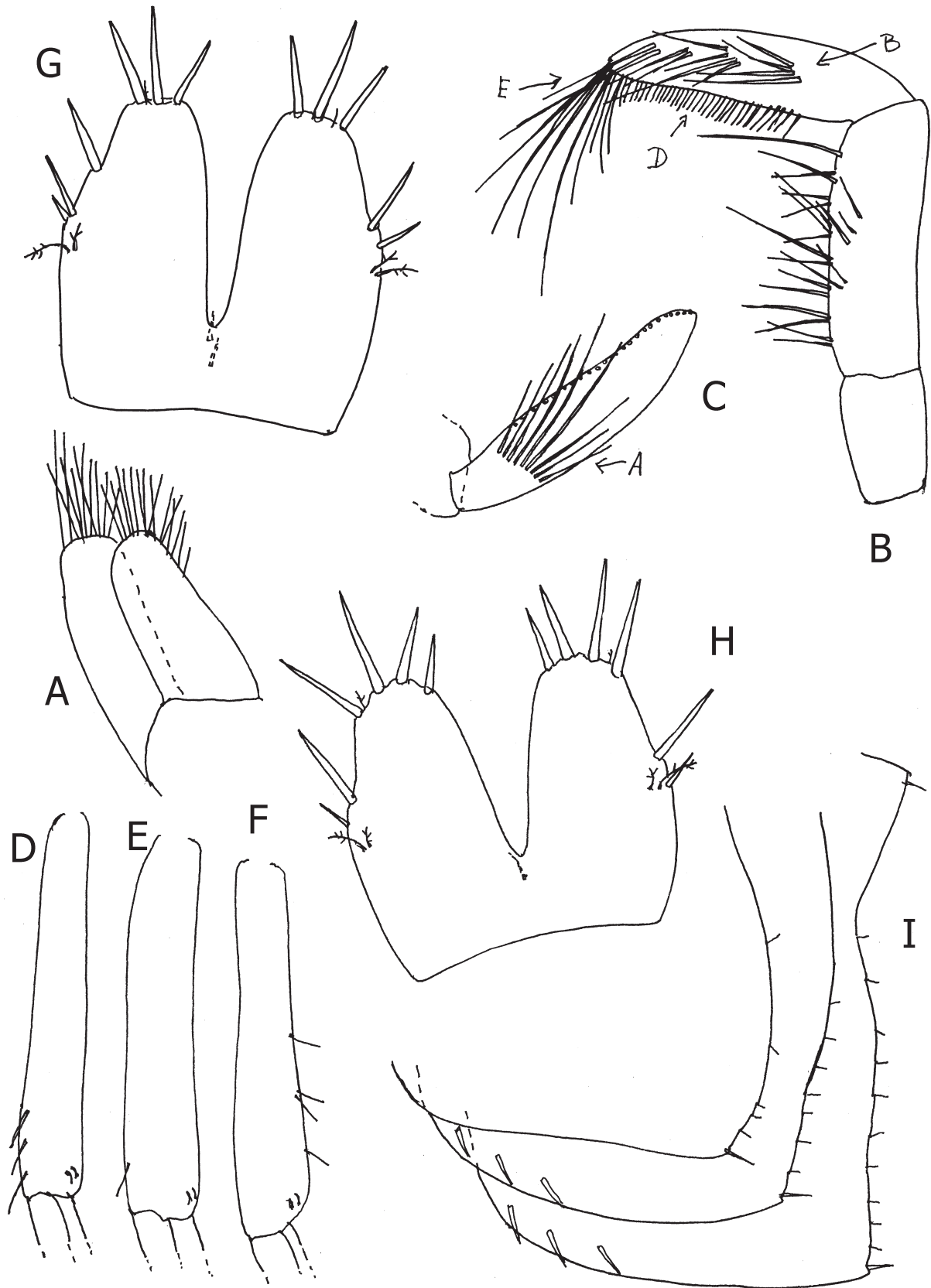


Fig. 12. *Niphargus (Niphargus) stygius* (Schiödte, 1847), Lubniška jama Cave, Lubnica (Škofja Loka), male 19.0 m: A= maxilla 2; B= mandible palpus, inner face [B= facial B-setae; D= marginal D-setae; E= distal E-setae]; C= mandible palpus distal article, outer face: [A= facial A-setae, other setae omitted]; D= pleopod 1 peduncle; E= pleopod 2 peduncle; F= pleopod 3 peduncle; G= telson.

FEMALE, 15.1 m: H= telson; I= epimeral plates 1-3.

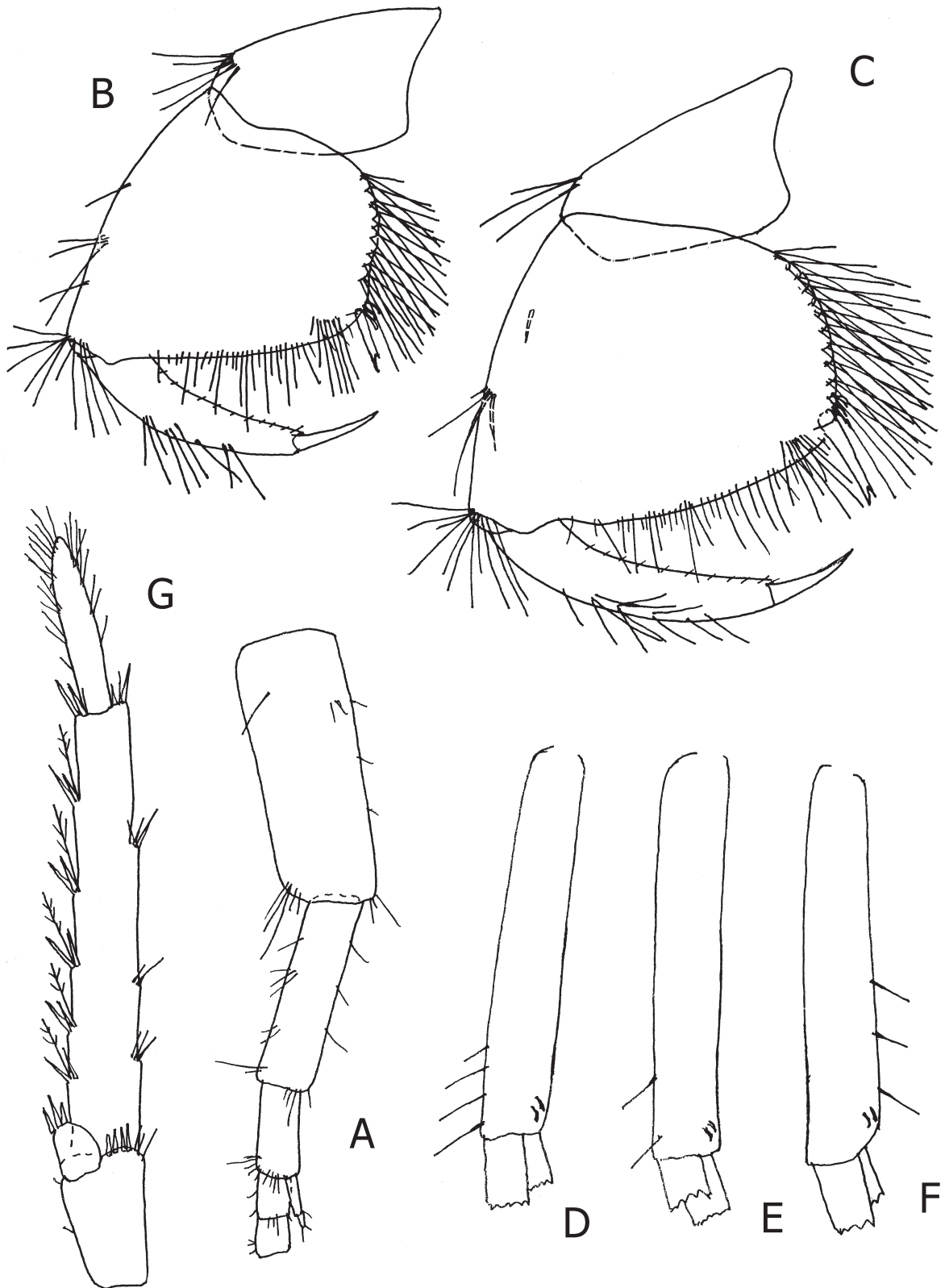


Fig. 13. *Niphargus (Niphargus) stygius* (Schiodte, 1847), Lubniška jama Cave, Lubnica (Škofja Loka), female 15.1 m: A= antenna 1; B= gnathopod 1 propodus, outer face; C= gnathopod 2 propodus, outer face; D= pleopod 1 peduncle; E= pleopod 2 peduncle; F= pleopod 3 peduncle; G= uropod 3.

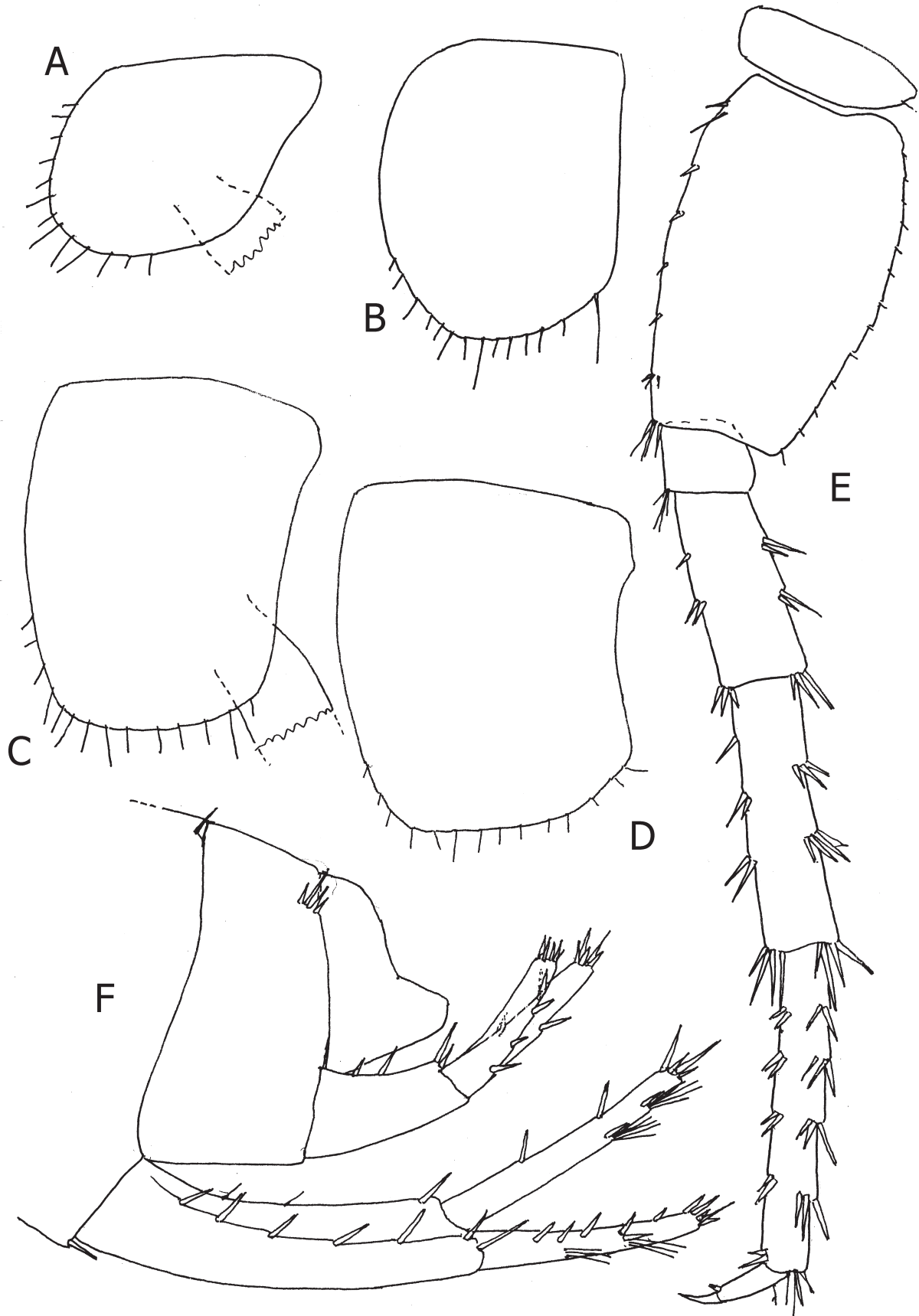


Fig. 14. *Niphargus (Niphargus) stygius* (Schiodte, 1847), Lubniška jama Cave, Lubnica (Škofja Loka), female 15.1 m: A= coxa 1; B= coxa 2; C= coxa 3; D= coxa 4; E= pereopod 7; F= urosome with uropods 1-2.

Uropod 3 shorter than that in male: peduncle longer than broad (ratio: 35:22), with several distal short spines; inner ramus short, scale-like, much shorter than peduncle, provided with 3 distal spines. Outer ramus 2-articulated: first article along outer margin with 4 bunches of short spines, along inner (mesial) margin with 6 groups of spines mixed with single long plumose setae (fig. 13G); second article remarkably shorter than first one (ratio: 45:112), both margins and tip with bunches of short simple setae.

Telson broader than long (ratio: 84:77), gapping, incised nearly 5/7 of telson-length; each lobe with 4 distal spines, at outer margin with one lateral spine and one seta (fig. 12H), facial spines absent. A pair of short sensitive setae attached near the middle of outer margin.

Gills like those in male. Oostegites broad, appear on gnathopod 2 to pereopod 5, with marginal setae.

DISCUSSION

The specimens from Lubniška Jama Cave are very close to *N. stygius* from type locality (Postojna Cave) and to *N. stygius stygius* f. *valvasori* S. Karaman 1952 (locus typicus: Križna jama Cave).

The male of Lubniška jama Cave is with obtusely angular epimeral plates, like these in *N. stygius* from Postojna Cave, but epimeral plates of female are more angular, like these in males and females of *N. stygius stygius* f. *valvasori* from Križna jama Cave. Uropod 1 in male with elongated inner ramus twice longer than outer one, like that in *N. stygius stygius* f. *valvasori*. Spines on telson short, like these in *N. stygius* from Postojna Cave.

The males 18.0 mm from Smoganica (Slovenia) are with elongated uropod 1 inner ramus twice as long as the outer one, like that in *N. stygius stygius* f. *valvasori*, uropod 3 distal article as long as first one; less angular epimeral plate 3.

Male of 15 mm with less pointed epimeral plates, uropod 1 outer ramus reaching 2/3 of inner one, and uropod 3 distal article as long as

first one. West of Postojna, towards the Adriatic coast, in Grotta Azzura near Trieste, males are similar to *N. stygius stygius* f. *valvasori*.

Detailed morphological characters of *N. stygius* are known from locus typicus only (Karaman, S., 1952, 1954; Sket, 1974; Karaman, G., 1993). We don't know much about morphological variability of *Niphargus stygius* outside locus typicus, because various authors cited *N. stygius* from many localities without or with very scarce morphological data.

Karaman, S. (1952) described *Niphargus stygius* forma *valvasori* [locus typicus: Križna Jama Cave, Slovenia] from several localities west of Postojna Cave in Slovenia, mainly based on differences regarding *N. stygius*: long inner ramus of uropod 1 in adult males, pointed epimeral plates in males, long spines on telson, slightly more setose gnathopods, etc. These differences are well developed in specimens from Križna jama Cave and some other localities mentioned by S. Karaman. Later various authors recognized this taxon as *N. stygius valvasori* (Sket & Stoch, 2014), or as *Niphargus valvasori* (NCBI, Taxonomic Browser 2021, based on genetic/molecular analysis), or *Niphargus stygius* (Delić et al., 2017A; 2017B) (based on genetic/ molecular analysis). But some authors consider NBCI as not reliable source.

The difficulties regarding uropod 1 were observed already by S. Karaman (1952), he mentioned (page 10) that within specimens from Logarček, all males of 16 mm were with uropod 1 inner ramus only slightly longer than outer one, but second article of uropod 3 reaching 2/3 of first one; by specimens of 20 mm inner ramus was twice longer than outer one, and uropod 3 was similar to that of 16 mm. He concluded that by this population (*valvasori*) in males during its grow, elongation of uropod 3 distal article appears before the elongation of uropod 1. We observed various combination of this manifestation also by various other species. Scarce knowledge of detailed morphological characters in populations of these two taxa from different localities, made its recognition and value difficult and debatable.

Our description of specimens from Lubniška

jama Cave near Škofja Loka support this opinion. Morphological differences between *stygius* and *valvasori* are relatively scarce and request further morphological and other studies on new samples. We have in hands relatively scarce number of specimens from limited number of localities, to resolve this problem based on morphological differences only.

DISTRIBUTION OF *STYGIUS*/ *VALVASORI* GROUP

Niphargus stygius was mentioned by many authors from numerous localities and caves over Balkan and Europe, but most of them later were recognized as other species. In Slovenia, *N. stygius* is cited from its central and southwestern part till region of Trieste (Venezia Giulia, Italy) and Rijeka in Croatia. I mentioned here the main citations of *stygius*/*valvasori* from Slovenia only.

Schellenberg (1936): cave Racizze (Castelnuovo, N. Istria); Mackowca Jama (Planina, Krain), cave Krasnica (Istria valley near St. Lucia) (sub *N. stygius*).

S. Karaman (1952): SLOVENIA: Postojna Cave (=Adelsberg Cave); Jama za Gradom near Predjama Cave (=Lueg) (Schiödte 1847). He mentioned also localities of D`Ancona (1942): Postojna Cave; Bucuie; Otocco; del Torrente; del Maestro; di Milesni; Zidanica; Castel Lueghi; Grotta del Orso; Samotorza [on italic-slovenian border (cited as original) (all sub *N. stygius stygius*).

S. Karaman (1954) mentioned the localities: Križna Jama Cave (locus typicus); Logarček; Studena Rupa; Jerinovec; Babja Luknja; Koševka; Lubniška Jama; Jama za Bukovim Vrhom; Stota Jama; Mala Pasica; Beč” probably also Nemška Vas near Ribnica”;” maybe Kevderce near Škofja Loka” (all in Slovenia, sub forma *valvasori*).

S. Karaman (1954) sub *N. stygius stygius* cited region from Postojna till Soča (=Isonzo): Ciganska Jama near Idrija; Ponikve-Druga; Medvednica Jama; Zidanica-Slap; Divja Jama near Plav; Sv. Lucija near Tolmin; in Friuli

near Prestento E. of Udine (=Videm); in south till subterranean waters of Timavo River, and in North till Škofja Loka (=Bischoflaak). He mentioned Škofja Loka as well as the specimens western of Postojnska Jama Cave sub f. *valvasori*.

Mezek et al. (2010): Iščica River and Velika Pasica Cave (SW Slovenia) (sub *N. stygius*).

Sket & Stoch, 2014: Križna jama Cave (sub *N. stygius valvasori*).

Pipan et al., 2012: Nanos Mt., Slovenia (sub *stygius*).

Delić et al., 2017a: Jelenska jama Cave, Borovnica, Vrhnika/ Predjamski system, Bukovje, Postojna/ Vogršček, Avče, Nova Gorica/Šumnik, Lepena, Bovec/ Marjino brezno, Lubnik, Škofja loka/ Bunker in Visintini, Dobredob, Gorica/ Studenec above St. Marjeto, Palče, Pivka/ Čendova jama Cave, Klavže, Šentviška gora Mt. (all sub *N. stygius*).

Delić et al. (2017b) mentioned: Križna jama Cave, Bloška polica, Lož (sub *N. stygius*).

Delić et al. (2017a) based on molecular genetics investigations of *stygius* group of taxa, split it into several new species (*N. goricae*, *N. cvajcki*, *N. kapelanus*, *N. iskae*, *N. malagorae*, *N. gottscheeanensis*, *N. chagankae*, *N. kordunensis*) based on genetic data and without clear diagnoses, descriptions and figures of these taxa, making one confusion in recognition of single species of *N. stygius* complex by morphological characters. Based on scarce data, specimens from Lubniška jama Cave differs from all these taxa.

Recently, Delić et al. (2021) used for molecular analyses and ecological niche modeling, samples of 56 localities from the entire range of the *N. stygius* species complex in Slovenia. Based on this study, they recognized 4 lineages of populations (alpine, central, karst and Vipava lineage) presented on their map. Unfortunately, they missed to study morphological and taxonomical characters of studied populations from these 56 localities, and these data remains still unknown.

S. Karaman (1952) described complex of different new taxa close to *Niphargus stygius* (Schiödte, 1847) (*valvasori*, *likanus*, *brachytelson*, *kenki*, *podpečanus*, *novomestanus*) including also

Niphargus stygius karamani Schellenberg, 1935, under new subgenus *Stygoniphargus* (typus subgeneris: *Gammarus stygius* Schiödte, 1847). Unfortunately, *N. stygius* is typus generis of entire genus *Niphargus* and also of nominal subgenus *Niphargus*, with typus subgeneris: *Gammarus stygius* Schiödte, 1847. By this way name subgenus *Stygoniphargus* is replaced with name subgenus *Niphargus* with the same typus subgeneris, *Gammarus stygius* Schiödte 1847.

ACKNOWLEDGEMENTS

I am thankful to the collectors of material Jasna Frišić & Ivan Napotnik as well as to Prof. Dr. Jasminko Mulaomerović from Sarajevo for material sent me for study. My thanks also to Dr. Fabio Stoch from Italy for some of material used in this study.

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Received: 1th September 2021.
Accepted: 22nd November 2021.