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Original paper

Niphargus graecus S. Karaman, 1934 (Fam. Niphargidae), poorly known species from Greece (Contribution to the Knowledge of the Amphipoda 301)

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Summary: The poorly known subterranean species *Niphargus graecus* S. Karaman, 1934 (Gammaridea, Niphargidae) is redescribed based on holotype and paratypes (males only) from Acrocorinth and new samples (males and females) from two new localities (Delphes and Lake Lisimachia), all in central Greece. The female of this species is described for the first time, based on specimen from Delphes. Various taxonomical characters, as well as the variability of males and females from Delphes and Lisimachia Lake are mentioned. Based on a study of morphological characters, specimens from Lisimachia Lake (loc. typ. of *N. aitolosi* Ntakis, Anastasiadou, Zakšek & Fišer, 2015) are identical with specimens of *N. graecus* from Acrocorinth and Delphes. The taxonomical relation of *N. graecus* to other known taxa of this genus from Greece is discussed.

Keywords: Amphipoda, Greece, Niphargidae, *Niphargus graecus*, redescription, taxonomy.

INTRODUCTION

The subterranean genus *Niphargus* Schiödte, 1849 (Crustacea, family Niphargidae) consists of over 300 known taxa ranging from Western Europe to the Near East and Iraq. In Greece over 18 species of this genus are known, and most of these are endemic for Greece (S. Karaman 1934, 1950, 1956; Fišer et al. 2006; Ntakis et al. 2015; G. Karaman 2015, 2016, 2017, etc.).

The first two new species of the family Niphargidae from Greece were discovered and described by Stanko L. Karaman *Niphargus graecus* S. Karaman, 1934, was described from a spring in Acrocorinth (central part of Greece), and *Niphargus adei* S. Karaman, 1934 was described from Samothraki Island in the Aegean Sea.

Niphargus graecus known from the springs in Acrocorinth only, was described and figured based on scarce material, and females were unknown. After this first description, this species was never collected or redescribed. Thus, in the present study we redescribed and figured this species based on original material in Stanko Karaman`s Collection, as well as based on some new material from central Greece, including the unknown females.

MATERIAL AND METHODS

The genus *Niphargus* in Greece is only partially known because of its great diversity, the relatively few studies conducted on this fauna and the difficult methods required for collecting these subterranean aquatic specimens (*e.g.* manual collection of specimens by use of a plankton net in subterranean caves and springs; Karaman-Chappuis method [collecting interstitial specimens from holes on river banks]; Tzvetkov`s method [collecting specimens from wells by use of a special type of net]; Bou-pump with iron tube [collecting interstitial animals from the deep sandy bottom of rivers and coastal areas]; diving in subterranean lakes and water caves; as well as various types of traps, etc.) (G. Karaman 1993: 20). All of these methods usually require multiple visits to each locality over various seasons of the year, making sampling more complicated and more expensive.

For these reasons, often a scarce number of specimens have been collected, or collected samples contained either only males or only females, and new species have been described sometimes based on a single or scarce number of specimens. All of these factors have made the status of these

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species with respect to other known taxa rather uncertain.

In the present study, specimens were preserved in 70% ethanol. Specimens were dissected using a WILD M20 microscope and drawn using a camera lucida attachment. All body-parts were temporarily submersed in a mixture of glycerin and water for study and drawing. The body-length of examined specimens were measured by tracing each individual's mid-trunk length (from the tip of the head to the end of the telson) using a camera lucida. After study, all appendages were stored in Liquid of Faure and covered by a thin cover glass to create permanent microscope slides. All illustrations were inked manually. Some figures were made directly from S. Karaman`s slides.

The advantage of using Liquid of Faure is the possibility to remove all dissected body-parts from this medium using water, allowing them to be restudied from various positions under the microscope.

Some morphological terminology and seta formula for the last mandibular palpus article follow G. Karaman's terminology (G. Karaman 1969) (A = A-setae on outer face; B = B-setae on inner face; C = additional submarginal C-setae on outer face; D = lateral marginal D-setae; E = distal long E-setae), and for propodus of gnathopods 1 and 2 (G. Karaman 2012) (S = corner strong S-spine; L = lateral slender serrate L-spines; M = facial M-setae; R = subcorner R-spine on inner face). The terms "setae" and "spines" are used based on shape, not origin.

This study is based on external morphology, ecology and zoogeography.

TAXONOMICAL PART

Family Niphargidae

Niphargus graecus S. Karaman, 1934

(Figs 1-8)

Niphargus graecus, n. sp., S. Karaman 1934: 217, Fig. 2; Schellenberg 1935: 207 (key); Schellenberg 1936: 9; S. Karaman 1950: 43; G. Karaman 1972: 7; S. Karaman 1956: 1; Pesce & Maggi 1983: 58; Barnard & Barnard 1983: 691; G. Karaman & Ruffo 1986: 525; G. Karaman 2015: 43; G. Karaman 2017: 1.

? *Niphargus aitolosi* Ntakis, Anastasiadou, Zakšek & Fišer, 2015. (Ntakis et al. 2015: 34, Fig. 2A; 35, Figs 3-4; 36, Figs 5-6.)

Material examined

Greece

-217 = Akrokorinth (Acrocorinth), spring (central part of Greece), 19. 6. 1931, 3 exp. (leg. Hans Stadler), holotype on 4 slides (217/1-217/4), and 2 paratypes including one slide (217/5, male 6 mm).

-G-248 (= Sp 313), Delphes, fountain (central part of Greece), 24. 4. 1954, 7 exp. (leg. K. Lindberg).

-S-7335= Lake Lisimachia, Klisovermata, Agrinio (central part of Greece) 24. 4. 2004, 4 exp. (leg. Fišerand andVerhovnik) (type locality of *N. aitolosi*).

Diagnosis

Body moderately slender, metasomal segments 1-3 with a few dorsomarginal setae; urosomal segments 1-2 scarcely settled with spines and setae. Epimeral plate 3 distinctly pointed; pleopods with 2 retinacula. Coxae relatively short, coxa 1 subrounded, coxa 4 unlobed.

Mandibular palpus contains a naked article 1. Maxilla 1 inner plate with 2 setae, outer plate with 7 spines (6 of them with one lateral tooth), palpus short. Maxilliped inner plate short, with 3-5 distal spines. Propodus of gnathopods 1 and 2 is not larger than the corresponding coxa, poorly trapezoid, with dactylus bearing a row of median setae along the outer margin; palm of gnathopods 1 and 2-propodus with one S-spine, 2-3 L-spines sitting laterally of S-spine and one R-spine, the number of M-setae is scarce.

Dactylus of pereopods 3-7 strong, with one spine or spine-like seta at the inner margin. Basipodit of pereopods 5-7 longer than broad, without a distinct ventroposterior lobe; the ventroanterior corner is not produced. Male uropod 1 with elongated inner ramus; male uropod 3 with remarkably elongated distal article of outer ramus; female uropod 1 with inner ramus distinctly longer than outer one; female uropod 3 with poorly elongated distal article of outer ramus. Telsonis more or less gaping, lobes with short distal, lateral and facial spines. Sexual dimorphic characters are visible mainly by different length of inner ramus of uropod 1 and distal article of uropod 3 outer ramus.

Description

Male 10.0 mm (holotype): Body moderately slender, head with short rostrum and subrounded lateral cephalic lobes (Fig. 3A), eyes absent. Metasomal segments 1-3 along dorsoposterior margin with 4-5 short setae only. Urosomal segments 1-3 undescribed.

Epimeral plates 1 and 2 almost subrounded, with a marked ventroposterior corner and convex posterior margin bearing 5-6 short setae each (Fig. 3G). Epimeral plate 1 with poorly concave ventral margin; epimeral plates 2 and 3 with slightly convex ventral margin. Epimeral plate 3 with distinctly pointed ventroposterior corner and slightly sinusoid posterior margin bearing several short setae (Fig. 3G). Epimeral plate 2 is provided with 2 subventral spines, epimeral plate 3 with 3 subventral spines.

Antenna 1 is slightly shorter than half of body-length. Peduncular articles 1-3 are progressively shorter (ratio: 60:40:22), scarcely setose (Fig. 1A); main flagellum consisting of 20-22 articles (most of them with one short aesthetasc).

Accessory flagellum short, 2-articulated (Fig. 1A).

Antenna 2: peduncular article 3 short, with distal setae (Fig. 1B); articles 4 and 5 of unequal length (ratio: 65:56), provided with groups of setae up to as long as or slightly longer than diameter of articles. Flagellum slender, longer than the last peduncular article and consisting of 9 poorly setose articles. Antennal gland cone short (Fig. 1B).

Mouthparts well-developed. Labrum not described. Labium with entire outer lobes, and small inner lobes (Fig. 5A).

Mandible with triturative molar. Left mandible: incisor with 4 teeth, lacinia mobilis bifurcate, with several teeth, accompanied by 6 rakers (Fig. 1E). Right mandible: incisor with 5 teeth, lacinia mobilis with 4 teeth accompanied by 5 rakers (Fig. 1F). Mandibular palpus 3-articulate: first article naked (Fig. 1C); articles 2 and 3 of nearly equal length; article 2 provided with 11-12 strong setae (Fig. 1C); palpus article 3 subfalciform, provided with nearly 24 D-setae and 6 distal E-setae; on outer face is attached one row of 4 A-setae (Fig. 1C), on inner face appear 3 long single B-setae (Fig. 1D).

Maxilla 1: inner plate is provided with 2 unequal setae (S. Karaman mentioned erroneously the appearance of one seta, but on his figure and slide 2 unequal setae are present); outer plate is provided with 7 spines (6 spines with one lateral tooth, inner spine with 2-3 small lateral teeth). Palpus is 2-articulated, not exceeding the distal tip of the outer plate-spines, and provided with 7 setae (Fig. 5B).

Maxilla 2: inner plate is rather smaller than outer one, both plates with marginal setae only (Fig. 3B).

Maxilliped: the inner plate is short, not reaching the outer distal tip of the first palpus article, and provided with 4-5 distal pointed spines accompanied by single setae (Fig. 1G); outer plate not exceeding half of palpus article 2 and provided with nearly10 smooth distomesial spines and single setae; palpus 4-articulated, article 3 along outer margin with one median and one distal bunch of setae (Fig. 1G); article 4 at inner margin with one seta near basis of the nail, along outer margin with one median seta (Fig. 1G), nail is well developed.

Coxae 1-4 relatively short. Coxa 1 is rhomboid, slightly broader than long (ratio: 46:38), with a subrounded ventro-anterior margin and provided with nearly 10 unequal marginal setae (Fig. 2A).

Coxa 2 is slightly broader than long (ratio: 54:50), with several marginal setae (Fig. 2D). Coxa 3 is nearly as long as broad, quadrate, with subrounded ventral corners and provided with several short marginal setae only (Fig. 3C). Coxa 4 is slightly broader than long (ratio: 55:50), without ventroposterior lobe and provided with several short marginal setae (Fig. 3E).

Coxa 5 is bilobed, much broader than long (ratio: 75:43), anterior lobe is not produced (Fig. 4A). Coxa 6 is shorter than coxa 5, bilobed, broader than long (ratio: 68:40) (Fig. 4C). Coxa 7 is entire, much broader than long (ratio: 53:22) with convex ventral margin (Fig. 4E).

Gnathopods 1-2 are relatively small, with propodus nearly as large as the corresponding coxa (Fig. 2A, D). Gnathopod 1: article 2 along the anterior and posterior margin with row of longer simple setae; article 3 at the posterior margin with one bunch of distal setae. Article 5 is shorter than the propodus (ratio: 33:41), along the anterior margin with one bunch of distal setae (Fig. 2A, B). Propodus is poorly trapezoid, slightly longer than broad (ratio: 73:68), along the posterior margin with 6 transverse rows of setae; palm convex, inclined nearly half of the propodus-length, defined on the outer face by one corner S-spine accompanied laterally by 3 unequal serrate L-spines and 3 long facial M-setae (Fig. 2C), on the inner face by one subcorner R-spine (Fig. 2C). Dactylus reaching the posterior margin of propodus, along the outer margin with 6 median setae, along the inner (mesial) margin with several short setae (Fig. 2B).

Gnathopod 2 is rather larger than gnathopod 1, article 2 is provided with longer setae along the anterior and posterior margin; article 3 at the posterior margin with one bunch of distal setae. Article 5 is rather shorter than the propodus (ratio: 42:45), along the anterior margin with one median and one distal group of setae (Fig. 2D, E). Propodus is poorly trapezoid, nearly as long as broad, along posterior margin with 6 transverse rows of setae (Fig. 2E). Palm convex, inclined less than half of propodus-length and defined on outer face by one corner S-spine accompanied laterally by 3 L-spines and 3 long facial M-setae (Fig. 2F), on inner face by one subcorner R-spine (Fig. 2F). Dactylus reaching posterior margin of propodus, along outer margin with 4 median setae, along inner (mesial) margin with a row of short setae (Fig. 2E).

Pereopods 3 and 4 are rather similar to each other, moderately strong. Pereopod 3: article 2 along the posterior margin with setae longer than those on the anterior margin; articles 4-6 of unequal length (ratio: 50:34:40), articles 4 and 5 along the posterior margin with several bunches of setae (the longest setae are longer than the diameter of the articles) (Fig. 3C). Article 6 along the posterior margin with 5 groups of short spines accompanied by single short setae. Dactylus strong, much shorter than article 6 (ratio: 18:40), at inner margin with one spine near basis of the nail, along outer margin with one median plumose seta (Fig. 3D); nail is shorter than pedestal (ratio 30:37).

Pereopod 4 is hardly shorter than pereopod 3, article 2 at anterior margin with shorter setae, at posterior margin with several long setae. Articles 4-6 of unequal length (ratio: 43:30:39); setae along posterior margin of articles 4 and 5 not exceeding diameter of articles themselves. Article 6 at posterior margin with 5 groups of short spines accompanied by single short setae (Fig. 3E). Dactylusis strong, much shorter than article 6 (ratio: 18:39), at the inner margin with one spine near basis of the nail, along the outer margin with one median plumose seta (Fig. 3F); nail is shorter than pedestal (ratio: 29:35).

Pereopods 5-7 are moderately strong. Pereopod 5 is distinctly shorter than pereopods 6 and 7; article 2 is longer than broad, almost ovoid (ratio: 74:50), with a convex anterior margin bearing several short spine-like setae, ventroanterior corner is not produced; along the posterior convex margin nearly 9 short setae are attached, the ventroposterior lobe is not developed (Fig. 4A). Articles 4-6 are of unequal length (ratio: 45:50:53), articles along both margins with spines and single short setae. Article 2 is longer than article 6 (ratio: 74:53). Dactylus is much shorter than article 6 (ratio: 21:53), at inner margin with one spine near basis of the nail, along outer margin with one median plumose seta (Fig. 4B); nail is shorter than pedestal (ratio: 25:45).

Pereopod 6: article 2 is longer than broad (ratio: 88:60), along anterior convex margin is provided with several spine-like setae, along posterior convex margin appear a row of nearly 9 short setae, ventroposterior lobe is not developed (Fig. 4C). Articles 4-6 are of unequal length (ratio: 50:64:65); article 4 at posterior margin with one median and one distal spine; articles 5 and 6 along both margins with groups of short spines. Article 2 is longer than article 6 (ratio: 88:65). Dactylus is much shorter than article 6 (ratio: 25:65), at inner margin with one spine near basis of the nail, at outer margin with one median plumose seta (Fig. 4D); nail is shorter than pedestal (ratio: 35:57).

Pereopod 7: article 2 is longer than broad (ratio: 88:62), along anterior convex margin is attached a row of several slender spines, along the posterior convex margin appear nearly 8 short setae, ventroposterior lobe absent (Fig. 4E). Articles 4-6 of unequal length (ratio: 48:63:73), along both margins with bunches of short spines (Fig. 4E, F). Article 2 is longer than article 6 (ratio: 88:73. Dactylus is much shorter than article 6 (ratio: 25:73), at inner margin with one spine near basis of the nail, at outer margin with one median plumose seta (Fig. 4G); nail is shorter than pedestal (ratio: 30:55).

Pleopods 1-3 are with 2 retinacula each. Peduncle of pleopods is partially damaged, and no setal structure on peduncle was observed.

Urosomal segments 1-3 and uropods 1-2 are missing, but S. Karaman mentioned (1934) that the inner ramus of uropod 1 and uropod 2 is longer than the outer ramus.

Uropod 3 is elongated: peduncle is longer than broad; the inner ramus is shorter than the peduncle and provided with 3 short lateral and 2 distal spines and one seta (Fig. 1H). Outer ramus is 2-articulated: first article is long, along the inner (mesial) margin with 5 groups of short spines mixed with single plumose setae (Fig. 1H), along outer margin are attached 5 bunches of short spines and 2 single setae; second article is shorter than first one (ratio: 68:116), along both margins and tip are attached several short simple setae.

Telson is relatively short, gaping, broader than long (ratio: 98:91), incised nearly 2/3 of telson length; each lobe is provided with 3 distal short spines; along outer margin appear 1-2 spines (Fig. 1I), along inner (mesial) margin are attached 2 spines; one dorsal facial spine is attached on each lobe; a pair of short plumose setae is attached near the middle of outer margin.

Coxal gills are moderately long, not reaching ventral tip of corresponding article 2 of the legs (Figs 2D; 3C).

Male 6.0 mm (paratype): Mainly similar to the holotype. Labrum is broader than long.

Urosomal segment 1 on each dorsolateral side with one seta, urosomal segment 2 on each dorsolateral side with one spine; urosomal segment 3 naked. Urosomal segment 1 on each ventroposterior corner with one spine near basis of uropod 1-peduncle (Fig. 5D).

Uropod 1: peduncle with dorsoexternal row of spines and dorsointernal row of setae (except distal spine). Inner ramus bearing several lateral spines and one simple seta, as well as 5 spines at the tip (Fig. 5D); outer ramus is distinctly shorter than inner one, bearing several lateral spines and 2 simple setae; at the tip of outer ramus are attached 4 unequal spines.

Uropod 2: peduncle with distal spines; both rami almost of equal length, bearing 1-2 lateral and 4-5 short distal spines each (Fig. 5E).

Uropod 3: peduncle is longer than broad (ratio: 40:26) bearing a row of small distal spines (Fig. 5E); inner ramus is short, scale-like, shorter than peduncle (Fig. 5F). Outer ramus consisting of 2 articles: first article along the outer margin with 4 groups of short spines and simple setae, along the inner (mesial) margin are attached 4 groups of spines (2 of them accompanied by one short plumose seta); distal article shorter than the first one (ratio: 38:103) and provided with single short simple marginal setae (Fig. 5F).

Telson is gaping, slightly broader than long (ratio: 85:78), incised nearly 2/3 of telson-length; each lobe is provided with 3 distal unequal spines (the longest spine reaching less than half of telson-length (ratio: 33:78); one short spine is attached at the inner (mesial) margin; on the dorsal face of each lobe appears one small slender spine; near the connection of two lobes appear 2 short setae; a pair of short plumose setae near the middle of the outer margin is poorly visible (Fig. 5C).

Female 7.0 mm with eggs, from Delphes: Body moderately slender, head and metasomal segments 1-3 are with 4-5 dorsolateral short marginal setae; urosomal segment 1 on each dorsolateral side with one strong seta; urosomal segment 2 on each dorsolateral side with 2 spines; urosomal segment 3 naked.

Epimeral plates 1-2 are angular, with poorly convex posterior margin bearing 3-4 short setae; ventral margin of epimeral plate 1 is slightly concave (Fig. 7D). Epimeral plate 3 is strongly pointed, with excavated posterior margin bearing nearly 6 short marginal setae; epimeral plates 2 and 3 with 3 subventral spines each (Fig. 7D).

Antenna 1is rather shorter than half of the body (ratio:

32:70), main flagellum consists of 16 articles (most of them with one short aesthetasc). Antenna 2 like that in males, flagellum consists of 7-8 articles.

Mouthparts like those in males. Mandible with nearly 6 rakers, palpus article 2 with 8 setae; palpus article 3 is subfalciform, with nearly 20 D-setae and 5 E-setae, on the inner face appear 4-5 B-setae, on the outer face are attached 5 A-setae.

Maxilla 1: the inner plate is with 2 setae, the outer plate with 7 spines [6 spines with one tooth, one spine with 2 teeth]; palpus 2-articulated, not reaching the tip of the outer plate-spines and provided with 6 distal setae.

Maxilliped: inner plate is short, with 3 distal smooth spines accompanied by several setae; outer plate reaching nearly half of palpus article 2 and provided with nearly 11 mesial pointed spines mixed with several distal setae; palpus article 3 at outer margin with 1-2 median setae; article 4 at inner margin with 1-2 setae near basis of the nail.

Coxae 1-4 are relatively short. Coxa 1 is nearly as long as broad, with subrounded ventroanterior margin and provided with nearly 5 short setae (Fig. 6A). Coxa 2 is slightly longer than broad (ratio: 53:45), with 8 marginal unequal setae (Fig. 6D). Coxa 3 is distinctly longer than broad (ratio: 59:50), with up to 10 short setae (Fig. 8A). Coxa 4 is nearly as long as broad, with a slightly concave posterior margin, ventroposterior lobe is not developed, ventral margin is provided with nearly 7 setae (Fig. 8B).

Coxa 5 is bilobed, much broader than long (ratio: 64:44), with the anterior lobe almost as long as coxa 4 (Fig. 7A). Coxa 6 is smaller than coxa 5, broader than long (ratio: 53:36), bilobed (Fig. 7B); coxa 7 is entire, broader than long (ratio: 53:25) (Fig. 7C).

Gnathopods 1-2 are relatively small, with a propodus nearly as large as the corresponding coxa (Fig. 6A, D). Gnathopod 1: article 2 at the anterior margin with a row of long setae, along the posterior margin with bunches of long setae; article 3 at the posterior margin with one bunch of setae (Fig. 6A). Article 5 is shorter than the propodus (ratio: 25:40), along the anterior margin with a distal bunch of setae. Propodus is trapezoid, slightly longer than broad (ratio: 80:75), along the posterior margin with 5 transverse rows of setae (Fig. 6B); palm slightly convex, inclined less than half of the propodus-length, defined on the outer face by one corner S-spine accompanied laterally by 3 serrate L-spines and 3 facial M-setae (Fig. 6C), on the inner face by one short subcorner R-spine. Dactylus reaching posterior margin of propodus, along the outer margin with 5 median single setae, along the inner margin with a row of short setae (Fig. 6B).

Gnathopod 2 is slightly larger than gnathopod 1: article 2 with a row of setae along the anterior margin and bunches of setae along the posterior margin; article 3 at the posterior margin with one bunch of setae (Fig. 6D). Article 5 is shorter than propodus (ratio: 35:40), along the anterior margin with one distal bunch of setae. Propodus trapezoid, nearly as long as broad, along the posterior margin with 6 transverse rows of setae (Fig. 6E); palm slightly convex, inclined slightly less than half of propodus-length, defined on outer face by one corner S-spine accompanied laterally by 2 serrate L-spines and 3 facial M-setae, on the inner face by one short subcorner R-spine (Fig. 6F). Dactylus reaching the posterior margin of the propodus, along the outer margin with 5 median single setae, along the inner margin with a row of short setae (Fig. 6E).

Pereopods 3 and 4 moderately strong. Pereopod 3 is slightly longer than pereopod 4, article 2 along the anterior margin with 4 long proximal and nearly 4 short distal setae, along the posterior margin with several longer setae. Articles 4-6 are of unequal length (ratio: 45:30:37); article 4 and article 5 along the anterior and posterior margins with single setae (the longest setae hardly exceeding diameter of articles themselves) (Fig. 8A); article 6 along the posterior margin with 6 groups of short spines. Dactylus is short and strong, much shorter than article 6 (ratio: 19:37), at inner margin with one slender spine near basis of the nail (Fig. 8A), at the outer margin with one median plumose seta, nail is shorter than pedestal.

Pereopod 4: article 2 along anterior margin with long proximal and shorter distal setae, along posterior margin with longer setae.Articles 4-6 are of unequal length (ratio: 40:29:36). Article 2 at anterior and posterior margin with setae of various size; article 5 along posterior margin with 3 groups of short spines and setae; article 6 along posterior margin with 5-6 groups of short spines and single short setae (Fig. 8B). Dactylus is strong, much shorter than article 6 (ratio: 16:36), at inner margin with one slender spine near basis of the nail, along outer margin with one median plumose seta, nail is shorter than pedestal.

Pereopods 5-7 are moderately strong. Pereopod 5 is remarkably shorter than pereopods 6 and 7 (Fig. 7A), article 2 is dilated, longer than broad (ratio: 68:45), along anterior slightly convex margin with row of short spinelike setae or setae, along the posterior margin with a row of nearly 10 short setae; ventroanterior corner is not produced, ventroposterior lobe is not fully developed (Fig. 7A). Articles 4-6 are of unequal length (ratio: 40:44:50), article 4 along anterior margin with several setae not exceeding diameter of article itself, along the posterior margin with one median and distal spine; articles 5 and 6 along both margins with short spines and single setae of various length. Article 2 is longer than article 6 (ratio: 68:50). Dactylus is much shorter than article 6 (ratio: 18:50), at the inner margin with one slender spine near the basis of the nail, along outer margin with one median plumose seta, nail is shorter than pedestal.

Pereopod 6: article 2 is longer than broad (ratio: 78:53), along anterior margin with 5 spine-like setae, along posterior margin with nearly 12 short setae, ventroposterior lobe is not fully developed (Fig. 7B). Articles 4-6 are of unequal length (ratio: 49:60:74); article 2 along anterior margin with several

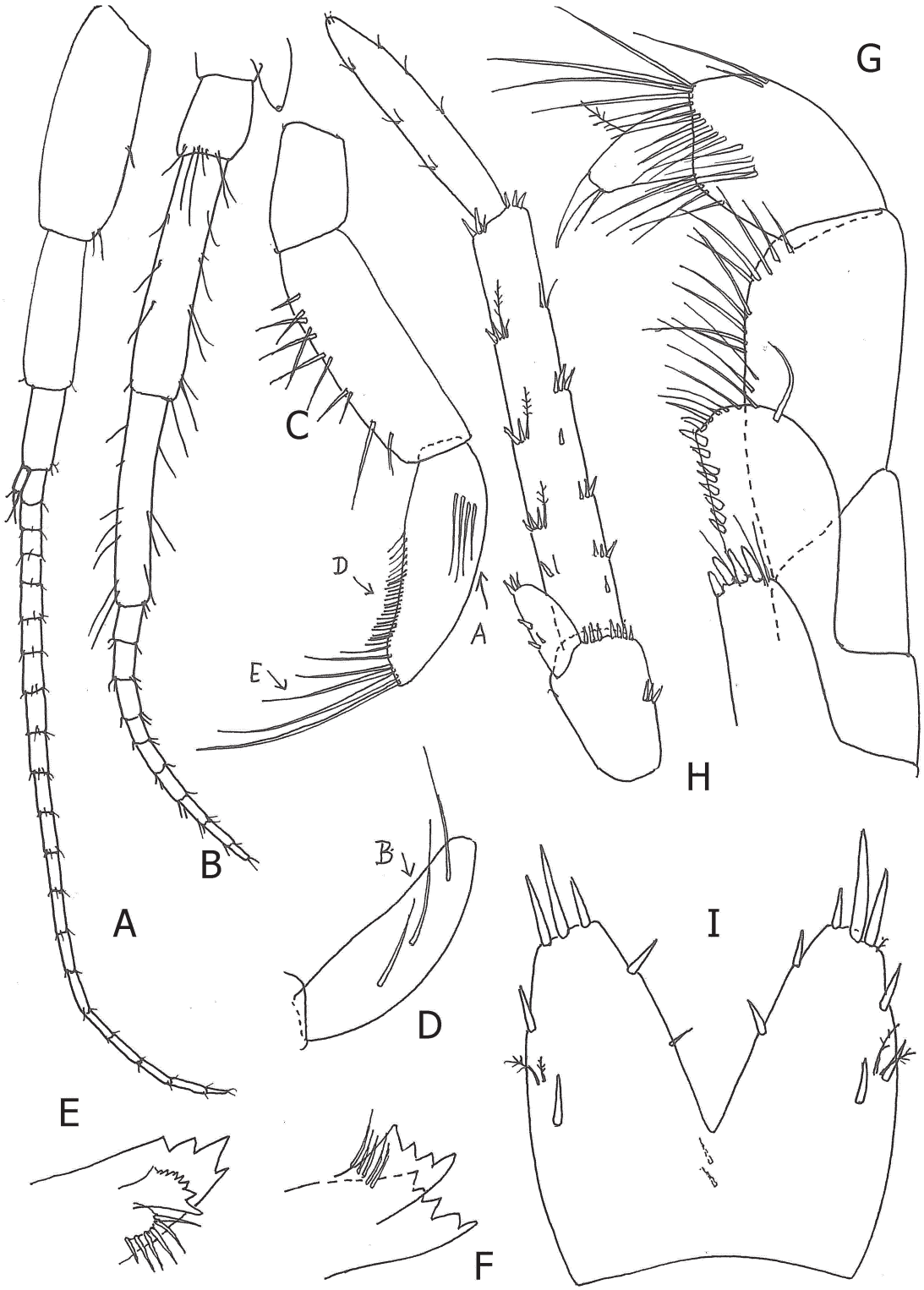

Fig. 1. *Niphargus graecus*, Acrocorinth, spring, Greece, male 10.0 mm, holotype: **A** = antenna 1; **B** = antenna 2; **C** = mandibular palpus, outer face (A = A-setae; D = D-setae; E = E-setae); **F** = distal article of mandibular palpus, inner face (B = B-setae); **E** = left mandible with incisor, lacinia mobilis and rakers; **F** = right mandible with incisor, lacinia mobilis and rakers; **G** = maxilliped; **H** = uropod 3; **I** = telson.

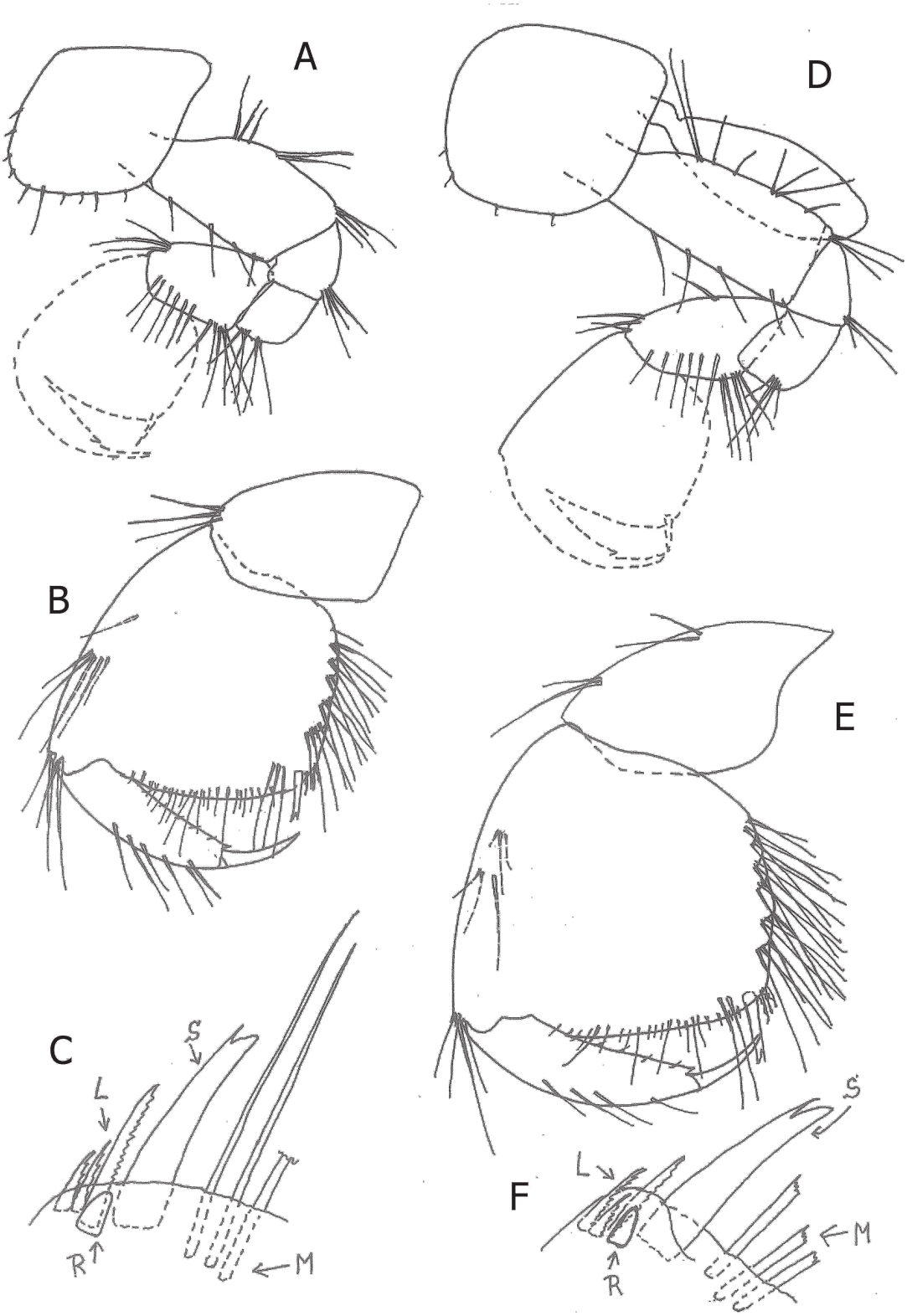

Fig. 2. *Niphargus graecus*, Acrocorinth, spring, Greece, male 10.0 mm, holotype: **A** = gnathopod 1, outer face; **B** = propodus of gnathopod 1, outer face; **C** = distal corner of gnathopod 1 propodus, inner face (S = corner S-spine; L- lateral L-spines; R = subcorner R-spine; M = facial M-setae); **D** = gnathopod 2, outer face; **E** = propodus of 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; M = facial M-setae).

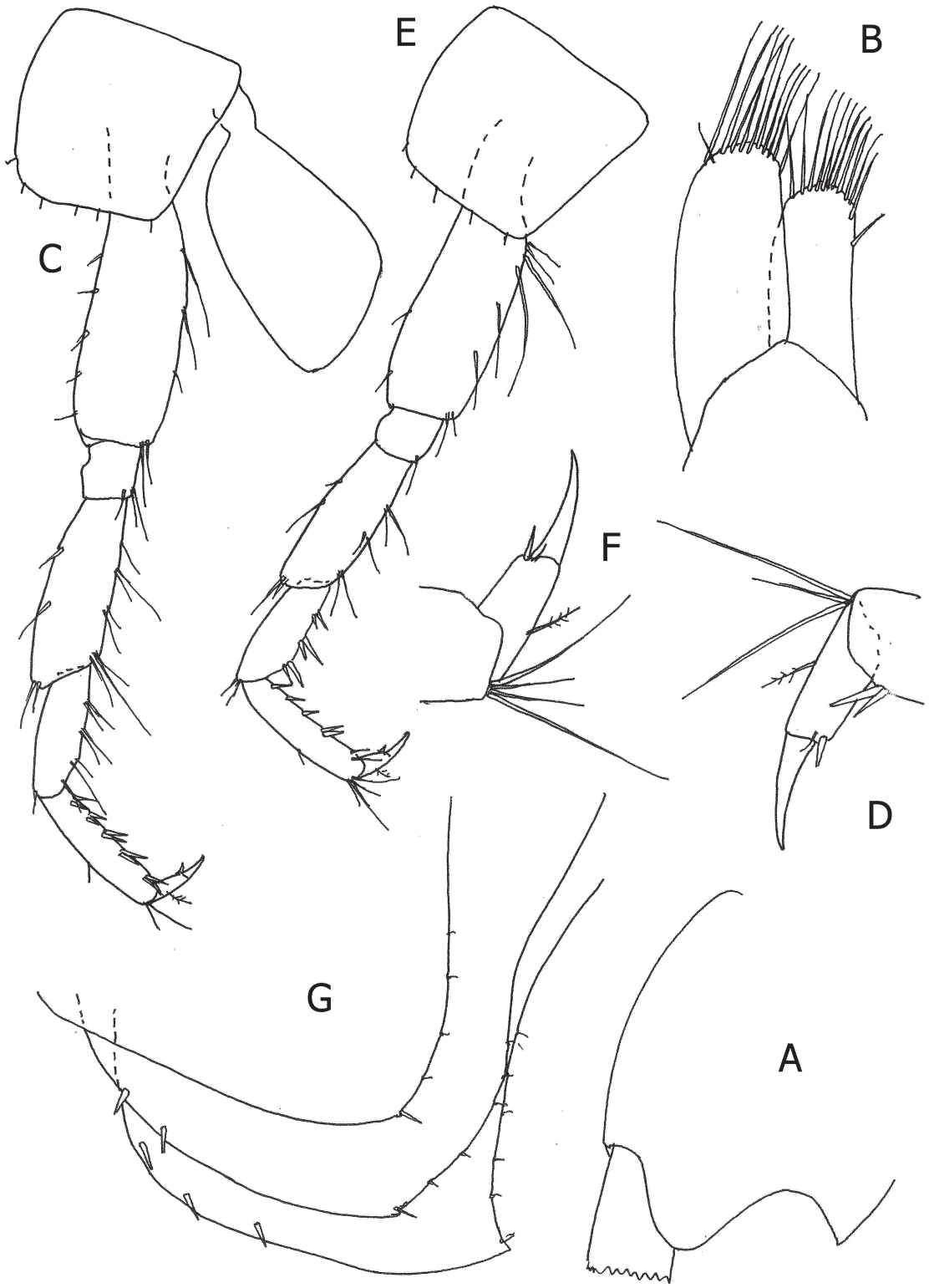

Fig. 3. *Niphargus graecus*, Acrocorinth, spring, Greece, male 10.0 mm, holotype: **A** = head; **B** = maxilla 2; **C-D** = pereopod 3; **E-F** = pereopod 4; **G** = epimeral plates 1-3.

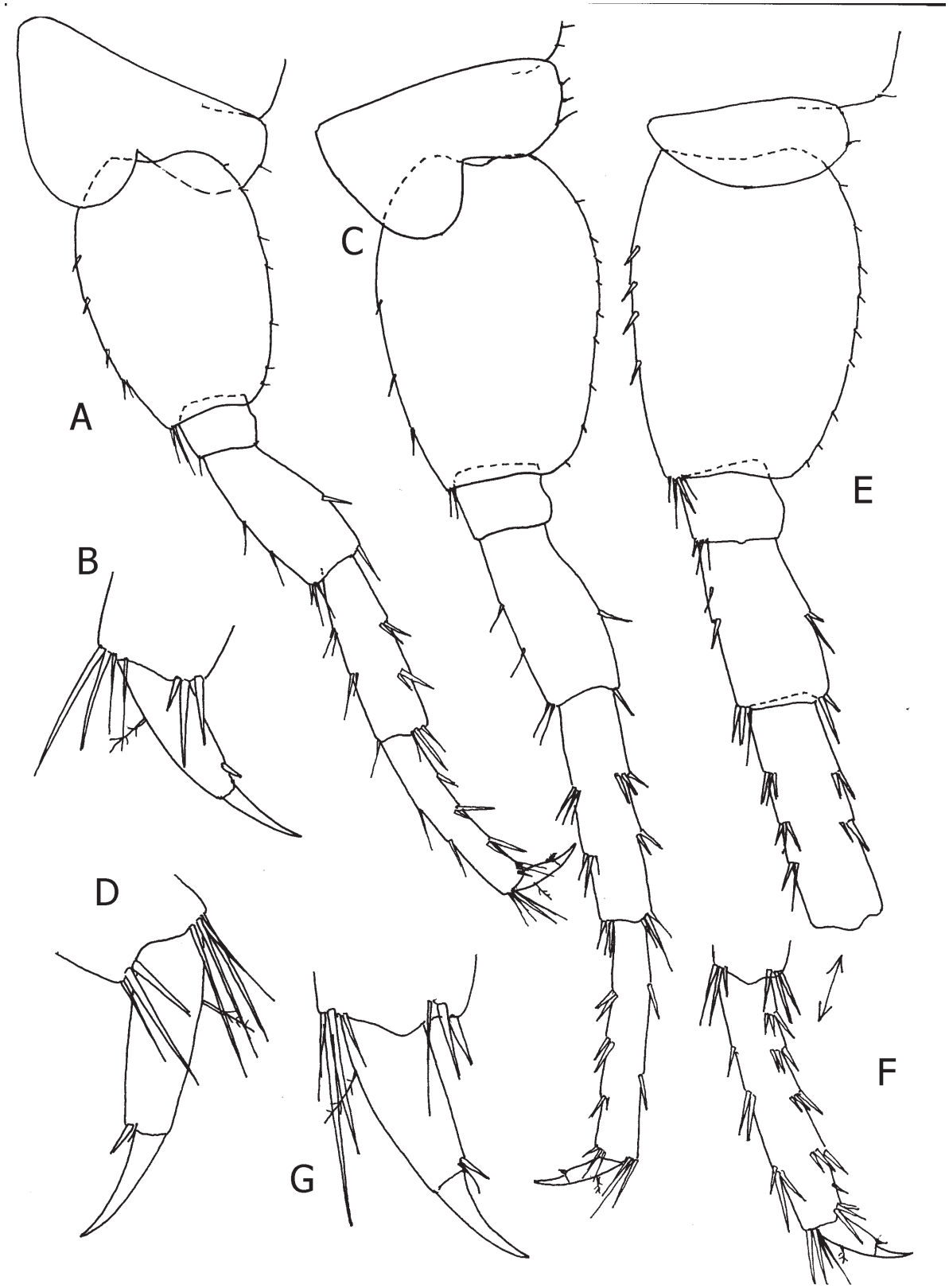

Fig. 4. *Niphargus graecus*, Acrocorinth, spring, Greece, male 10.0 mm, holotype: **A-B** = pereopod 5; **C-D** = pereopod 6; **E-F-G** = pereopod 7.

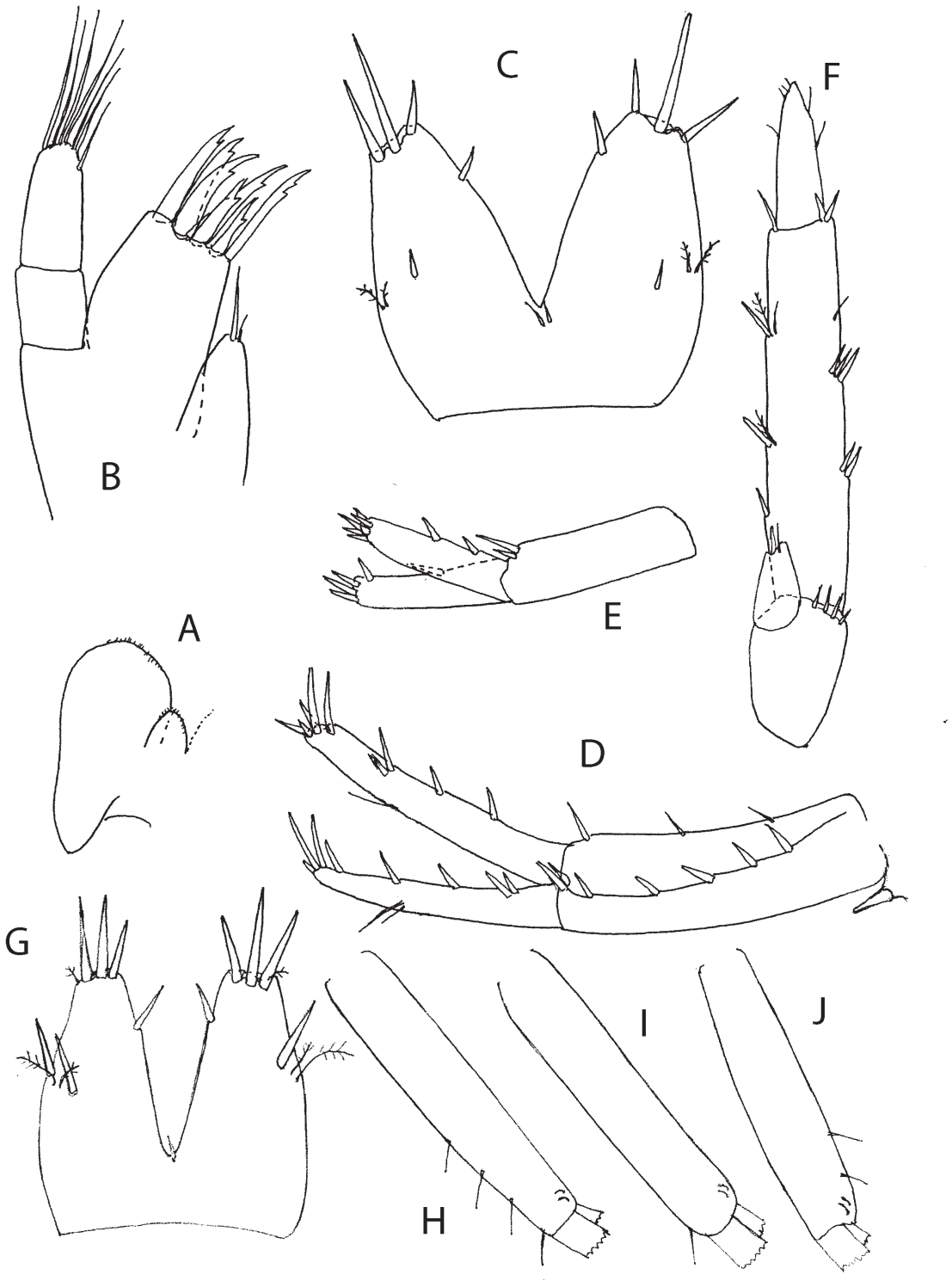

Fig. 5. *Niphargus graecus*, Acrocorinth, spring, Greece, male 10.0 mm, holotype: **A** = left half of labium; **B** = maxilla 1; Male 6.0 mm (paratype): **C** = telson; **D** = uropod 1; **E** = uropod 2; **F** = uropod 3; Female 7.0 mm ovig., Lisimachia Lake ("*aitolosi*"): **G** = telson; **H** = peduncle of pleopod 1; **I** = peduncle of pleopod 2; **J** = peduncle of pleopod 3.

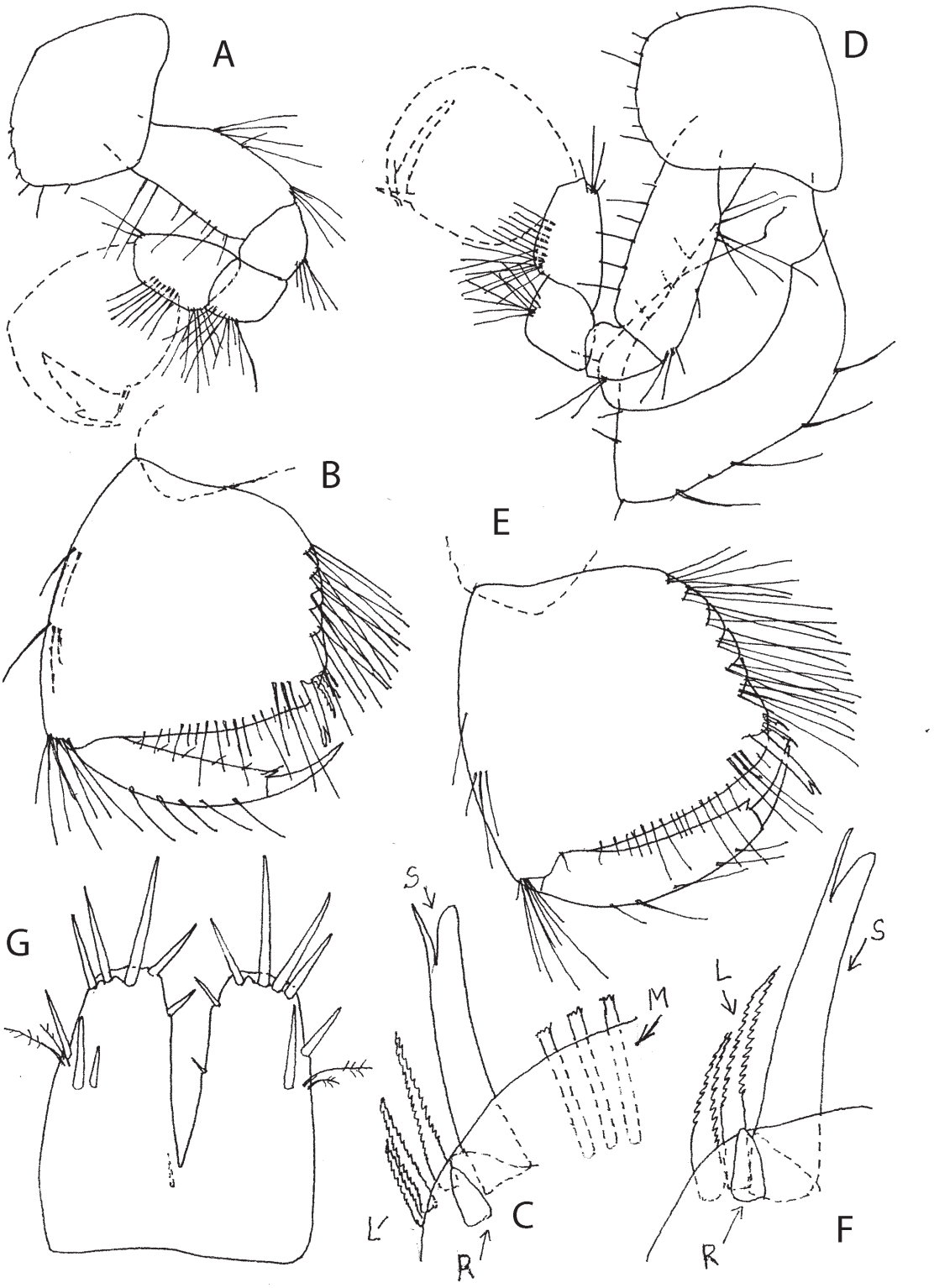

Fig. 6. *Niphargus graecus*, Delphes, female ovig. 7.0 mm: **A-B** = gnathopod 1; **C**= distal corner of gnathopod 1 propodus, inner face (S = corner S-spine; L = lateral L-spines; R = subcorner R-spine; M = facial M-setae); **D-E** = gnathopod 2; **F** = distal corner of gnathopod 2-propodus, inner face (S = corner S-spine; L= lateral L-spines; R = subcorner R-spine; M-setae are omitted); **G** = telson.

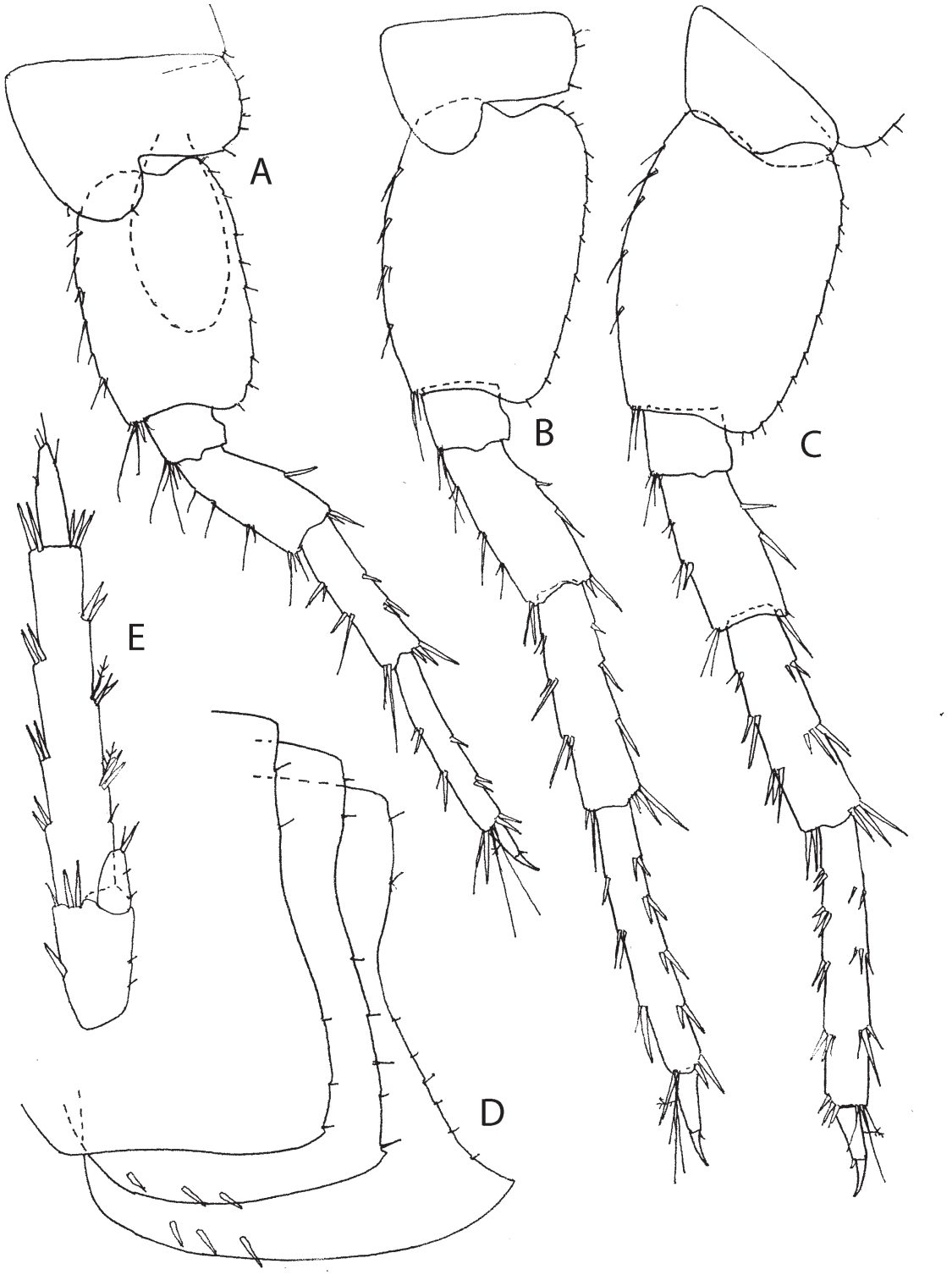

Fig. 7. *Niphargus graecus*, Delphes. Female ovig. 7.0 mm: **A** = pereopod 5; **B**= pereopod 6; **C** = pereopod 7; **D** = epimeralplates 1-3; **E** = uropod 3.

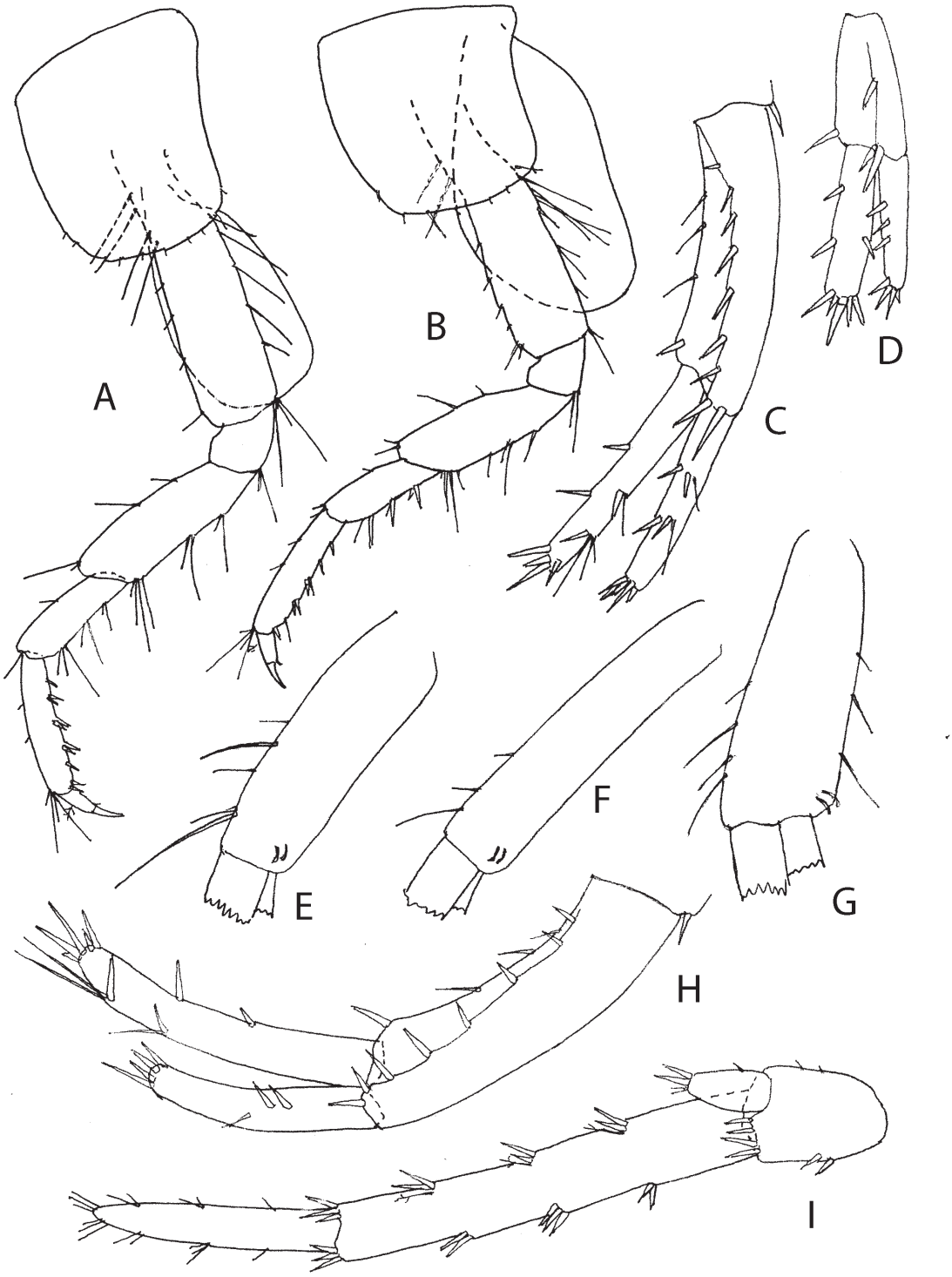

Fig. 8. *Niphargus graecus*, Delphes. Female ovig. 7.0 mm**: A** = pereopod 3; **B** = pereopod 4; **C** = uropod 1; **D** = uropod 2; **E** = peduncle of pleopod 1; **F** = peduncle of pleopod 2; **G** = peduncle of pleopod 3; Male 8.5 mm: **H** = uropod 1; **I** = uropod 3.

setae and spine-like setae, along the posterior margin with 3 groups of setae and slender spines; article 5 along both margins with slender spines; article 6 along posterior margin with 5 groups of short spines. Article 2 is rather longer than article 6 (ratio: 78:74). Dactylus is much shorter than article 6 (ratio: 25:74), at inner margin with one slender spine near basis of the nail, at the outer margin with one median plumose seta; nail is shorter than the pedestal (Fig. 7B).

Pereopod 7: article 2 is dilated, longer than broad (ratio: 81:56), at anterior slightly convex margin are attached nearly 6 spine-like setae, along posterior margin appear nearly 12 short setae, ventroposterior lobe is not fully developed (Fig. 7C). Articles 4-6 are of unequal length (ratio: 45:59:80); article 4 at both margins with short spines and single short setae; articles 5 and 6 along anterior and posterior margin with bunches of spines. Article 6 is almost as long as article 2. Dactylus is short and strong, much shorter than article 6 (ratio: 25:80), at inner margin with one slender spine near basis of the nail, at outer margin with one median plumose seta; nail is shorter than pedestal (Fig. 7C).

Pleopods 1-3 are with 2 retinacula each. Peduncle of pleopod 1 at the anterior margin with 4-5 setae (Fig. 8E); peduncle of pleopod 2 along anterior margin with 3 short setae (Fig. 8F); peduncle of pleopod 3 with 4 setae along anterior margin, and 3 setae along posterior margin (Fig. 8G).

Uropod 1: peduncle is provided with a dorsoexternal row of strong spines and a dorsointernal row of setae (except distal spine) (Fig. 8H). Inner ramus is slightly shorter than peduncle, along both margins are attached single spines and 2 bunches of simple setae, at tip appear 4 distal short spines. The outer ramus is distinctly shorter than the inner one, along margins appear several bunches of short spines and one simple seta, at top of the article appear 4-5 short spines.

Uropod 2: peduncle with single lateral and distal spines; inner ramus is distinctly longer than outer ramus and provided with several lateral and 5 distal short strong spines, outer ramus is provided with several lateral and 4 distal short strong spines (Fig. 8D).

Uropod 3 is relatively short; peduncle is slightly longer than broad (ratio: 35:22), with one lateral and several distal spines; inner ramus is scale-like, very short, with one spine and seta at the tip (Fig. 7E); outer ramus is consisting of 2 articles: first article is relatively narrow, along outer margin with 5 bunches of spines, along inner (mesial) margin with 3 groups of spines mixed with single short plumose setae; second article is much shorter than first one (ratio: 28:97), with single lateral and distal simple short setae (Fig. 7E); distal article is longer than diameter of first article.

Telson is nearly as long as broad, incised nearly 2/3 of telson-length; each lobe is provided with 4 distal unequal spines hardly shorter than half of telson-length (Fig. 6G), at outer margin is attached one spine, at mesial margin appear 1-2 spines, on dorsal face are attached 1-2 spines; a pair of short plumose setae is attached near the middle of outer margin of each lobe.

Coxal gills are moderately large, not exceeding ventral tip of corresponding article 2; the longest coxal gills are on gnathopod 2 and pereopod 4 (Figs 6D, 8B), on other legs are shorter (Figs 7A, 8A).

Oostegites are very large, occur on pereopods 2-5, and are provided with long marginal setae (Fig. 6D).

Male 8.5 mm from Delphes: Male is similar to male from Acrocorinth, Urosomal segment 1 on each dorsolateral side with one seta; urosomal segment 2 on each dorsolateral side with 2 spines, urosomal segment 3 naked. Pleopods like these in females.

Uropod 1: peduncle with a dorso external row of spines and a dorso internal row of strong setae (except distal spine); inner ramus is much longer than the outer ramus, provided with several lateral spines and 3 simple setae (2+1), at tip appear 5 short spines (Fig. 8H); outer ramus is with 3-4 lateral setae and one short seta, at tip with 4 short spines.

Uropod 2: inner ramus is distinctly longer than outer one. Uropod 3 with elongated distal article of outer ramus like that in holotype (Fig. 8 I). Telson like that in female, bearing distal, lateral and facial spines.

Specimens from Lisimachia Lake are similar to our specimens of *N. graecus* from Acrocorinth and Delphes. Telson of ovigerous. female 7.5 mm is nearly as long as broad, incised over 2/3 of telson-length; each lobe is provided with 3 distal spines, 0-1 outer marginal spine, one spine at the mesial margin and one facial spine; a pair of short plumose setae is attached near the middle of the outer margin (Fig. 5G).

Pleopods 1-3 with 2 retinacula each; peduncle of pleopod 1 with 4 setae along the anterior margin (Fig. 5H); peduncle of pleopod 2 with one distal setae at the anterior margin (Fig. 5 I); peduncle of pleopod 3 with 2 distal setae at posterior margin (Fig. 5J).

Locus typicus: Spring in Acrocorinth, Greece.

Distribution: Central Greece, endemic.

Remarks and affinities

S. Karaman described *N. graecus* based on several male specimens. The holotype (male 10 mm) was only partially dissected and figured by S. Karaman (1934). So, in the present study I have completely dissected, figured and redescribed this holotype specimen, except for missing urosome and uropods 1-2 (not in the slides of S. Karaman, but mentioned in S. Karaman`s description). During this process, because of the compression of cover glasses, some structures become slightly dilated, which is visible in some figures.

Niphargus graecus was overlooked by some authors because of the scarce and incomplete description of this species. Recently several new species of *Niphargus* have been described and not directly compared with *N. graecus*. Thus, it is now important to redescribe this species to understand the position of other recently described species from Greece

(Fišer et al. 2006; Ntakis et al. 2015; G. Karaman 2016, etc.).

Specimens collected by Dr. Lindberg from Delphes agree with S. Karaman`s description of *N. graecus*, and we described a female and male from this locality to complete the description of taxonomical characters for this species.

The recently described species *Niphargus aitolosi* Ntakis, Anastasiadou, Zakšek & Fišer, 2015, which was also collected from central Greece (Lisimachia Lake), seems to be identical to *N. graecus*. Thanks to specimens of *Niphargus* from Lisimachia Lake, sent to me several years ago by Dr. Cene Fišer (Ljubljana), we compared these specimens (males and females) with specimens of *N. graecus*, and no significant morphological differences were found.

Niphargus adei S. Karaman, 1934, described from Samothraki Island (Aegean Sea, Greece) is also rather similar to *N. graecus*, but differs remarkably in the shape of its epimeral plates and by the armature of its telson, etc.

All other known Greek *Niphargus* species (about 17 species) are clearly different from *N. graecus* by combination of the relevant taxonomical characters.

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