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Gordan S. Karaman[*]

NIPHARGUS ADEI S. KARAMAN, 1934 (FAM. NIPHARGIDAE), POORLY KNOWN SPECIES FROM SAMOTHRAKE ISLAND, GREECE (Contribution to the Knowledge of the Amphipoda 300)

Abstract

The subterranean species of the family Niphargidae (Amphipoda, Gammaridea), *Niphargus adei,* has been described by Stanko L. Karaman (1934) from the subterranean waters of Samothrake Island in Aegean Sea, Greece. As this description was very short and poorly figured (as many as other descriptions of amphipods of various authors in first half of twenty`s century), and by this way often overlooked by scientists, this species is here redescribed and figured based on holotype and paratypes. The taxonomical position of this species regarding other known species of genus *Niphargus* known from Greece and some adjacent regions is discussed.

Keywords: Amphipoda, *Niphargusadei*, subterranean waters, Samothrakeisland, Greece

INTRODUCTION

Fauna of the family Niphargidae (Amphipoda Gammaridea) from the subterranean waters of Greece is partially investigated despite the fact that many scientists and researchers collected and investigated specimens from various types of subterranean waters (caves, springs, wells, fresh- and brackish subterranean waters, etc.). These investigations have been provided over the continental Greece as well as on its numerous islands.

[*] Academician Gordan S. Karaman, Montenegrin Academy of Sciences and Arts
E-mail: karaman@t-com.me

At the present our knowledge, over 18 species of genus *Niphargus* are discovered in the subterranean waters of the Greek islands and these from the Continental Greece. Among them, half of them are discovered on the Greek islands, and half of them on the continental part of Greece. This situation is due to the geographical and ecological conditions on the Greek islands and these on continental Greece, as well as due to the intensity of study of the subterranean waters on both regions. Crete Island, because of its large size and specific geological and zoogeographical conditions, is settled with the highest number of endemic taxa of the family Niphargidae among Greek islands, with 3 genera [*Exniphargus* G. Kar. 2016 b, *Niphargobatoides* G. Kar. 2016 b, *Niphargus* Schiödte, 1849) and 3 species of genus *Niphargus* (*N. impexus* G. Kar. 2016 a, *N. lakusici* G. Kar. 2017 a, *N. zarosiensis* Zettler & Zettler 2017.

The continental part of Greece is still only partially investigated, especially its transborder regions, where new or already known species can be expected. The accumulation of numerous new species discovered recently, requires better knowledge of the taxonomical characters of already known species. In this light, we tried to redescribe some species previously poorly described and figured from Greece, to make possible the recognition of taxonomical position of newly described species regarding already known taxa. In this work we redescribe the species *Niphargus adei* described by Stanko Karaman (1934) from Samothrake Island in the Aegean Sea not far from Asia Minor (Turkey) based on holotype and paratypes existing in Karaman's Collection in Podgorica, Montenegro.

MATERIAL AND METHODS

The material in hands from Karaman`s Collection in Podgorica, Montenegro, has been preserved in 4% formol and later transferred in 70% ethanol. The specimens were dissected using a WILD M 20 microscope and drawn using camera lucida attachment. All appendages were temporarily submersed in the mixture of glycerin and water for study and drawing. The body-length of examined specimens was measured from tip of head to end of telson using camera lucida. All illustrations were inked manually. After the end of the study, the dissected body-parts were submerged in Liquid of Faure on slides and covered by thin cover glass for permanent preservation.

Some morphological terminology and seta`s formulae follows Karaman`s terminology (Karaman, G. 1969; 1993)regarding the last mandibular palpus article [A= setae on outer face; B= setae on inner face; C= additional setae on outer face; D= lateral marginal setae; E= distal long setae] and propodus of gnathopods 1 and 2 [S= corner S-spine; L= lateral slender serrate L-spines; M= facial M-setae; R= subcorner R-spine on inner face] (G. Karaman, 2012). Terms „setae" and

„spines" are used based on its shape, not origin. The study was realized based on morphological, ecological and zoogeographical research and data.

The advantage of use of Liquid of Faure is the possibility to remove the dissected body-parts from Liquid of Faure by water and study it again in the various positions under the microscope.

TAXONOMICAL PART

Family NIPHARGIDAE

NIPHARGUS ADEI S. Karaman 1934

Figures 1–5

Niphargus adei S. Karaman 1934: 216, 1 fig.; Schellenberg 1935: 210 (key); S. Karaman 1950: 43; G. Karaman 1972: 7; Pesce & Maggi 1983: 58; Barnard & Barnard 1983: 689; G. Karaman & Ruffo 1986: 522; G. Karaman 2017 b: 5.

MATERIAL EXAMINED: GREECE:

– 412 = Samothrake Island, Greece, Aegean Sea, 1933, 4 exp. (leg. Ade) [holotype male 8 + mm, on 3 slides [412/1–412/3], 3 paratypes [+ slide 412/4].

Loc. typ.: Island Samothrake, Aegean Sea, Greece

DIAGNOSIS (males only).

Body moderately slender, metasomal segments are with scarce number of dorsoposterior setae; epimeral plate 3 is poorly angular; urosomal segment 1 on each dorsolateral side is provided with one seta. Coxae 1–4 are relatively short, coxa 1 with subrounded ventroanterior corner, coxa 4 unlobed, excavated posteriorly. Gnathopods 1–2 are small, with propodus nearly as large as corresponding coxa. Article 3 of gnathopod 1 along posterior margin with one median seta and one distal bunch of setae, that of gnathopod 2 with one distal bunch of setae only; propodus of gnathopods 1–2 trapezoid, palm moderately inclined, S-spine is accompanied laterally by 2 L-spines, outer face with 5–7 M-setae; dactylus with row of median setae along outer margin. Dactylus of pereopods 3–7 strong, with one spine at inner margin.

Basipodit of pereopods 5–7 moderately dilated, without distinct ventroposterior lobe. Pleopods with 2 retinacula, peduncles scarcely setose or naked. Uropod 1 with inner ramus strongly elongated in old specimens, outer ramus is much shorter than inner one; slightly compressed. Uropod 3 elongated, with second article of

outer ramus almost as long as or shorter (in smaller specimens) than first article. Telson is more or less gapping, broader than long, lobes with 3–4 distal spines and single spines along outer and inner (mesial) margin, facial spines absent.

DESCRIPTION: **Male 8** mm (holotype):

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

Epimeral plate 1 is almost subrounded, with poorly concave ventral margin and broadly convex posterior margin bearing short corner spine and nearly 7 short setae (fig. 4 E); epimeral plate 2 is with poorly marked ventroposterior corner defined by short spine-like seta, ventral and posterior margin are convex, posterior margin with nearly 8 short setae. Epimeral plate 3 is poorly subangular, almost subrounded, with marked ventroposterior corner spine-like seta, ventral and posterior margin are poorly convex, posterior margin is with nearly 10 short setae; 2 subventral spines are attached on epimeral plates 2 and 3 (fig. 4 E).

Head iswith short rostrum and subrounded lateral cephalic lobes, ventroanterior sinus is excavated, eyes are absent (fig. 1 A).

Antenna 1 not exceeding half of body-length; peduncular articles 1–3 are progressively shorter (ratio: 54: 42: 17), scarcely setose (fig. 1 G). Main flagellum is consisting of 24 articles poorly setose [most of the articles with short aesthetasc); accessory flagellum is 2-articulated (fig. 1 C), shorter than last peduncular article.

Antenna 2 is relatively slender; peduncular article 4 is rather longer than article 5 (ratio: 61: 51), both articles with several bunches of short setae [the longest setae not exceeding diameter of articles themselves]; flagellum slender, consisting of 10 slender articles scarcely setose (fig. 1 D). Antennal gland cone is short (fig. 1 C).

Labrum is broader than long. Labium broader than long, with subrounded outer lobes, inner lobes small, but well developed (fig. 2 A).

Mandible is with large triturative molar. Left mandible: incisor with 5 teeth, lacinia mobilis with 4 teeth and 8 rakers (fig. 4 A). Right mandible: incisor is with 4 teeth, laciniamobilis with is bifurcate, serrate, number of rakers unknown. Mandibular palpusis 3-articulated: first article is naked; second article is slightly shorter than third one (ratio: 56: 68), provided with 10 setae (fig. 4 B). Third article is subfalciform, with nearly 20 marginal D-setae and distal 5 E-setae; on outer face appear a row of 4 A-setae (fig. 4 C), on inner face are attached 4 B-setae (3 + 1) (fig. 4 B).

Maxilla 1: inner plate is with 2 distal setae (fig. 4 D); outer plate with 7 spines [6 spines with one lateral tooth, one spine with 2 lateral teeth]; palpus 2-articulated, relatively short, hardly exceeding tip of outer plate-spines and provided with 8 setae (fig. 4 D).

Maxilla 2 is longer than broad, inner plate is slightly shorter and smaller than outer plate, both plates are with numerous marginal setae only (fig. 2 B).

Maxilliped: inner plate hardly exceeding distal outer tip of first palpus article and provided distally with 5 smooth spines and 2 setae (fig. 3 A); outer plate slightly exceeding half of palpus article 2 and provided with row of nearly 11 smooth spines and single setae; palpus 4-articulate, second article with one distal group of setae along outer margin; palpus article 3 along outer margin with one median and one distal bunch of setae; palpus article 4 at outer margin with one median seta, at inner margin with 2 unequal setae near basis of the nail (fig. 3 A).

Coxae 1–4 are relatively short. Coxa 1 is remarkably broader than long (ratio: 58: 41), with subrounded ventroanterior margin and several short marginal setae (fig. 1 E). Coxa 2 is slightly broader than long (ratio: 62: 55), with subrounded ventral margin bearing nearly 12 short setae (fig. 1 F). Coxa 3 is slightly broader than long (ratio: 63: 55), along convex ventral margin with nearly 10 setae (fig. 1 G). Coxa 4 is distinctly broader than long (ratio: 67: 56), with almost straight ventral margin bearing nearly 10 short setae, unlobed, but with concave posterior margin (fig. 1 I).

Coxa 5 is hardly shorter than coxa 4, broader than long (ratio: 77: 41), bearing very short marginal setae (fig. 3 B). Coxa 6 is smaller than coxa 5, broader than long (ratio: 65: 35) (fig. 3 E). Coxa 7 is shallow, entire. broader than long (ratio: 58: 26), with slightly concave ventral medial part. (fig. 3 F).

Gnathopods 1–2 are relatively small, with propodus nearly as large as corresponding coxa. Gnathopod 1: article 2 along both margins is provided with numerous long setae; article 3 along posterior margin with one median and one distal group of setae (fig. 2 C). Article 5 is slightly shorter than propodus (ratio: 50: 69), at anterior margin with one distal bunch of long setae (fig. 2 D). Propodus is trapezoid, slightly longer than broad (ratio: 84: 72), along posterior margin with 7 transverse rows of setae (fig. 2 D); palm poorly convex, inclined slightly less than half of propodus-length, defined on outer face by one corner S-spine accompanied laterally by 2 slender L-spines and by 7 facial M-setae, on inner face by one subcorner R-spine (fig. 2 E); dactylus reaching posterior margin of propodus, with nearly 6 median setae along outer margin and several short setae at inner margin (fig. 2 D).

Gnathopod 2: [articles 2–4 missing in holotype]; article 5 shorter than propodus (ratio: 78: 96), along anterior margin with one distal bunch of setae (fig. 2 F). Propodus trapezoid, slightly longer than broad (ratio: 97: 88), along posterior

margin with 10 transverse rows of setae; palm inclined slightly less than half of propodus-length, poorly convex, defined on outer face by one corner S-spine accompanied laterally by 2 L-spine and 7 facial M-setae, on inner face by one subcorner R-spine. Dactylus reaching posterior margin of propodus, along outer margin with nearly 8 median setae, along inner margin with row of short setae (2 F).

Pereopods 3 and 4 are rather similar to each other, moderately strong. Pereopod 3: article 2 along anterior margin with shorter setae, along posterior margin with numerous long setae. Articles 4–6 of unequal length (ratio: 57: 43: 50), articles 4 with 4 groups of setae along posterior margin and 3 groups of setae along anterior margin [the longest setae not exceeding diameter of articles]; article 5 at posterior margin with 3 groups of setae and one spine, along anterior margin with 2 single short setae; article 6 along posterior margin with 5 single spines accompanied sometimes with single short seta (fig. 1 G). Dactylus is short and strong, much shorter than article 6 (ratio: 20: 50), at inner margin with one spine near basis of the nail, at outer margin with one median plumose seta; nail is shorter than pedestal (ratio: 33: 39) (fig. 1 H).

Pereopod 4: article 2 along anterior margin with long proximal and short distal setae, along posterior margin with numerous proximal long setae and several short distal setae (fig. 1 I). Articles 4–6 of unequal length (ratio: 55: 43: 49); article 4 along anterior and posterior margin with 3 groups of short setae; article 5 along posterior margin with 3 single spines accompanied sometimes with single short setae. Article 6 along posterior margin with 6 single short spines. Dactylus is much shorter than article 6 (ratio: (20: 49), at inner margin with one spine near basis of the nail, at outer margin with one median plumose seta; nail is shorter than pedestal, like that in pereopod 3 (fig. 1 I).

Pereopods 5–7 are moderately strong. Pereopod 5 is distinctly shorter than pereopod 7 (fig. 3 C, G), article 2 is longer than broad (ratio: 72: 48), along anterior poorly convex margin with 6 groups of 1–2 short spine-like setae; along posterior, medially straight margin appear nearly 15 short setae, ventroposterior lobe is not fully developed (fig. 3 C). Articles 4–6 are of unequal length (ratio: 44: 48: 52); article 4 along anterior margin with 4 short spines, along posterior margin with 2 spines; article 6 along both margins with 3–4 short spines; article 6 along posterior margin with 4 pairs of short spines, along anterior margin with 3 single spines and single distal setae). Dactylus is much shorter than article 6 (ratio: 17: 52), at inner margin with one spine near basis of the nail, at outer margin with one median plumose seta; nail is shorter than pedestal (fig. 3 D

Pereopod 6 missing in holotype.

Pereopod 7; article 2 is narrowed, much longer than broad [ratio: 91: 46], along anterior almost straight margin appear 7 groups of 1–2 spine-like setae; along posterior almost straight margin are attached nearly 15 short setae,

ventroposterior lobe is not distinctly developed (fig. 3 G). Articles 4–6 are of unequal length (ratio: 50: 64: 83); article 4 along anterior margin with 3 groups of short setae, along posterior margin with 4 spines; article 5 along both margins with 4 groups of short spines; article 6 along posterior margin with 6 bunches of short spines, along anterior margin with 4 bunches of spines (fig. 3 G). Article 2 is slightly longer than article 6 (ratio: 91: 83). Dactylus is much shorter that article 6 (ratio: 25: 83), along inner margin with one spine near basis of the nail, along outer margin with one median plumose seta; nail is shorter than pedestal (ratio: 35: 50) (fig. 3 H).

Pleopods 1–3 are with 2 retinacula each. Peduncle of pleopod 1 is with 3 setae along anterior margin (fig. 3 I); peduncle of pleopod 2 naked (fig. 3 J); peduncle of pleopod 3 is with 2 short setae along posterior margin (fig. 3 K).

Uropod 1 is elongated, peduncle is with dorsoexternal row of spines and dorsointernal row of strong setae (fig. 4 F); inner ramus remarkably longer than peduncle (ratio: 125: 101), bearing along margins and tip nearly 10 short spines mixed with several short simple setae (fig. 4 F). Outer ramus is much shorter than inner one (ratio: 55: 125) bearing 3 lateral spines accompanied by 2 groups of simple setae and 4 distal short spines (fig. 4 F).

Uropod 2: peduncle is provided with 2 lateral and 2 distal spines; inner ramusis provided with 3 lateral and 4 distal short spines (fig. 4 G); outer ramus is slightly shorter than inner one (ratio: 41: 35), provided with 2 lateral and 5 distal short spines.

Uropod 3 is long; peduncle is remarkably longer than broad (ratio: 44: 20), with single very short lateral spines and setae; inner ramus is narrow, shorter than peduncle (ratio: 25: 44) bearing distally one short spine and 3 short setae (fig. 4 H). Outer ramus is narrow, 2-articulated: first article is provided with 4 groups of very short spines along outer margin and with 4 groups of short spines along inner margin, accompanied by single very short simple setae; second article is hardly shorter than first article (ratio: 97: 105), provided with several single short setae along both margins and tip.

Telson is hardly broader than long (ratio: 94: 90), slightly gaping; each lobe with 3–4 distal short spines; along outer margin appear one spine and one spine-like seta (fig. 4 I), along inner (mesial) margin are attached 2 spines; one facial spine-like seta appears on left lobe; pair of short plumose setae is attached in the middle of outer margin (fig. 4 I).

Coxal gills ovoid, moderately long, not exceeding ventral margin of corresponding article 2 of the legs (figs. 1 G, I; 3 C).

FEMALES: unknown.

VARIABILITY:

Paratype male 7.0 mm is rather similar to holotype. Metasomal segment 3 is provided with 4 dorsoposterior marginal setae (fig. 5 C). Urosomal segment 1 on each dorsolateral side with one seta; urosomal segment 2 on each dorsolateral side with one spine and seta or with 2 spines; urosomal segment 3 naked. Urosomal segment 1 with one short spine at ventroposterior corner near basis of uropod 1-peduncle (fig. 5 D).

Epimeral plate 2 is provided with 2 subventral spines. Epimeral plate 3 is with obtuse ventroposterior corner defined by short spine-like seta, along almost straight posterior margin appear 3–4 short setae, ventral margin is subrounded, bearing 3 subventral spines (fig. 5 C).

Antenna 1 is shorter than half of body. Maxilliped palpus article 4 at ventral margin is provided with 1–2 setae near basis of the nail.

Gnathopod 1: article 3 at posterior margin with one median seta and one distal bunch of setae (fig. 5 A); propodus along posterior margin with 6 transverse rows of setae, dactylus along outer margin with row of median setae.

Gnathopod 2: article 2 along posterior margin with numerous long setae, along anterior margin with 2 long proximal setae and 5 short medial and distal setae; article 3 along posterior margin with one distal bunch of setae only (fig. 5 B). Article 5 is poorly shorter than propodus (ratio: 58: 62), along anterior margin with one distal bunch of setae. Propodus is trapezoid, hardly longer than broad (ratio: 62: 59), along posterior margin with 7 transverse rows of setae; palm poorly convex, inclined nearly 2/5 of propodus-length, defined on outer face by one S spine accompanied laterally by 2 L-spines and 5 facial M-setae, on inner face by one R-spine (fig. 5 B). Dactylus is reaching posterior margin of propodus and bearing 7 median spines along outer margin.

Pereopods 5–7 are with slightly broader article 2 without distinct ventroposterior lobe. Dactylus of pereopods 3–7 are with one spine near basis of the nail, along outer margin with one median plumose seta; nail is always shorter than pedestal.

Uropod 1: peduncle is with dorsoexternal rows of spines and dorsointernal row of setae (except distal spine) (fig. 5 D). Inner ramus is almost as long as peduncle, bearing 3 long lateral spines and 3–4 distal spines; outer margin is shorter than inner one (ratio: 64: 85, without spines), bearing 2 lateral and 3 distal spines.

Uropod 2: peduncle is provided with one lateral and distal spine; inner ramus is provided with 2 lateral and 4 distal spines; outer ramus is slightly shorter than inner one (ratio: 45: 50), bearing 1–2 lateral and 4 distal spines (fig. 5 D).

Uropod 3 is elongated. Peduncle is longer than broad (ratio: 47: 20), bearing several distal short spines. Inner ramus is short, longer than broad, with one distal spine. Outer ramus is 2-articulated: first article along outer margin is

provided with 5 groups of short spines, along inner margin appear 5 groups of long spines, plumose setae are not visible; second article is much shorter than first one (ratio: 42: 122), along both margin and tip with several single short simple setae (fig. 5 F).

Telson is gaping, broader than long (ratio: 75 : 64), each lobe with 3 long distal spines; one spine appears at outer margin, and one very shot weak spine is attached on inner margin of each lobe (fig. 5 E). A pair of short plumose setae is poorly visible, attached near the middle of outer margin (fig. 5 E).

Coxal gills like these in holotype.

All investigated 3 specimens (males) are provided with one median and one distal group of setae on posterior margin of gnathopod 1 article 3, and this character seems to be stable character of this species.

The smaller male specimens have shorter distal article of uropod 3, less elongated inner ramus of uropod 1 and longer spines on uropods 1–2 and telson.

REMARKS AND AFFINITIES

Niphargus adei belongs to the group of species in Greece provided with several setae at outer margin of dactylus in gnathopods 1 and 2 (11 + species). Article 3 of gnathopod 1 in all these species is provided with one group of setae at posterior margin, but that of *N. adei* is provided with 2 groups of setae at posterior margin (median and distal group) (figs. 2 C, 5 A).

In Europe are known some other species with 2 groups of setae on posterior margin of article 3 of gnathopod 1, but always 2 groups of setae are present in gnathopod 1 and in gnathopod 2 [*Niphargus spinulifemur* S. Karaman 1954, known from NE Italy and Istra (Slovenia/ Croatia)[loc. typ.: Zazid, Rizana valley, Istra].

Dorsoventrally compresed inner ramus of uropod 1 is present in *N. adei*. But this character was observed also in various other species over Europe, mainly in old „senile" male specimens. We observed it in *Niphargus pecarensis* S. Kar. & G. Kar. 1959 [loc. typ.: Pecara Dupka Cave in Bulgaria], *N. kragujevensis* S. Karaman 1950 [loc. typ.: Kragujevac, Serbia]. *N. remus* G. Karaman 1992 [loc. typ.: Prekonoga, Serbia], N. *occultus* G. Karaman, 1994 [loc. typ.: Mratinje, Montenegro] etc., but these species differ from *N. adei* by combination of various other taxonomical characters (epimeral plates, telson, pleopods etc.).

As *N. adei* is present in the locality relatively close to the Asia Minor (Samothrake Island), probably the relative species we must search among the taxa from Turkey.

HOLOTYPE: Holotype male 8 + mm on 3 slides [412/1- 412/3] and paratypes are deposited in KARAMAN`s Collection in Podgorica, Crna Gora (Montenegro].

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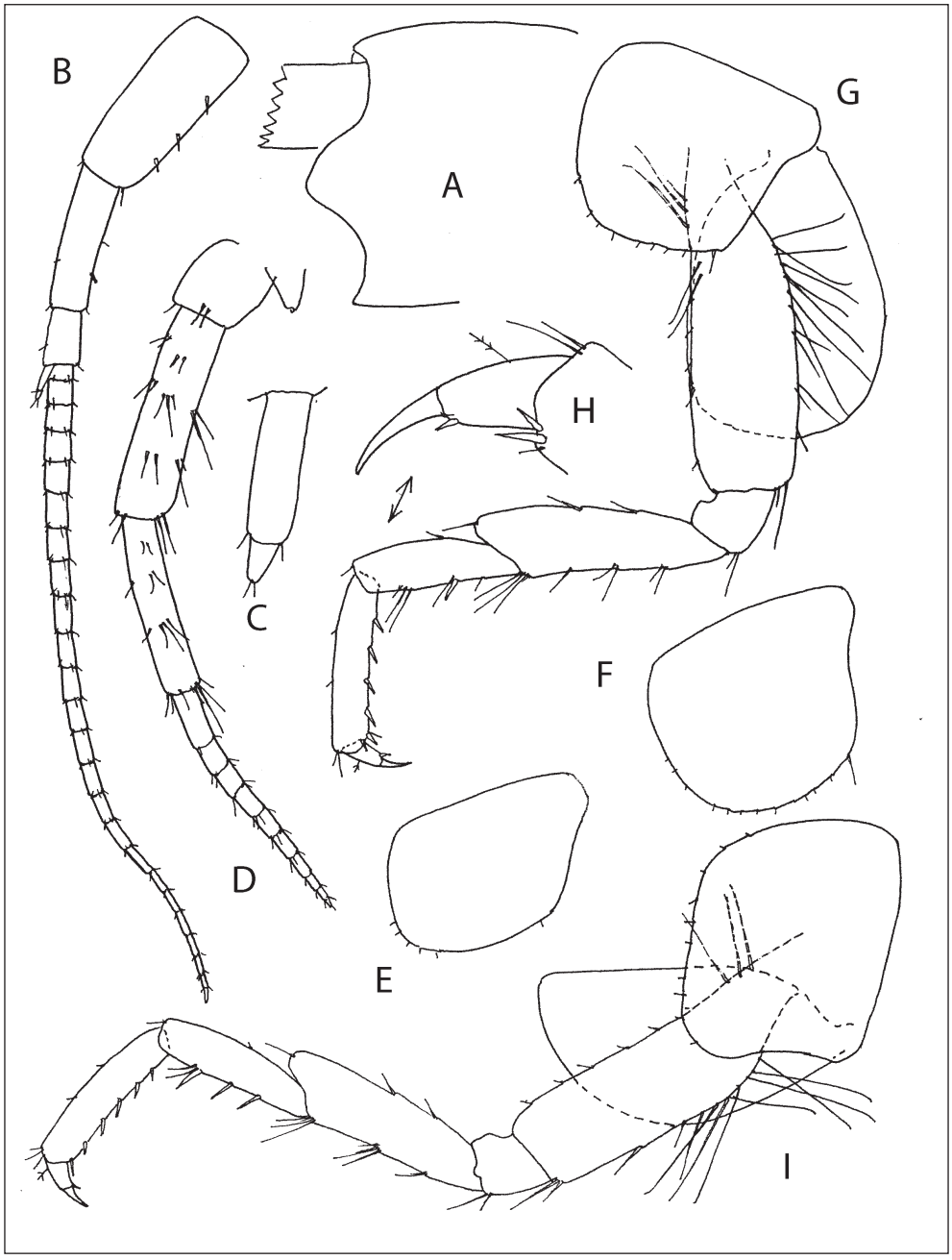

Fig. 1. *Niphargus adei* S. Karaman 1934, Samothrake island, male 8 + mm (holotype): A = head; B = antenna 1; C = accessory flagellum; D = antenna 2; E = coxa 1; F = coxa 2; G = pereopod 3; H = dactylus of pereopod 3; I = pereopod 4.

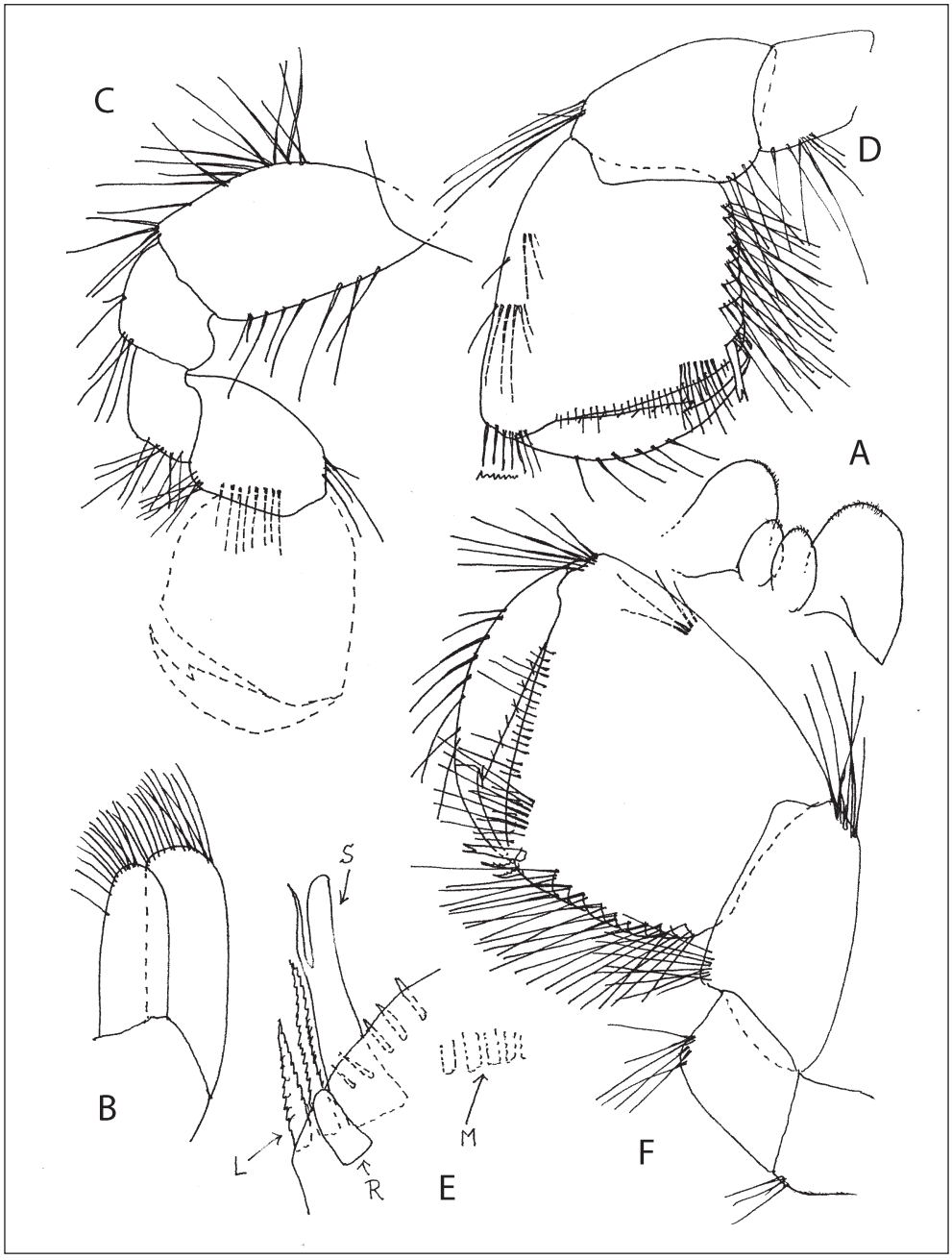

Fig. 2. *Niphargus adei* S. Karaman 1934, Samothrake island, male 8 + mm (holotype): A = labium; B = maxilla 2; C-D = gnathopod 1, outer face; E = distal corner of gnathopod 1 propodus, inner face [S = corner S-spine; L= lateral L-spines; R = subcorner R-spine; M = facial M-setae]; F = gnathopod 2, outer face.

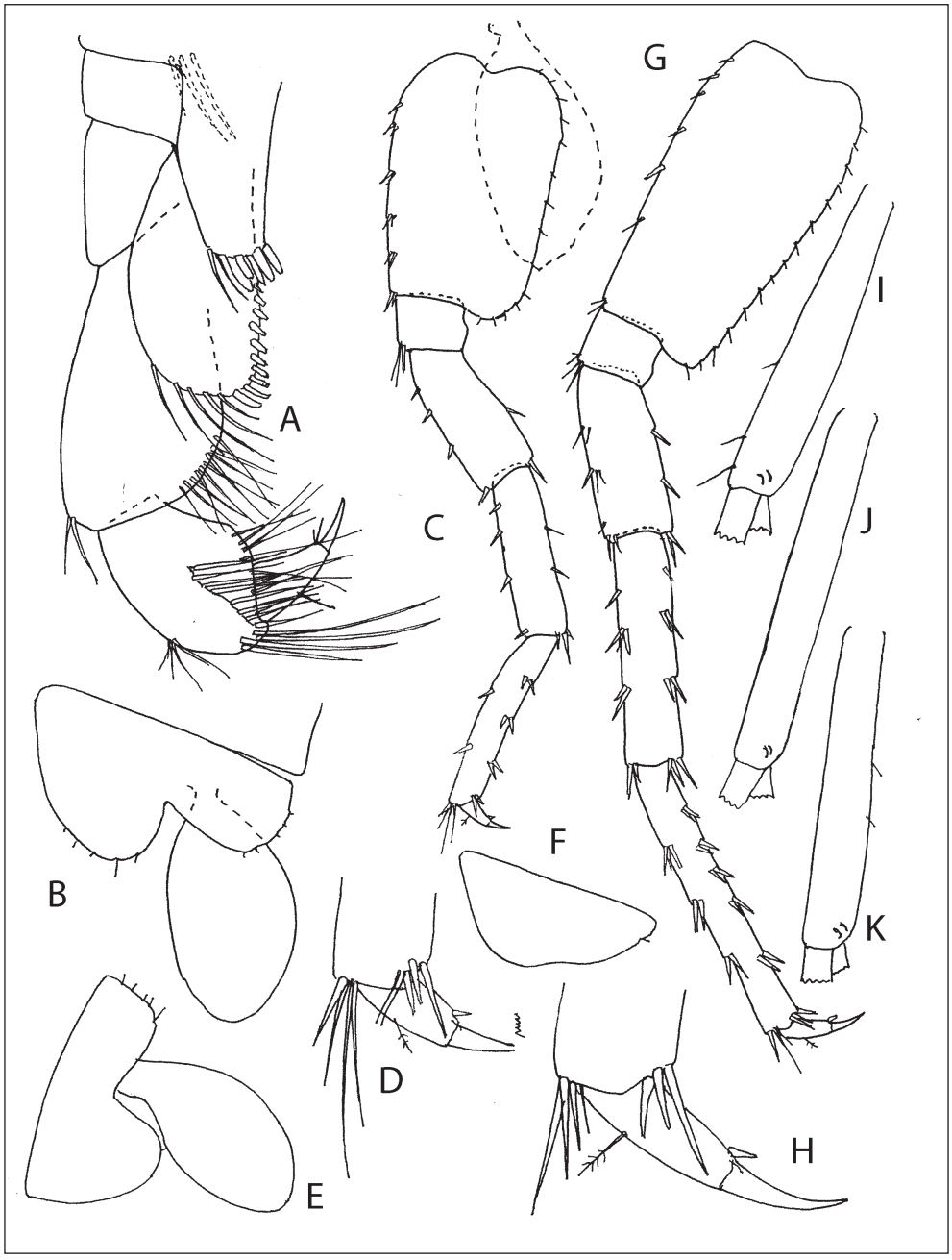

Fig. 3. *Niphargus adei* S. Karaman 1934, Samothrake island, male 8 + mm (holotype): A = maxilliped; B = coxa 5; C = pereopod 5; D = dactylus of pereopod 5; E = coxa 6; F = coxa 7; G = pereopod 7; H = dactylus of pereopod 7; I = pleopod 1 peduncle; J = pleopod 2 peduncle; K = pleopod 3 peduncle.

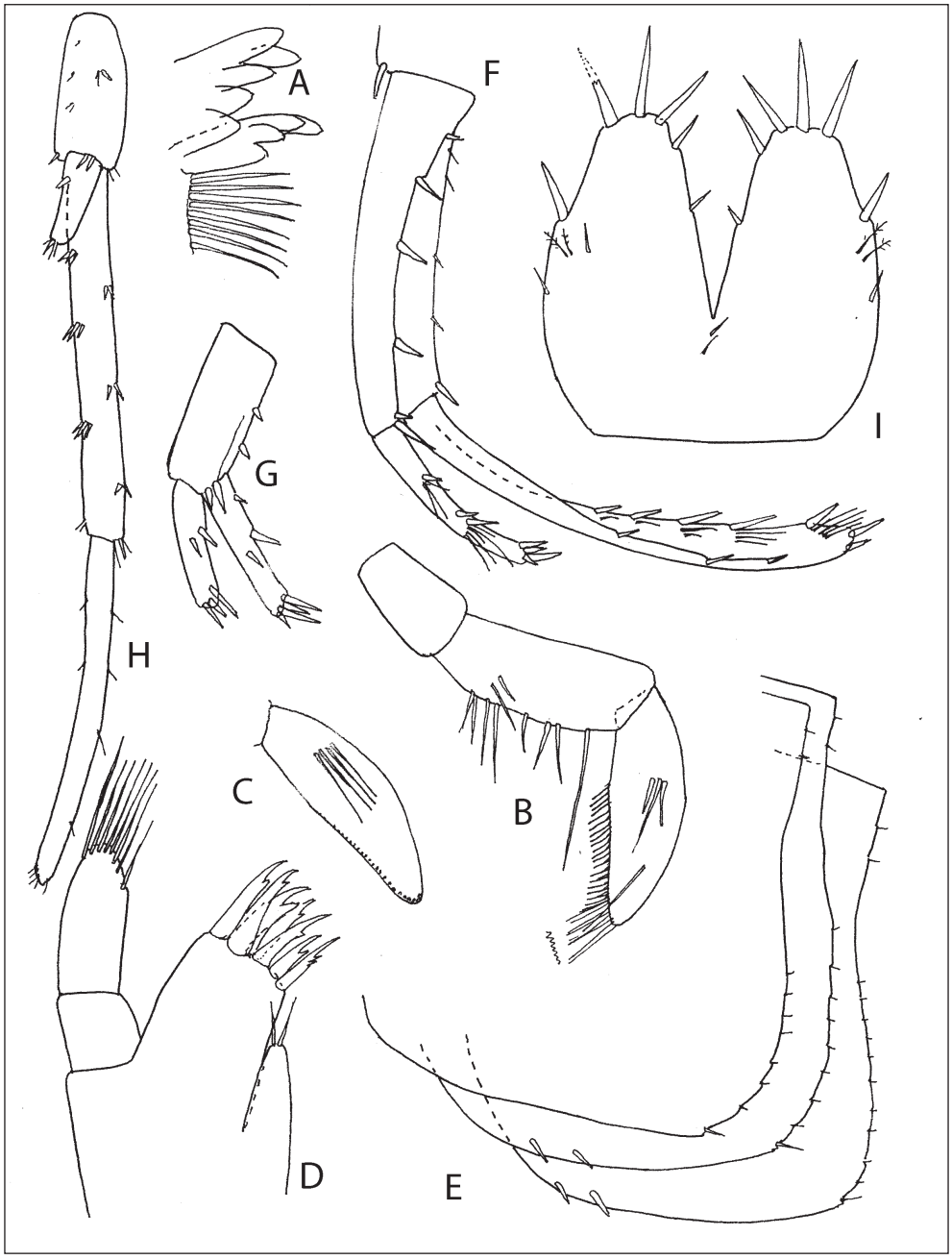

Fig. 4. *Niphargus adei* S. Karaman 1934, Samothrake island, male 8 + mm (holotype): A = left incisor, laciniamobilis and rakers; B = mandibular palpus, inner face with B, D and E-setae; C = palpus article 3 with A-setae [other setae omitted], outer face; D = maxilla 1; E = epimeral plates 1–3; F = uropod 1; G = uropod 2; H = uropod 3; I = telson.

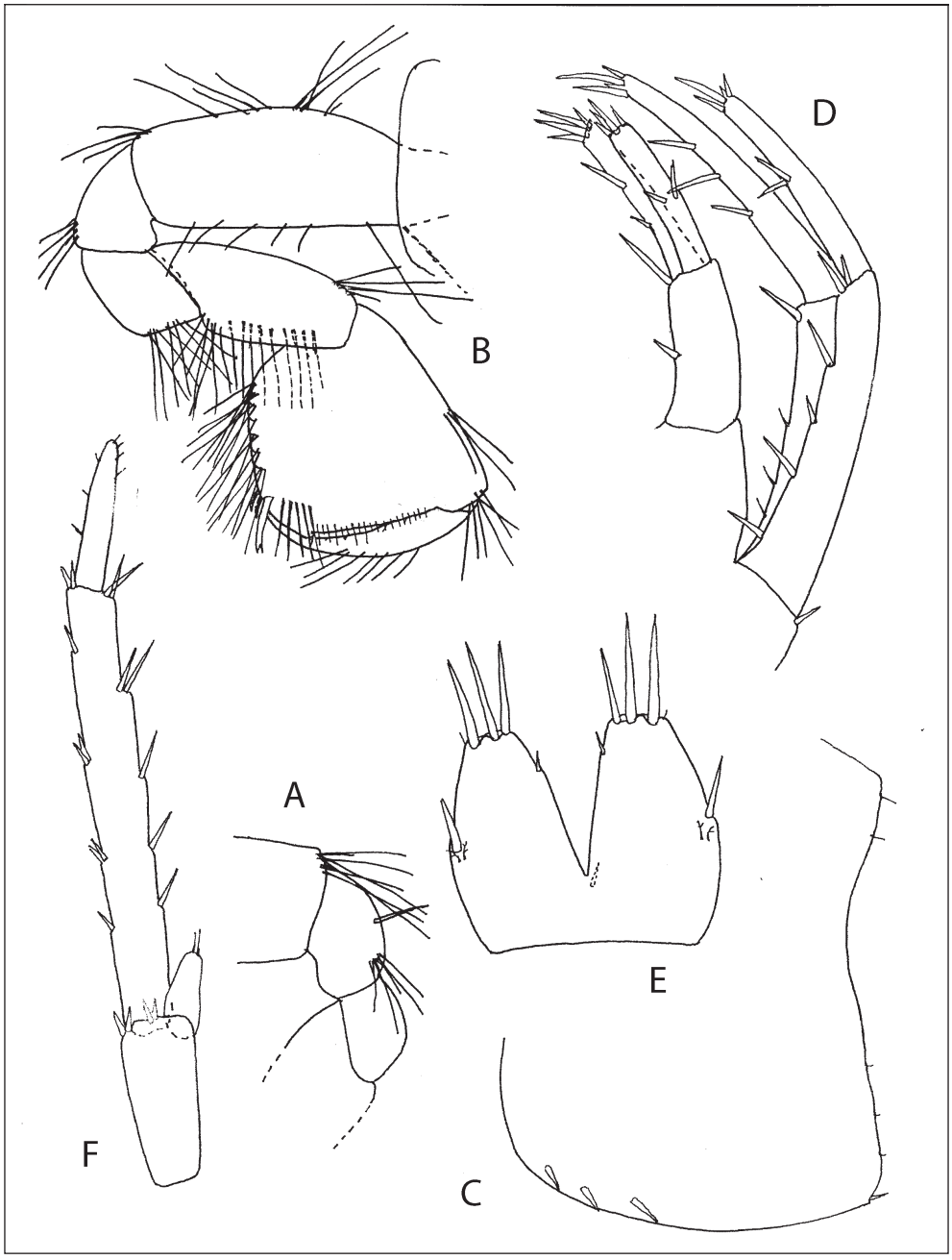

Fig. 5. *Niphargus adei* S. Karaman 1934, Samothrake island, male 7.0 mm, paratype: A = article 3 of gnathopod 1; B = gnathopod 2; C = epimeral plate 3; D = uropods 1–2; F = uropod 3.