Records of the Australian Museum (2023)
vol. 75, issue no. 4, pp. 437–446
https://doi.org/10.3853/j.2201-4349.75.2023.1883

Records of the Australian Museum
a peer-reviewed open-access journal
published by the Australian Museum, Sydney
communicating knowledge derived from our collections
ISSN 0067-1975 (print), 2201-4349 (online)

New Data on Niphargidae (Amphipoda) from Northern Macedonia, *Niphargus lowryi* sp. nov.

(Contribution to the Knowledge of the Amphipoda 326)

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Abstract. New species of subterranean freshwater species, *Niphargus lowryi*, sp. nov. (Amphipoda, fam. Niphargidae) from the springs near St. Naum Monastery on Ohrid Lake, Northern Macedonia, is described and figured. This species was collected mixed with numerous specimens of *N. sanctinaumi* S. Karaman, 1943. The relation of this species to other species of *Niphargus* from Northern Macedonia and Greece is discussed.

Introduction

The subterranean fauna of Amphipoda in Northern Macedonia has been studied intensively mainly by Stanko Karaman (1929, 1931, 1933, 1943, 1957, 1959), S. Karaman & G. Karaman (1959), and later by G. Karaman (1960, 1963, 1973, 1977, 2020a, b), Karaman & Pinkster (1987), and Gabrovsky *et al*. (2017). Regarding the family Niphargidae, nearly 20 taxa of this family have been discovered and described from 1929 to today. This fauna, however, is still only partially known, confirmed by the present discovery of a new species of *Niphargus* Schiödte, 1849 from this country, *N. lowryi* sp. nov. This species was collected in 1968 from a spring near the Monastery St. Naum at the coast of Ohrid Lake, amongst numerous specimens of *Niphargus sanctinaumi* S. Karaman, 1943. Numerous subsequent attempts to collect this species, were unsuccessful.

Materials and methods

The specimen used in this study was collected in the spring near Monastery St. Naum and preserved in 70% ethanol and is deposited in Karaman's Collection in Podgorica, Montenegro. The studied specimen was immersed in a solution of glycerin and water for study with a WILD M20 microscope and drawn manually using a camera lucida. The dissected body-parts were mounted in Liquid of Faure as permanent slides.

Some morphological terminology and setal formulae follow G. Karaman (1969, 2012): for the last mandibular palp article (A = A-setae on outer face; B = B-setae on inner face; D = lateral marginal D-setae; E = distal long E-setae) and for the propodus of gnathopods 1 and 2 (S = corner S-spine; L = lateral slender serrate L-spines; M = corner facial M-setae; R = subcorner R-spine on inner face).

The terms "setae" and "spines" are used based on shape, not origin. The study is based on morphological, ecological, and zoogeographical data.

Keywords: taxonomy, new species, *Niphargus lowryi*, Amphipoda, subterranean waters, Ohrid Lake region, Northern Macedonia
ZooBank registration: urn:lsid:zoobank.org:pub:F0F262CC-DC6C-4046-90CF-32752F3EF63E
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Submitted: 4 May 2022 **Accepted**: 16 July 2022 **Published**: 6 December 2023 (in print and online simultaneously)
Publisher: The Australian Museum, Sydney, Australia (a statutory authority of, and principally funded by, the NSW State Government)
Citation: Karaman, Gordan S. 2023. New data on Niphargidae (Amphipoda) from northern Macedonia, *Niphargus lowryi* sp. nov. In *Festschrift in Honour of James K. Lowry*, ed. P. B. Berents, S. T. Ahyong, A. A. Myers, and L. Fanini. *Records of the Australian Museum* 75(4): 437–446. https://doi.org/10.3853/j.2201-4349.75.2023.1883

Taxonomy

Family Niphargidae Bousfield, 1977

Niphargus Schiödte, 1849

Type species. *Niphargus stygius* (Schiödte, 1847).

Niphargus lowryi sp. nov.

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Figs 1–5

Holotype: No. S-4046, ovigerous female (22.0 mm), Spring near Monastery St. Naum, near the coast of Ohrid Lake, Northern Macedonia, 40°54'50"S 20°44'42"E, amongst specimens of *Niphargus sanctinaumi* S. Karaman, 1943, coll. G. Karaman, 21 July 1968.

Diagnosis (ovigerous female). Large species over 20 mm, metasomal segments with several short dorsoposterior marginal setae, urosomal segments 1–2 with dorsolateral spines; epimeral plates sharply angular. Antenna 1 peduncular articles progressively shorter, flagellar articles with one aesthetasc each; antenna 2 flagellum slender, as long as last peduncular article. Coxae 1–4 relatively short, coxa 4 unlobed. Maxilla 1 inner plate with 7–9 setae, outer plate spines not pectinate, palpus short. Maxilliped inner plate short, with 4 distal spines, palp article 4 with 5 marginal setae at inner margin of the dactylus. Gnathopods 1–2 large, with propodus larger than corresponding coxae, rather trapezoid, palm very oblique; L-spines of gnathopod 1 propodus sitting laterally; L-spines of gnathopod 2 propodus sitting partially behind S-spine; dactylus with row of several short outer marginal setae. Dactylus of pereopods 3–7 strong, with strong spine at inner margin near basis of nail. Pereopods 5–7 elongated, with narrowed unlobed article 2. Pleopods 1–3 with 4–6 retinacula, peduncles scarcely setose. Uropod 1 peduncle with dorsointernal row of setae, rami of equal length. Uropod 3 slender, spinose, not elongated, with very short distal article of outer ramus. Telson short, incised nearly half of its length, gaping, with 3 short distal spines and shorter lateral plumose setae.

Description of female holotype. *Body*: strong, metasomal segments 1–3 with 4 or 5 dorsoposterior marginal short setae (Fig. 4F). Urosomal segment 1 with 1 spine and 1 seta at each dorsolateral side; urosomal segment 2 with 2 spines and 1 or 2 setae on each dorsolateral side; urosomal segment 3 smooth (Fig. 1F). Urosomal segment 1 with 1 strong spine on each ventroposterior corner near basis of uropod 1-peduncle (Fig. 1F).

Epimeral plates: 1–3 nearly quadrate, sharply angular, with well-marked ventroposterior corner and poorly concave posterior margin bearing 1 stronger seta and 4–6 short single setae at at corner (Fig. 4F). Epimeral plate 2 with 1, and epimeral plate 3 with 2 ventral submarginal spines.

Head: with slightly convex dorsal margin (in lateral projection), rostrum short, lateral cephalic lobes subrounded and short, ventroanterior excavation deep; eyes absent (Fig. 1A).

Antenna 1: reaching nearly half body length; peduncular articles 1–3 moderately slender, progressively shorter (ratio: 59:48:24), very scarcely setose (all setae shorter than the diameter of articles themselves) (Fig. 1B). Main flagellum slender, with 42 scarcely setose articles, most articles with aesthetasc reaching nearly half length of article itself (Fig. 1D). Accessory flagellum very short, 2-articulated, reaching nearly half length of peduncular article 3 (Fig. 1C).

Antenna 2: moderately slender; peduncular article 3 short, nearly as long as broad, provided with distoventral cluster of setae almost as long as article itself (Fig. 1E); article 4 slightly shorter and broader than article 5 (ratio: 95:102), ventral margin with 3 clusters of setae (longest setae exceeding diameter of article itself), dorsal margin with 5 groups of short setae; article 5 with 5 ventral clusters of setae (many remarkably longer than diameter of article itself), at dorsal margin with 5 or 6 clusters of short setae; flagellum slender, nearly as long as peduncular article 5, scarcely setose, consisting of 16 articles. Antennal gland cone short (Fig. 1E).

Labrum: broader than long, slightly concave distally (Fig. 1A). Labium much broader than long, inner lobes small but well developed, outer lobes broad, entire (Fig. 2B).

Mandible: with triturative molar. Left mandible incisor with 5 teeth, lacinia mobilis with 4 teeth accompanied by 8 rakers. Right mandible incisor with 4 teeth, lacinia mobilis serrate, accompanied by 12 rakers (Fig. 2C). Mandibular palp 3-articulated: article 1 smooth, article 2 with 18 setae; article 3 subfalciform, slightly longer than article 2, more-or-less slender (Fig. 2D), with nearly 28 marginal D-setae and 6 long distal E-setae, outer face with transverse row of 7 A-setae (Fig. 2E), inner face with 4 groups of B-setae (3-4-3-1, or: 2-3-4-4) (Fig. 2D).

Maxilla 1: inner plate short, not reaching basis of outer plate-spines, with 7–9 distal setae (Fig. 4A); outer plate with 7 spines (5 spines with lateral tooth, 2 spines with 2 teeth; or 4 spines with 1 lateral tooth, 3 spines with 2 or 3 teeth); palp 2-articulated, not reaching tip of outer plate-spines and provided with 6 or 7 distal setae.

Maxilla 2: inner plate rather smaller than outer plate, with numerous distal setae, as well as marginal setae in upper half of plate (Fig. 2F); outer plate with numerous distal setae.

Maxilliped: inner plate short, with 4 distal pointed spines mixed with several setae (Fig. 2G); outer plate not exceeding half of palp article 2, at mesial margin with 3 proximal setae and 10 or 11 spines, tip with several longer setae; palp article 3 with 2 clusters of setae on outer margin and row of setae on inner margin; article 4 (dactylus) with 5 setae near basis of nail along inner margin (Fig. 2H), with median seta along outer margin; nail much shorter than pedestal.

Coxae: relatively short. Coxa 1 broader than long (ratio: 42:33), ventroanterior corner subrounded, with nearly 11 short marginal setae (Fig. 3A). Coxa 2 remarkably larger than coxa 1, nearly as long as broad, with 9 short setae along ventral margin of convex shape (Fig. 3D). Coxa 3 broader than long (ratio: 53:51), with 9 setae along the ventral margin of convex shape (Fig. 4B). Coxa 4 broader than long (ratio: 51:46), anterior margin broadly convex, with 6 or 7 setae, ventroposterior lobe absent (Fig. 4D). Coxa 5 only slightly shorter than 4, bilobed, much broader than long (ratio: 59:37), anterior lobe short, subrounded, with 4 marginal setae, posterior lobe of more quadrate shape, with 2 setae (Fig. 5A). Coxa 6 bilobed, much broader than long (ratio: 48:27), with 2 or 3 marginal setae only (Fig. 5C). Coxa 7 entire, much broader than long (ratio: 35:21), with short posterior seta (Fig. 5F).

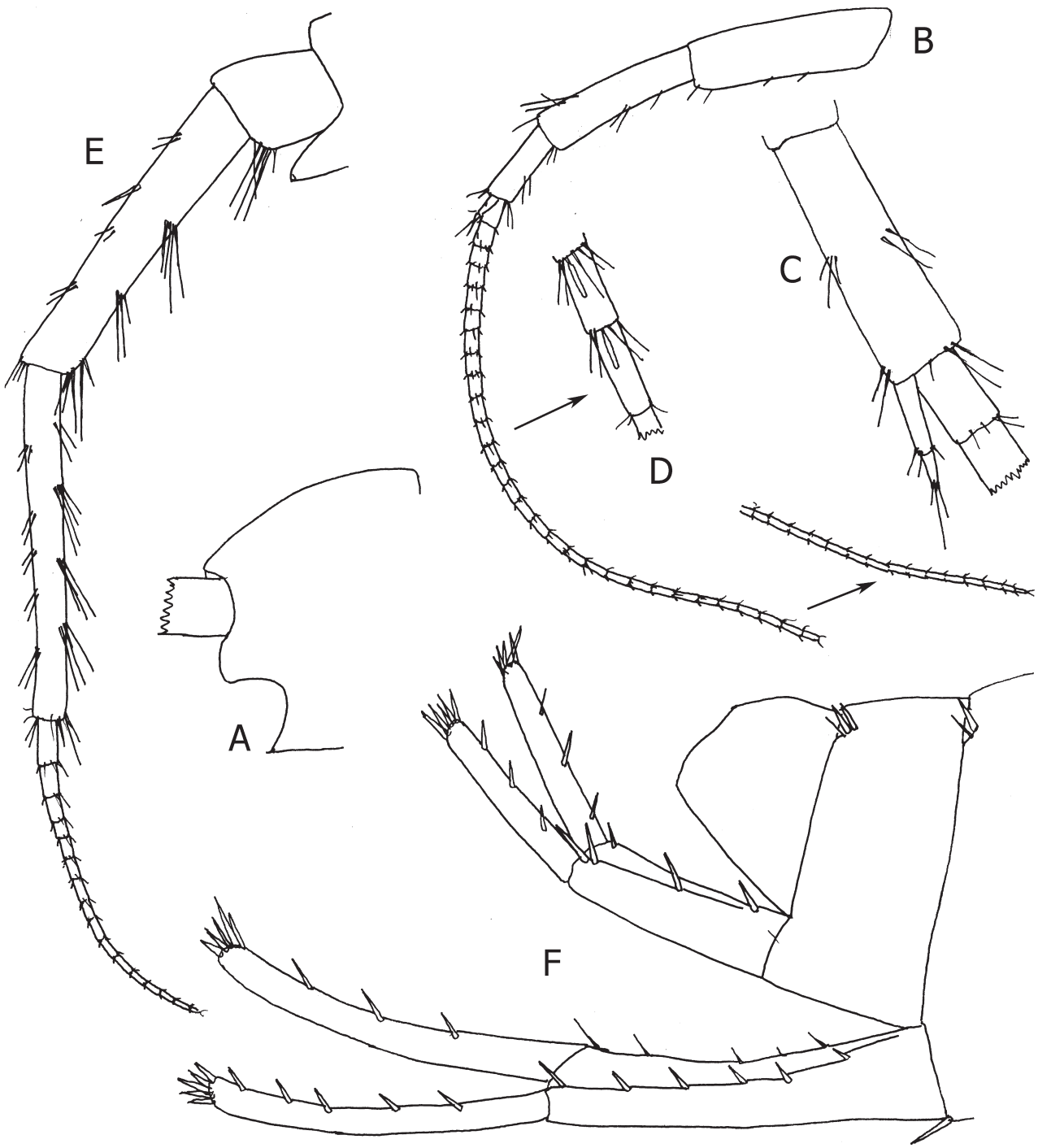

Figure 1. *Niphargus lowryi* sp. nov., spring near Monastery St. Naum, Ohrid Lake coast, female 22.0 mm (holotype): (*A*) head; (*B*) antenna 1; (*C*) accessory flagellum; (*D*) aesthetasc on antenna 1; (*E*) antenna 2; (*F*) urosome and uropods 1–2.

Gnathopods 1–2: large, propodus remarkably larger than corresponding coxa (Fig. 3A, D). Gnathopod 1 article 2 with numerous long setae at anterior and posterior margin; article 3 with distoposterior cluster of setae. Article 5 short, triangular, much shorter than propodus (ratio: 33:58), with distoanterior cluster of setae and numerous setae posteriorly (Fig. 3A). Propodus rather trapezoid (ratio: 91:77); convex posterior margin with 12 transverse rows of setae; palm convex, rather inclined over half of propodus-length, with row of numerous marginal short unequal setae (Fig. 3B), defined on outer face by corner S-spine accompanied laterally by 2 L-spines sitting very close to S-spine, and by 4 corner facial M-setae, on inner face by short subcorner R-spine (Fig. 3C). Dactylus reaching posterior margin of propodus, along outer margin a row of 6 or 7 short single or paired setae, along inner margin with row of very short setae (Fig. 3B).

Gnathopod 2 remarkably larger than gnathopod 1, article 2 with row of anterior marginal shorter setae and row of posterior long setae; article 3 with distoposterior cluster of setae. Article 5 remarkably shorter than propodus (ratio: 46:75), with distoanterior cluster of setae and numerous

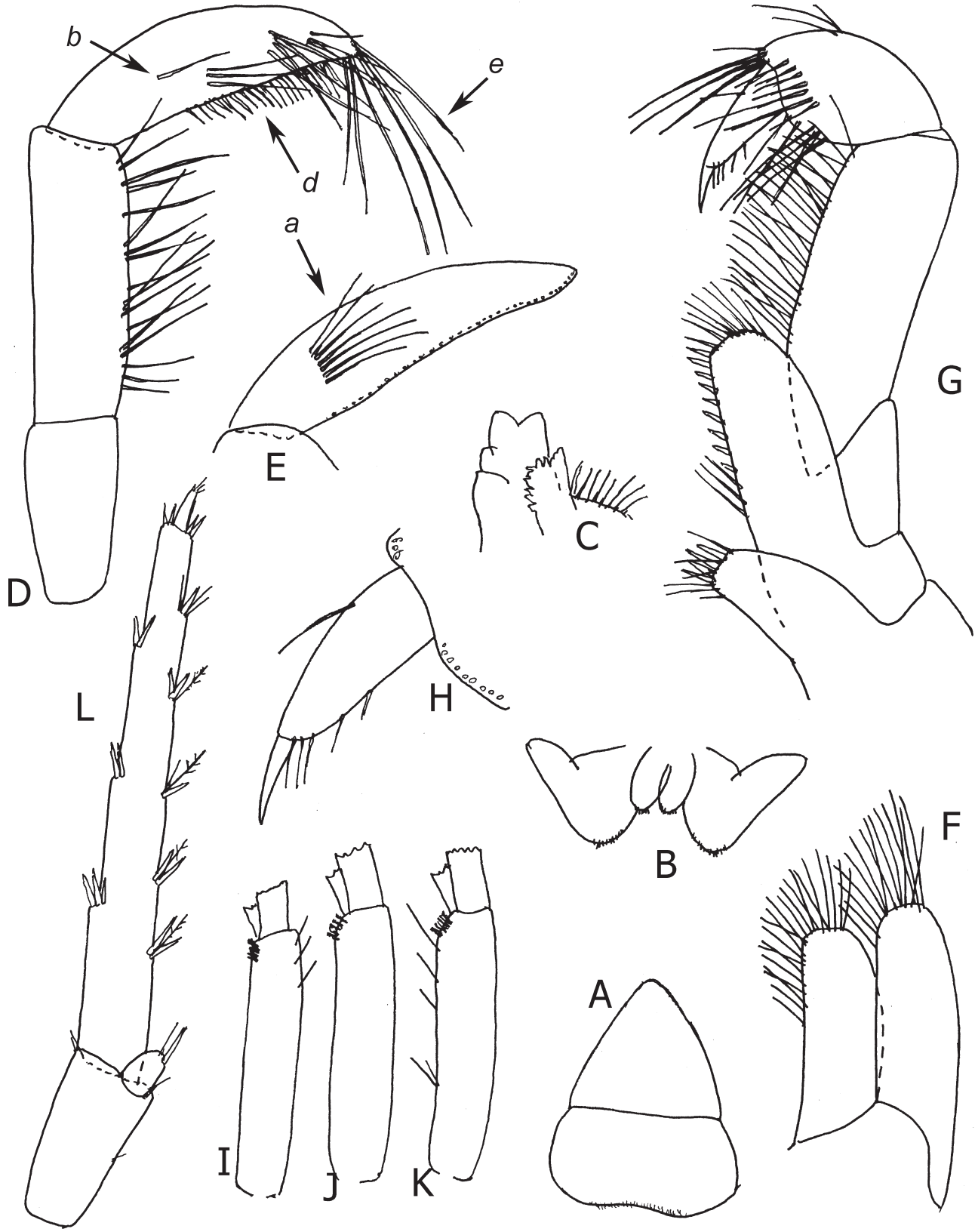

Figure 2. *Niphargus lowryi* sp. nov., spring near Monastery St. Naum, Ohrid Lake coast, female 22.0 mm (holotype): (*A*) labrum; (*B*) labium; (*C*) right mandible; (*D*) mandibular palp, inner face [*b* = facial B-setae; *d* = marginal D-setae; *e* = distal E-setae]; (*E*) mandibular palp distal article, outer face [*a*= facial A-setae]; (*F*) maxilla 2; (*G*) maxilliped; (*H*) maxilliped, distal part of palp; (*I*) pleopod 1 peduncle; (*J*) pleopod 2 peduncle; (*K*) pleopod 3 peduncle; (*L*) uropod 3.

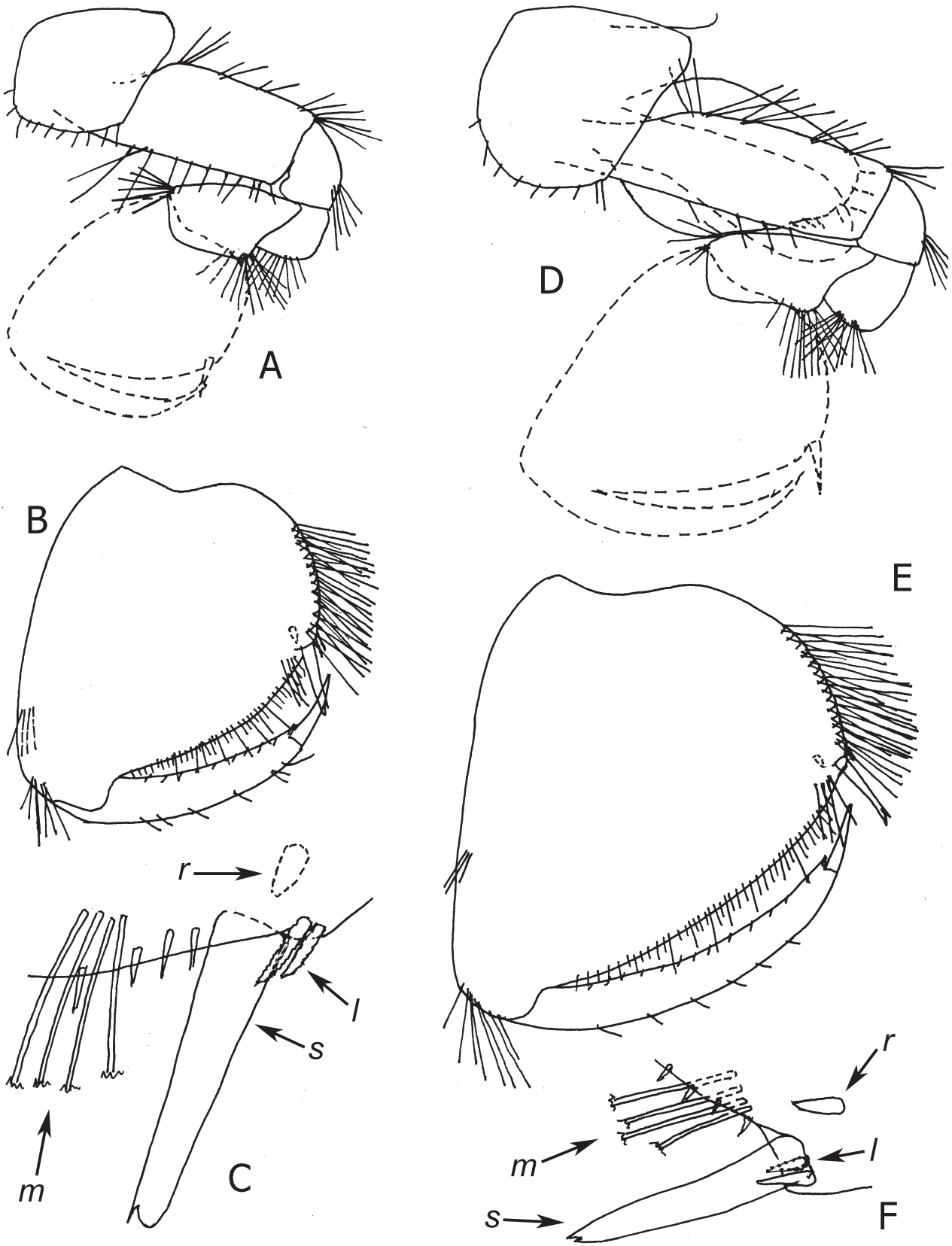

Figure 3. *Niphargus lowryi* sp. nov., spring near Monastery St. Naum, Ohrid Lake coast, female 22.0 mm (holotype): (*A–B*) gnathopod 1, outer face; (*C*) corner of gnathopod 1 propodus, outer face [*s* = corner S-spine; *l* = lateral L-spines; *r* = subcorner R-spine; *m* = corner facial M-setae]; (*D–E*) gnathopod 2, outer face; (*F*) corner of gnathopod 2 propodus, outer face [*s* = corner S-spine; *l* = lateral L-spines; *r* = subcorner R-spine; *m* = corner facial M-setae].

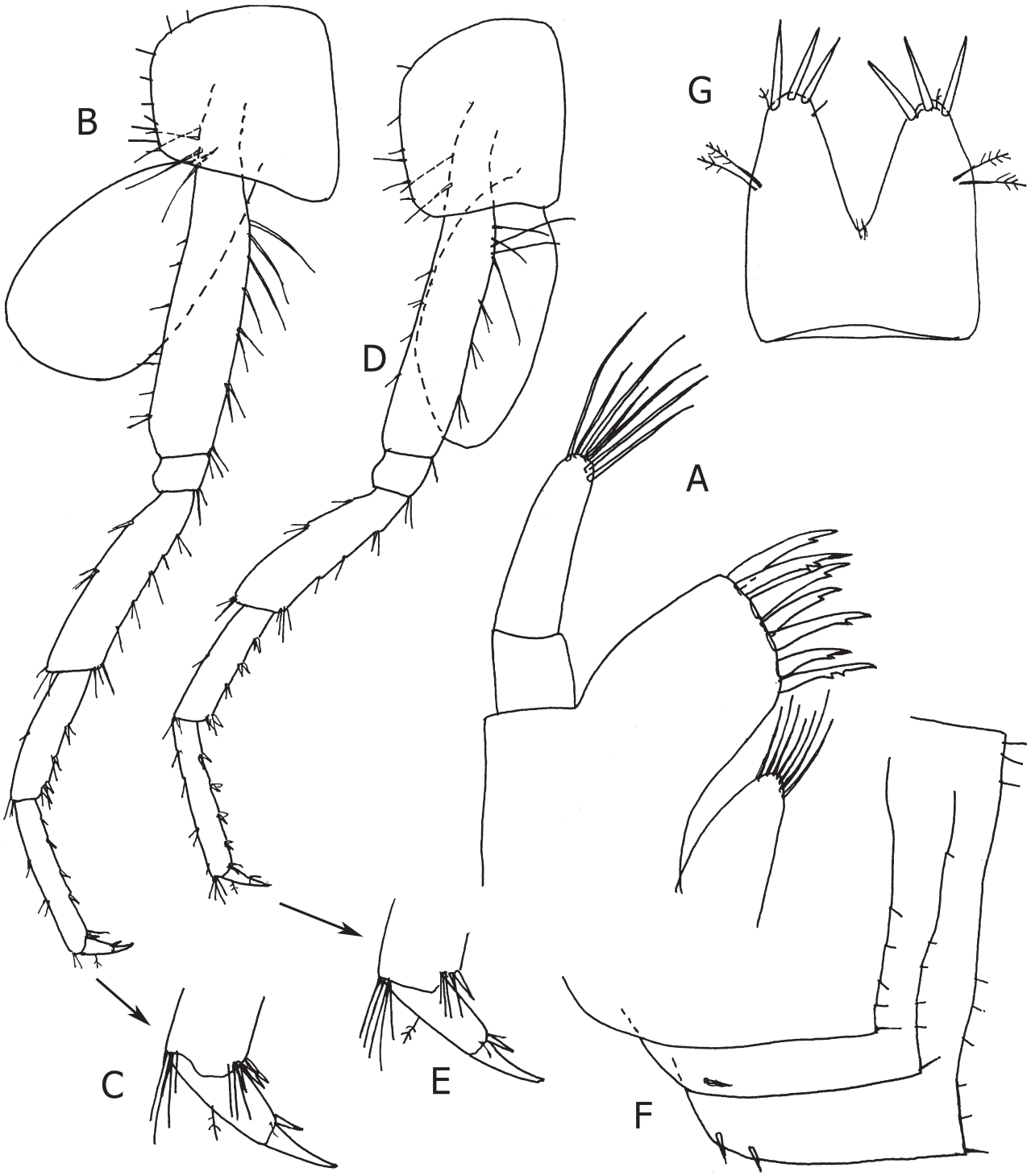

Figure 4. *Niphargus lowryi* sp. nov., spring near Monastery St. Naum, Ohrid Lake coast, female 22.0 mm (holotype): (*A*) maxilla 1; (*B–C*) pereopod 3; (*D–E*) pereopod 4; (*F*) epimeral plates 1–3; (*G*) telson.

posterior setae (Fig. 3D). Propodus longer than broad (ratio: 114:102), rather trapezoid, along posterior convex margin 14 transverse rows of setae; palm convex, inclined, nearly ⅔ of propodus-length, with row of short unequal marginal setae (Fig. 3E) and defined by corner S-spine on outer face, accompanied by 1 or 2 L-spines (heavily damaged) partially behind it and by 4 corner facial M-setae; inner face of propodus with 1 subcorner R-spine (Fig. 3F). Dactylus nearly reaching posterior margin of propodus, along outer margin with row of 6 or 7 short single setae, along inner margin with row of very short setae (Fig. 3E).

Pereopod 3: slender; article 2 with long setae at anterior and posterior margin, and shorter setae on distal part of article; articles 4–6 of different lengths (ratio: 58:42:48); article 4 posterior margin with groups of short setae (setae not exceeding diameter of article itself); posterior margin of article 5 with 3 groups of short setae mixed with short spines; article 6 posterior margin with 5 groups of short spines and

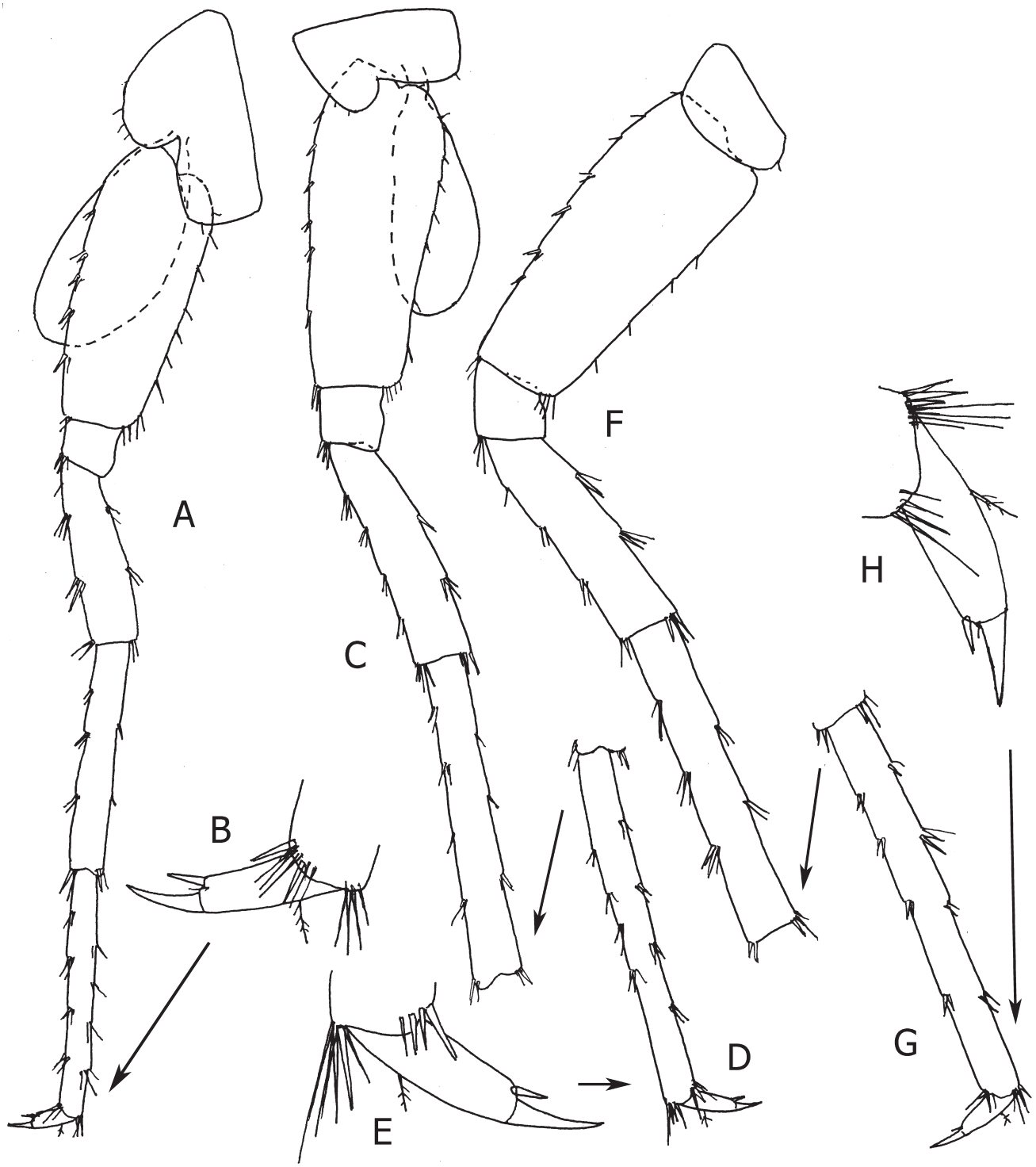

Figure 5. *Niphargus lowryi* sp. nov., spring near Monastery St. Naum, Ohrid Lake coast, female 22.0 mm (holotype): (*A–B*) pereopod 5; (*C–E*) pereopod 6; (*F–H*) pereopod 7.

single short setae (Fig. 4B). Dactylus short and strong, much shorter than article 6 (ratio: 16:48), inner margin with strong spine near the basis of nail mixed with 1 or 2 short setae, outer margin with median plumose seta (Fig. 4C); nail shorter than pedestal (ratio: 21:45).

Pereopod 4: similar to pereopod 3, slightly shorter; pilosity of articles 2–6 similar to pereopod 3. Articles 4–6 of different length (ratio: 50:38:45) (Fig. 4B). Dactylus much shorter than article 6 (ratio: 16:45), with strong spine at inner margin mixed with small seta and median plumose seta on outer margin (Fig. 4E); nail shorter than pedestal (ratio: 31:23).

Pereopod 5: distinctly shorter than pereopods 6 and 7, article 2 narrow, much longer than broad (ratio: 80:34); anterior margin with 6 groups of short spines mixed with single short setae; posterior margin almost straight, with 7 short setae; ventroposterior tip with 3–5 short setae (Fig. 5A). Articles 4–6 of different lengths (ratio: 51:66:70); articles

4–5 anteriorly and posteriorly with groups of short setae mixed with single very short spines; article 6 at anterior margin with 5 groups of short spines and short single setae, at posterior margin with 5 groups of short setae and distal spine. Article 2 longer than article 6 (ratio: 80:70). Dactylus much shorter than article 6 (ratio: 21:70), strong, with strong spine and small seta at inner margin; 1 median plumose seta on outer margin (Fig. 5B); nail shorter than pedestal (ratio: 22:40).

Pereopod 6: article 2 narrow, poorly tapering distally, much longer than broad (ratio: 91:38), with 7 groups of short spines on anterior margin and 7 or 8 short setae at posterior linear margin; 3 or 4 short setae on ventroposterior corner of article 2 (Fig. 5C). Articles 4–6 of different lengths (ratio: 66:91:102), along anterior and posterior margin with bunches of very short setae and short spines much shorter than diameter of articles themselves. Article 6 longer than article 2 (ratio: 102:91) (Fig. 5D). Dactylus strong, much shorter than article 6 (ratio: 24:102), with strong spine and short seta at inner margin near basis of nail, 1 median plumose seta on outer margin (Fig. 5E); nail shorter than pedestal (ratio: 27:55).

Pereopod 7: rather longer than pereopod 6 (mainly article 6); article 2 narrow, much longer than broad (ratio: 94:40), somewhat tapering ventrally, anterior margin almost straight bearing 7 groups of short spines and short setae, posterior margin straight, with 4 or 5 short setae, 4 short setae at ventroposterior corner (Fig. 5F). Articles 4–6 of different lengths (ratio: 67:94:119), articles along anterior and posterior margins with several groups of short spines and setae (always much shorter than diameter of articles themselves) (Fig. 5G). Article 2 is shorter than article 6 (ratio: 94:119). Dactylus remarkably shorter than article 6 (ratio: 29:119), with 1 strong spine and 1 small seta on inner margin near basis of nail and 1 median plumose seta at outer margin (Fig. 5H); nail shorter than pedestal (ratio: 25:63).

Pleopods: with elevated number of retinacula. Peduncle of pleopod 1 with 4 retinacula, and 3 distoanterior marginal simple setae (Fig. 2 I); peduncle of pleopod 2 smooth, with 5 retinacula (Fig. 2J). Peduncle of pleopod 3 with 6 retinacula and 5 posterior marginal setae (Fig. 2K).

Uropod 1: peduncle with dorsointernal row of setae and dorsoexternal row of spines (Fig. 1F), inner ramus scarcely longer than outer ramus, bearing 3 lateral and distal short spines; outer ramus with 5 lateral and 5 distal spines.

Uropod 2: peduncle with 2 lateral and 3 distal spines; inner ramus only slightly longer than outer ramus, with 3 lateral and 5 distal spines; outer ramus with 5 lateral and 5 distal spines (Fig. 1F).

Uropod 3: not elongated; peduncle longer than broad (ratio: 44:24), inner ramus very short, scale-like, with distal spine and seta; outer ramus 2-articulated: proximal article along outer margin with 4 bunches of spines, along inner (mesial) margin with 6 groups of spines mixed with single plumose setae (Fig. 2L); distal article short, narrowed, length not exceeding width of first article, with 3 very short distal simple setae.

Telson: short, nearly as long as broad, gaping, incised half of telson-length; each lobe with 3 distal spines shorter than half of telson-length; a pair of plumose setae attached mediolaterally at outer margin (Fig. 4G).

Coxal gills 2–6: ovoid, not exceeding distal margin of corresponding article 2 of pereopods (Figs 3D, 4B, D, 5A, C).

Oostegites: broad, appear on pereopods 2–5, provided with short marginal setae (Fig. 3D).

Males. Unknown.

Distribution. Northern Macedonia, endemic.

Etymology. The new species, *Niphargus lowryi*, sp. nov., is dedicated to the recently deceased great scientist-amphipodologist and my dear friend, Dr Jim Lowry, Senior Research Associate at the Australian Museum Research Institute, Australia.

Remarks and affinities. The female of *N. lowryi* sp. nov. shows high affinity to species of the subgenus *Orniphargus* S. Karaman, 1950a (type species: *Niphargus orcinus* Joseph, 1869), characterized by a large, strong and often spinose body, large gnathopods, spinose short uropod 3 in both sexes, subequal rami of uropod 1 in both sexes, various positions of L and S- spines on the gnathopods 1–2 propodus (article 6) and the maxilliped palp article 4 near the basis of the nail is provided with various numbers of setae (*Niphargus orcinus* Joseph, 1869, *N. steueri* Schellenberg, 1935, *N. trullipes* Sket, 1958). Further discovery of males of *N. lowryi* will help determine the position of *N. lowryi* within *Niphargus*.

The female of *N. lowryi* seems to be very similar to *Niphargus* (*Orniphargus*) *pellagonicus* S. Karaman, 1943 (type locality: spring on road Bitola-Magarevo, Northern Macedonia, Aegean drainage system) in numerous characters (short uropod 3, narrowed pereopods 5–7, shape of gnathopods 1–2, antennae, epimeral plates, gaping telson, number of aesthetascs on antenna 1). However, *N. lowryi* differs from *N. pellagonicus* by the elevated number of setae on the maxilla 1 inner plate and on the palp, by the elevated number of ventral setae on the maxilliped palp article 4 near the basis of the nail, by the elevated number of retinacula, by the twice longer body-size, and by the longer spines on the telson.

The second species from Bitola region, *N. bitoljensis* S. Karaman, 1943 (type locality: spring in Bitola, Northern Macedonia) differs from *N. lowryi* by the much smaller body-size, remarkably broader and shorter pereopods, telson with facial spines, having only 2 retinacula on pleopods and the lower number of inner setae on the maxilliped palp.

The three other known large species of *Niphargus* from Ohrid Lake basin (Adriatic drainage system), *N. sanctinaumi* S. Karaman, 1943 (type locality: springs of St. Naum), *N. maximus* S. Karaman, 1929 (type locality: springs Šum in Struga, at opposite side of Ohrid Lake) and *N. petkovskii* G. Karaman, 1963 (type locality: Biljanini izvori-Springs (= Studenčišće) in Ohrid Town), differ distinctly by presence of dorsofacial spines on telson, pleopods with 2 retinacula only and the less oblique palm of gnathopods 1–2.

Niphargus (*Orniphargus*) *macedonicus* S. Karaman, 1929 (type locality: Rašče Springs near Skopje (= Skoplje), Aegean drainage system, Northern Macedonia), a large species up to 20 mm long, is also rather similar to *N. lowryi* in the elevated number of retinacula, oblique palm of the gnathopods, large body-size and absence of lateral and facial spines on telson. This species differs from *N. lowryi* by the elevated number of aesthetascs on each flagellar article of antenna 1, by the maxilla 1 inner plate having 2 setae and the more pointed epimeral plate 3. As the male of *N. lowryi* is currently unknown, the taxonomic position of *N. lowryi* within *Niphargus* remains open.

From Greece, three members of the subgenus *Orniphargus* are known: *Niphargus (Orniphargus) lindbergi* S. Karaman, 1956 (type locality: Cave Draconera, Attique, Greece), *N. (Orniphargus) lourensis lourensis* Fišer, Trontelj & Sket, 2006 (type locality: spring of Louros River, Vouliasta, Ioannina, Epirus, Greece) and *N. (O.) lourensis skirosi* G. Karaman, 2018 (type locality: Molos, radar station, Skiros Island, Aegean Sea, Greece).

Niphargus (O.) lindbergi differs distinctly from *N. (O.) lowryi* by the presence of two ventroposterior spines on urosomite 1 near the basis of the uropod 1 peduncle.

Niphargus (O.) lourensis lourensis differs from *N. (O.) lowryi* by the remarkably broader article 2 of pereopods 5–7, by the lower number of setae on the maxilla 1 inner plate, shorter and less setose maxilla 1 palp, and the presence of only 2 retinacula on pleopods.

Niphargus (O.) lourensis skirosi differs from *N. (O.) lowryi* by the remarkably smaller gnathopods with a much less inclined propodus, by the lower number of retinacula, and by the partially developed ventroposterior lobe of pereopods 5–7 article 2.

From Albania, no members of subgenus *Orniphargus* are known.

Note

In the paper the classical terms "subgenus" and "subspecies" are used, being validly recognized terms in zoological nomenclature. Various molecular/genetic studies have used alternative terms such as "species aggregate" (Fišer *et al*., 2006), *Niphargus* "clades" (Flot *et al*., 2010) or "species complexes" (Ziga Fišer *et al*., 2015), "morphologically cryptic species" (Hupalo *et al*., 2022), some of which variously correspond to classical concepts used herein. Recently some authors have questioned whether the time has come to describe new species without diagnoses (see Ahrens *et al*., 2021 for review). Evidently, these issues may bear on the *International Code of Zoological Nomenclature* (ICZN, 1999). As the problems are very complex and require extensive exposition, I gave up on this discussion here.

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