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**NEW DATA OF THE SUBTERRANEAN SPECIES *NIPHARGUS RHODI*
S. KARAMAN, 1950 (FAM. NIPHARGIDAE)
IN RHODOS ISLAND, GREECE
(CONTRIBUTION TO THE KNOWLEDGE OF THE AMPHIPODA 296)**

SUMMARY

The partially known species *Niphargus rhodi* S. Karaman, 1950b (Amphipoda, fam. Niphargidae) was described based on one female from the subterranean waters of Rhodos Island ["(spring on the Propheta Mt. (?Elias?)" (? = Profitis Ilias)], and later only mentioned by Pesce & Maggi (1983) for several localities of this island accompanied sometimes with amphipods *Bogidiella longiflagellum* S. Kar. 1959 or *Medigidiella chappuisi* (Ruffo, 1952).

This species, discovered and collected in numerous localities on Rhodos Island by various scientists, is now redescribed and figured, and its variability and relation to other members of genus *Niphargus* of Greece and some adjacent regions is discussed.

Keywords: taxonomy, redescription, *Niphargus rhodi*, Rhodos Island, Greece, subterranean.

INTRODUCTION

The freshwater fauna of Amphipoda in Greece has been studied for long time by various scientist and expedition (C. Bou, S. Karaman, S. Ruffo, A. Vigna-Taglianti, J. Stoch, G. Karaman, etc.) and numerous taxa were discovered and described belonging to various Amphipoda families [Ingolfiellidae, Bogidiellidae, Crangonictidae, Salentinellidae, Gammaridae, Hadziidae, Niphargidae, etc.]. Among them the most numerous taxa belong to the family Niphargidae (genera *Niphargus* Schiödde, 1849, *Exniphargus* G. Karaman, 2016b, *Niphargobatooides* G. Karaman, 2016b), i. e. to the genus *Niphargus* (nearly 15 taxa), almost all highly endemic.

Despite the fact that the subterranean fauna of the family Niphargidae in Greece was studied since 1934, when S. Karaman described some new taxa [*Niphargus adei* from Samothrake island and *N. graecus* from Akrokorinth in continental Greece], this fauna in Greece is still only partially known, and we can expect discovery of other new taxa from this region.

Regarding Rhodos Island (Aegean Sea), S. Karaman described (1950b) new species *Niphargus rhodi* based on one adult female from spring Nimpha on

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Mt. Propheta. Pesce & Maggi (1983) mentioned this species from several localities of Rhodos, but without any taxonomical data.

Thanks to the deceased Prof. Dr. Jan Stock from Holland, who sent us the samples of genus *Niphargus* collected from various subterranean waters of Rhodos Island, Greece, as well as by some samples sent me by Dr. Hans Malicky from Austria and Dr. Giuseppe Pesce from Italy, we have a possibility to redescribe taxonomically partially known species *Niphargus rhodi* S. Karaman, 1950b, despite the fact that within all numerous samples in hands. not final adult males were found. At the moment, *N. rhodi* is single *Niphargus* taxon known from this island.

MATERIAL AND METHODS

The studied material was preserved in the 70% ethanol. The specimens were dissected using a WILD M20 microscope and drawn using camera lucida attachment. All appendages were temporarily submersed in the mixture of glycerine and water for study and drawing. Later, all appendages have been transferred to Liquid of Faure on permanent slides. The body-length of examined specimens were measured by tracing individual's mid-trunk lengths (from tip of head to end of telson) using camera lucida. All illustrations were inked manually. Some morphological terminology and setae formulae follow G. Karaman's terminology (Karaman, G., 1969; 2012c) regarding the last mandibular palpus article [A= setae on outer face; B= setae on inner face; D= lateral marginal setae; E= distal long setae] and propodus of gnathopods 1 and 2 [S= corner spine; L= lateral slender serrate L-spines; M= facial M-setae; R= subcorner R-spine on inner face]. Terms "setae" and "spines" are used based on its shape, not origin. The study was provided using morphological, ecological and zoogeographical data.

TAXONOMICAL PART

Family NIPHARGIDAE

NIPHARGUS RHODI S. Karaman, 1950b

Niphargus rhodi, S. Karaman, 1950b, 43, figs. 1-10; G. Karaman, 1972: 7; Pesce & Maggi, 1983: 58; Barnard & Barnard 1983: 694; G. Karaman & Ruffo, 1986: 530.

MATERIAL EXAMINED: Rhodos Island, Greece

-688 = "Monte Propheta, spring Nimpha, Rhodos Island, Greece", 2.6.1937, one female 7.0 mm (holotype) (leg. H. Stadler) (incl. 2 slides No. 688/1, 688/2) [? = Profitis Ilias];

S-7385 (No.11). Spring-brook of the river Gaidouras, 1.5 km W of Apollona; slowly running, clear water; pebbles, decomposed leaves; temp.

15.7°C; pH 6.5; Cl 28 mg/l, 12.3; Ca⁺⁺ 78.5 mg/l; 12.3. 1973, 18 exp. (leg. J. Stock);

No. 4. Stream alongside the road Kallithie-Afantou, 1 km S of Kallithie (16 km S of Rhodos city); slowly running, oligosaprobe to alpha-mesosaprobe; coarse gravel bottom; depth 0-25 cm, width 100-125 cm; pH 6.5-7; Cl 48 mg/l; Ca⁺⁺ 66.3 mg/l; temp. 16.2°C; 14.3.1973, 3 exp. (leg. J. Stock);

No. 5. Small limnocene springs on the left bank of the river Loutani, near the mouth of a small affluent named brook of Epta Piges (SW of the village Afantou; slightly thermal (17.4°C); pebbles, loam, decomposed leaves; depth 0-10 cm, width 0-10 cm; pH 6.0; Cl 25 Mg/l; Ca ++68.7 mg/l; 12.3.1973, 5 exp. (leg. J. Stock);

S-5460 (No. 6). The Seven Springs (Epta Piges), in the Loutani river valley, gravel, tree roots, slightly loamy; depth 10-20 cm; width 0-50 cm; temp. 16.8°C; pH 6.0; Cl 24 mg/l; Ca⁺⁺45.0 mg/l, 10.3. 1973, 5 exp. (leg. J. Stock);

No. 7. Captured well (fountain) on the left bank of the river Loutani, upstream of Epta Piges, dimensions of concrete basin 60x30 cm, depth 10 cm; slowly running, clear; bottom with decomposed leaves and loam; temp. 17.1°C, pH 6.5; Cl 28 mg/l; Ca⁺⁺53.7 mg., 12.3.1973, one female (leg. J. Stock);

No. 9. Captured well, marked "1951" on the S side of the road Genadion-Vation, 2 km SW of Genadion; dimensions of concrete basin 130x40 cm; depth 0-10 cm; oligosaprobe; bottom muddy with some pebbles; *Chara*; temp. 18.4°C, pH 6.0; Cl 139 mg/l; Ca⁺⁺43.7 mg/l, 15.3.1973, 9 exp. (leg. J. Stock);

No. 10. Captured well alongside the road Salakos- Embonas, near the side-way to Ag. Issidoros (= 3 km N. of Embonas), dimensions of concrete basin 80x30 cm, depth 30 cm; muddy, stones; alpha- to beta-mesosaprobe; 12.3.1973, 2 exp. (leg. J. Stock);

No. 13. Nameless stream, near small cascade alongside the road Platania-Apollona, just past the side-way to Laerma (= 1 km E of Apollona); slowly running, oligosaprobe, boulders, gravel; *Taxus* leaves; temp. 15.5°C; pH 6.0; Cl 49 mg/l; Ca⁺⁺133.5 mg/l; 12.3.1973, 25 exp. (leg. J. Stock);

No. 14. Upper course of the river Plati, 0.5 km N of Dimilia (= 36 km SW of Rhodos City); moderately running, oligosaprobe stream; bottom gravel (particles diameter 0.5-5 cm) and some loam; depth 10-40 cm, width 100-150 cm; temp. 15.8°C, pH 6.5-7; Cl 34 mg/l; Ca⁺⁺77.5 mg/l. 15.3.1973, 8 exp. (leg. J. Stock);

No. 15. Cemented well (fountain) just E of the village Psinthos (alongside the road Psinthos- Archipolis) (= 9.5 km W of the Afantou); slowly running; oligosaprobe; gravel and sand; temp. 18.6°C, pH 6.5; Cl 25 mg/l; Ca⁺⁺ 77.0 mg/l. 11.3.1973, one female (leg. J. Stock);

No. 16. Cemented well marked "D 1963" N of the road Painthos-Petaloudes (= 24 km SW of Rhodos City); dimensions of basin 800x40 cm; depth 30 cm; slowly to moderately running; oligosaprobe; bottom with one stone, and some filamentous algae; temp. 16.0°C, pH 6.0; Cl 22 mg/l; Ca⁺⁺ 114 mg/l; 16.3.1973, 25 exp. (leg. J. Stock);

No. 17. Affluent of Plati River system at Petaloudes (= Butterfly Valley, 25 km SW of Rhodos-city; depth 10-40 cm, width 10-150 cm; slowly to moderately running; oligosaprobe; bottom: pebbles and fallen leaves; temp. 15.9°C, pH 6.0; 16.3.1973, one female (leg. J. Stock);

No. 18. Nameless stream SW of Damatria, crossing the road Paradission-Psinthos; depth 0-20 cm (up to 50 cm); width 700 cm; bottom gravel, slightly loamy; temp. 16.5°C; pH 7.0; Cl 50 mg/l; Ca⁺⁺ 68.5 mg/l. 11.3.1973, 8 exp. (leg. J. Stock);

G-6450= Mandriko, well, June 1981, one exp. (leg. G. Pesce);

S-6451= Tolos, June 1981, one exp. (leg. G. Pesce);

S-6452= airport, Rhodos island, June 1981, one male 5.0 mm, 2 juv. (leg. G. Pesce);

S-6454= Kalavarda, June 1981, 2 females (leg. G. Pesce);

S-6458= Soron, June 1981, one exp. (leg. G. Pesce);

S-6459= "[R-8], Rhodos island", June 1981, one juv. (leg. G. Pesce);

S-6460= "[R-6] Rhodos island", June 1981, one male 5.8 mm (leg. G. Pesce);

R-5= 2 km SW of Laerma, 210 m a.s.l., 6.5.1975, one male 4 mm (leg. H. Malicky);

R-6= 4 km SW of Laerma, 220 m a.s.l., 2 exp. damaged (leg. H. Malicky).

DESCRIPTION

FEMALE 7.5 mm with setose oostegites, from Spring brook of the river Gaidouras (No. 11):

Body moderately slender, metasomal segments 1-3 with 2 stronger and 2 weak dorsoposterior setae (fig. 3F). Urosomal segment 1 on each dorsolateral side with one spine-like seta; urosomal segment 2 on each dorsolateral side with 1-2 spines; urosomal segment 3 naked. Urosomal segment 1 on each ventroposterior corner with one spine near basis of uropod 1-peduncle (fig. 5E).

Epimeral plates 1-3 angular. Epimeral plate 1 along posterior convex margin with 2-3 setae; epimeral plate 2 along posterior straight margin with 4-5 setae (fig. 3F); epimeral plate 3 along posterior straight inclined margin with 4-5 setae. Epimeral plate 2 with 2-3 subventral spines, epimeral plate 3 with 4 subventral spines (fig. 3F).

Head with short rostrum and subrounded lateral cephalic lobes, ventroanterior sinus developed (fig. 1A).

Antenna 1 hardly exceeding half of body (ratio: 45:75); peduncular articles 1-3 progressively shorter (ratio: 53:40:25), scarcely setose (fig. 1B); main flagellum consisting of 17 articles [most of them with one short aesthetasc]. Accessory flagellum 2-articulated, short (fig. 1B). Antenna 2 moderately slender; peduncular article 4 hardly longer than article 5 (ratio: 72:67), each of them with several bunches of short setae; flagellum slender, remarkably longer than last peduncular article and consisting of 8 articles scarcely setose (fig. 1C). Antennal gland cone short (fig. 1C).

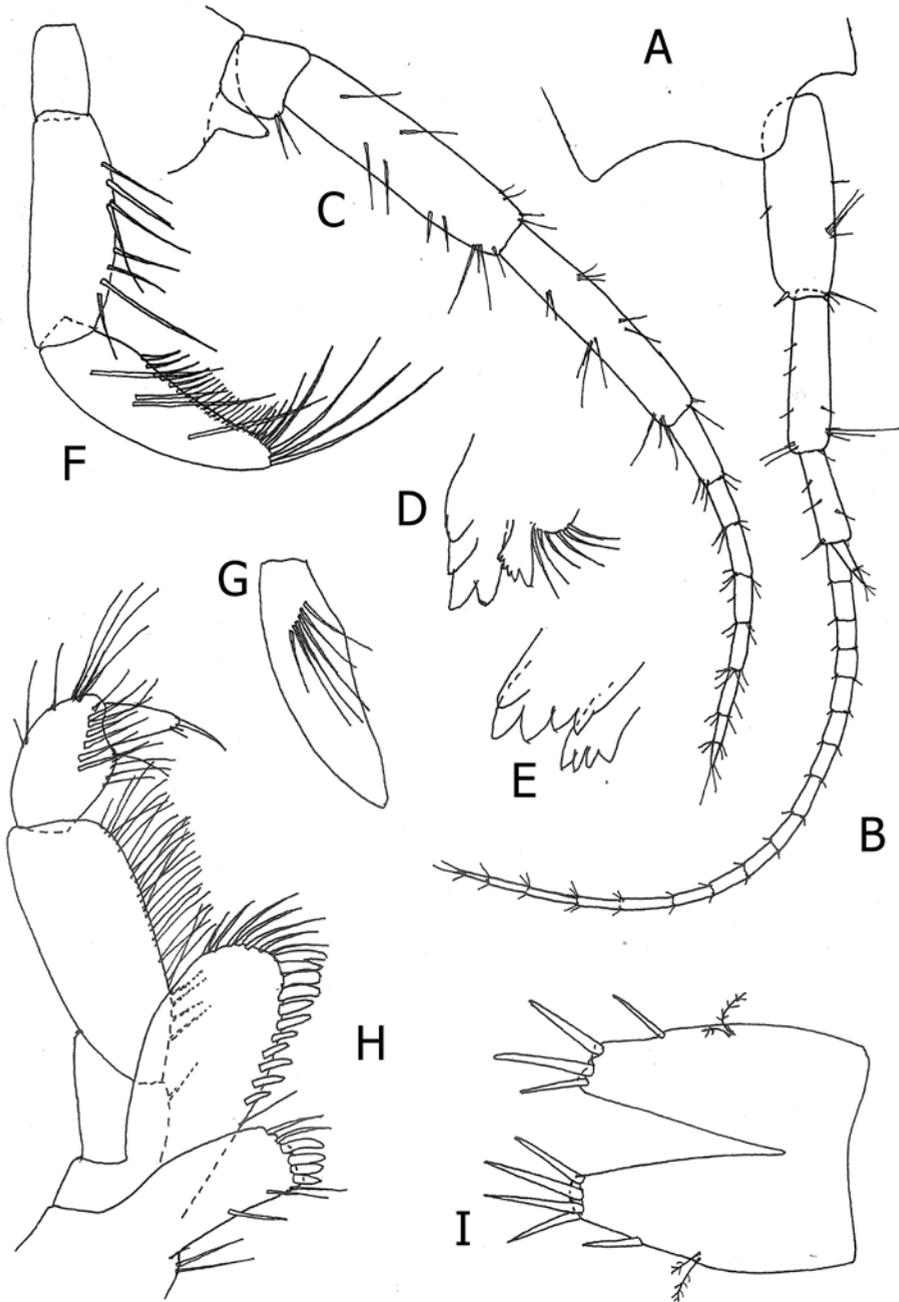


Fig. 1. *Niphargus rhodi* S. Karaman, 1950, Gaidouras, Rhodos island, female 7.5 mm: A= head; B= antenna 1; C= antenna 2; D= incisor and lacinia mobilis of left mandible; E= incisor and lacinia mobilis, right mandible; F= mandibular palpus, inner face with facial B-setae; G= mandibular palpus article 3, outer face with facial A-setae; H= maxilliped; I= telson

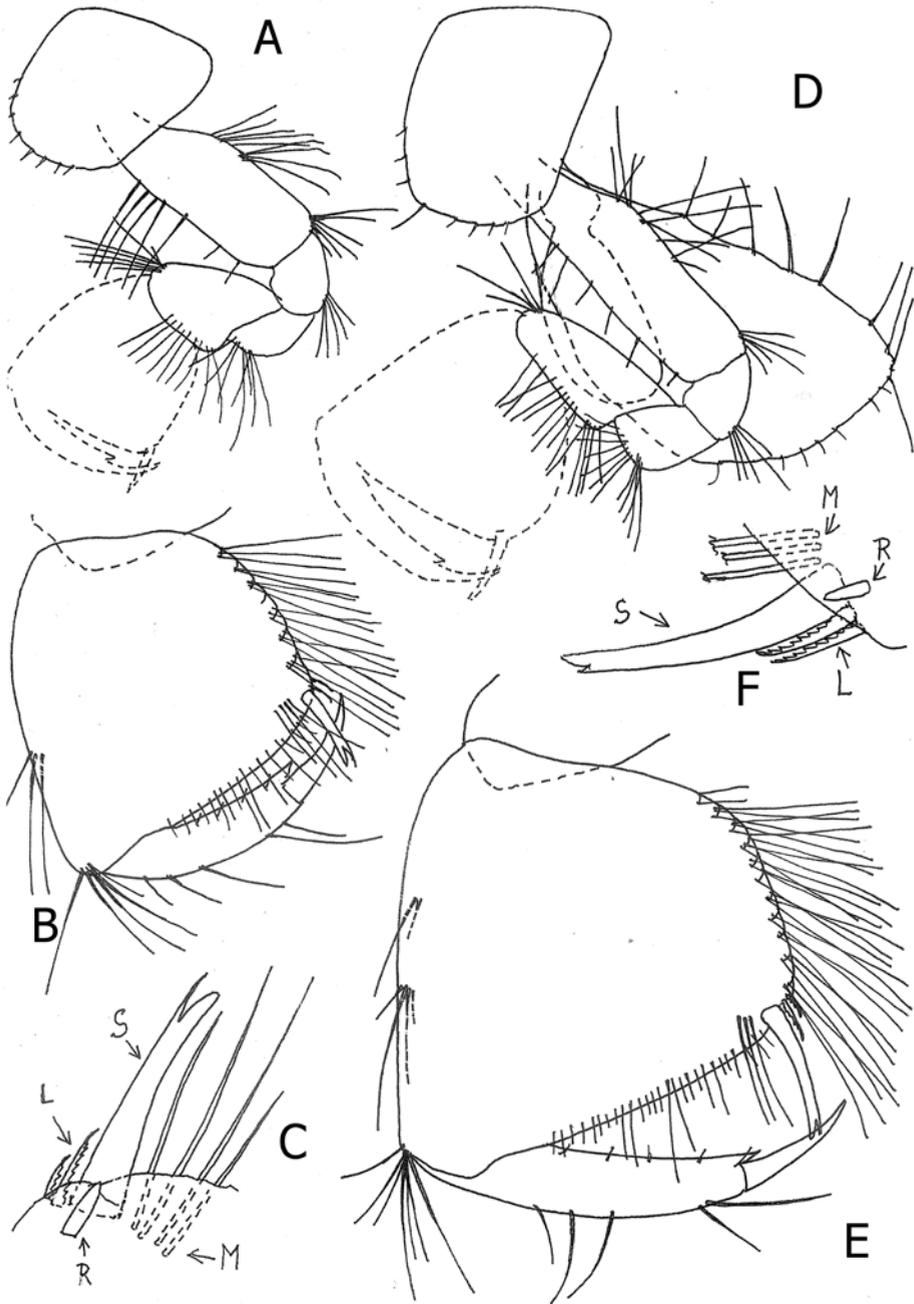


Fig. 2. *Niphargus rhodi* S. Karaman, 1950, Gaidouras, Rhodos island, female 7.5 mm: A-B= gnathopod 1, outer face; C= distal tip of gnathopod 1 propodus, inner face [S= corner S-spine; L= slender serrate L-spines; R= subcorner R-spine; M= facial M-setae]; D-E= gnathopod 2, outer face; F= distal tip of gnathopod 2 propodus, inner face [S= corner S-spine; L= slender serrate L-spines; R= subcorner R-spine; M= facial M-setae].

Mouthparts well developed. Labrum much broader than long, with convex anterior margin (fig. 5A). Labium broader than long, with subrounded outer lobes and well developed inner lobes (fig. 5B).

Mandibles with triturative molar. Right mandible: incisor with 5 teeth, lacinia mobilis with 4 teeth and 6 rakers (fig. 1E). Left mandible: incisor with 4 teeth, lacinia mobilis bifurcate, with several teeth, and 6 rakers (fig. 1D). Mandibular palpus article 1 naked, article 2 with 8 strong setae (fig. 1F); article 3 hardly longer than article 2 (ratio: 68:62), subfalciform, provided with nearly 20 marginal D-setae and 5 distal E-setae, on outer face is attached one bunch of 6 A-setae (fig. 1G), on inner face appear 4 B-setae (1-2-1) (fig. 1F).

Maxilla 1: inner plate with 2 unequal setae, outer plate with 7 spines [6 spines with one lateral tooth, one spine with 3 small lateral teeth] palpus 2-articulated, not reaching distal tip of outer plate spines and provided with 6 distal setae (fig. 3A).

Maxilla 2 with subequal both lobes bearing distomarginal setae (fig. 5C).

Maxilliped: inner plate relatively short, with 4 distal spines accompanied by single setae (fig. 1H); outer plate not exceeding half of palpus article 2, with row of nearly 11 strong mesial spines (fig. 1H); palpus article 3 along outer margin with 2 median and one distal bunch of setae; article 4 with 1-2 setae at inner margin near basis of the nail (fig. 1H).

Coxae relatively short. Coxa 1 hardly broader than long (ratio: 45:42), with subrounded ventroanterior corner and bearing nearly 8 short marginal setae (fig. 2A). Coxa 2 longer than broad (ratio: 58:45), along ventral margin appear 9 setae (fig. 2D). Coxa 3 longer than broad (ratio: 66:58), bearing nearly 8 marginal setae (fig. 3B). Coxa 4 nearly as long as broad, with concave posterior margin, along margin appear nearly 9 setae, ventroposterior lobe absent (fig. 3D).

Coxae 5-7 are short. Coxa 5 bilobed, much broader than long (ratio: 63:44), anterior subrounded lobe poorly shorter than coxa 4, provided with 2-3 setae only (fig. 4A); article above coxa with one short seta at ventroposterior margin (fig. 4A). Coxa 6 smaller than 5, bilobed, broader than long (ratio: 52:31) (fig. 4C); article above coxa with one short seta at ventroposterior margin (fig. 4C). Coxa 7 short, entire, much broader than long (ratio: 53:22); article above coxa with one short seta at ventroposterior margin (fig. 4E).

Gnathopods 1 and 2 of moderate size. Gnathopod 1: article 2 along both margins with long setae; article 3 at posterior margin with one bunch of setae (fig. 2A). Article 5 is shorter than propodus (ratio: 36:47), along anterior margin with one distal bunch of setae (fig. 2A). Propodus trapezoid, nearly as large as corresponding coxa, slightly longer than broad (ratio: 87:80), along posterior margin with 7 transverse rows of setae (fig. 2B); palm inclined slightly less than half of propodus-length, convex, defined on outer face by one corner S-spine accompanied laterally by 2 L-spines and 4 long facial M-setae (fig. 2C), on inner face by one subcorner R-spine. Dactylus reaching posterior margin of propodus, along outer margin with 5 median setae, along inner margin with 5 short setae (fig. 2B).

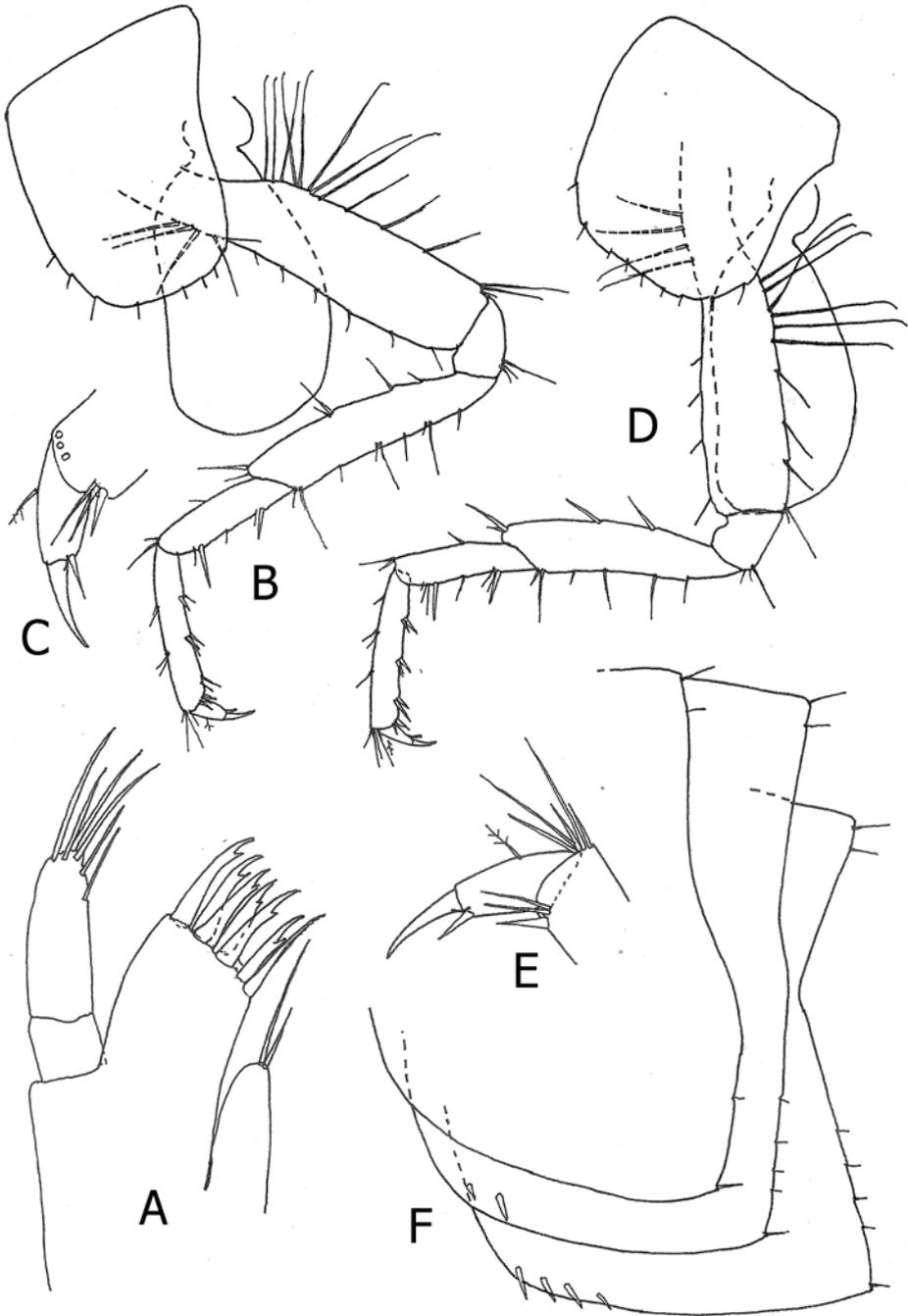


Fig. 3. *Niphargus rhodi* S. Karaman, 1950, Gaidouras, Rhodos island, female 7.5 mm: A= maxilla 1; B-C= pereopod 3; D-E= pereopod 4; F= epimeral plates 1-3.

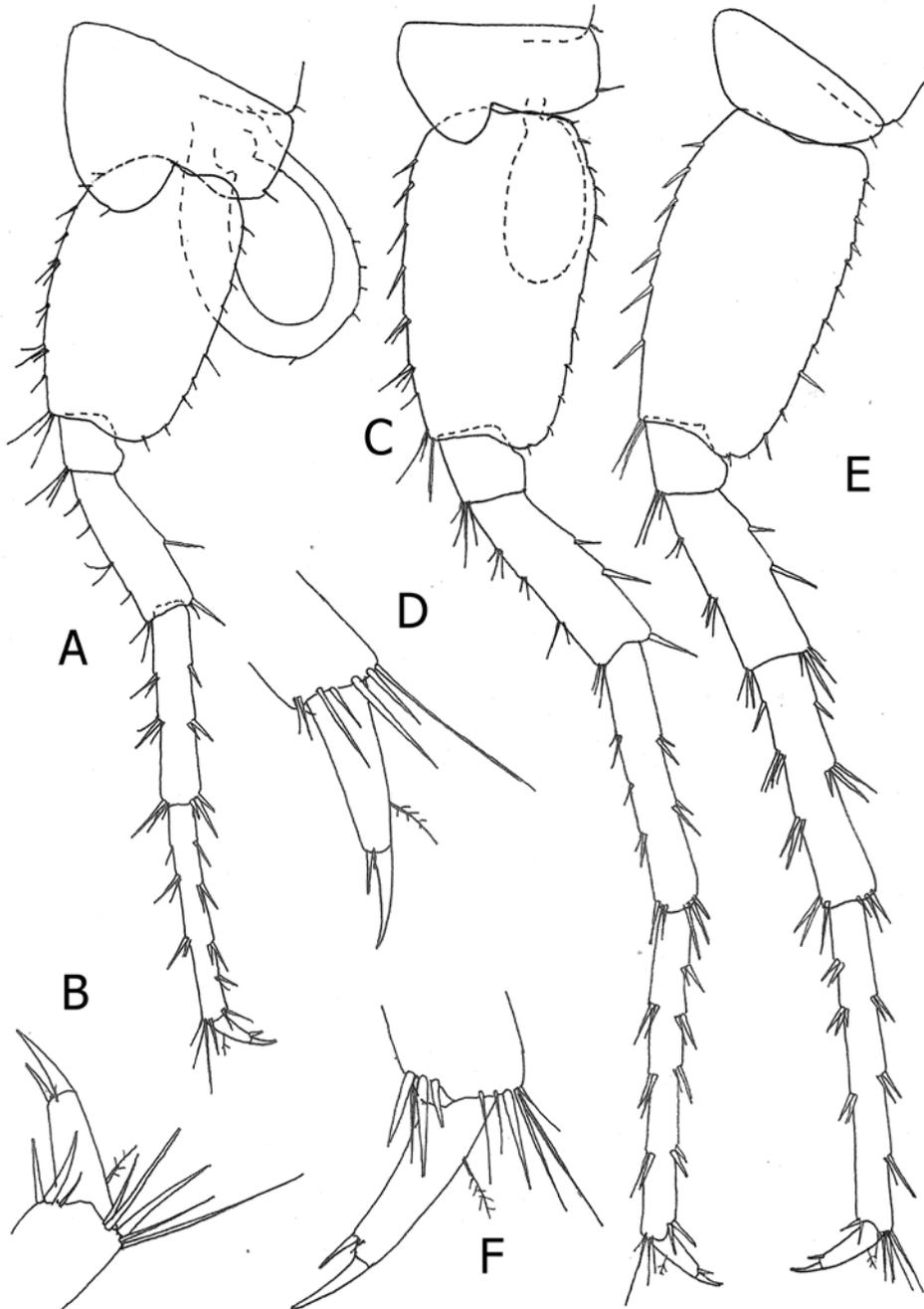


Fig. 4. *Niphargus rhodi* S. Karaman, 1950, Gaidouras, Rhodos island, female 7.5 mm: A-B= pereopod 5; C-D= pereopod 6; E-F= pereopod 7.

Gnathopod 2 remarkably larger than gnathopod 1 and corresponding coxa 2 (fig. 2D); article 2 along anterior margin with row of shorter setae, along posterior margin with row of long proximal setae and short distal setae; article 3 at posterior margin with one bunch of setae; article 5 shorter than propodus (ratio: 48:60), along anterior margin with distal bunch of setae. Propodus trapezoid, remarkably larger than that of gnathopod 1, poorly longer than broad (ratio: 112:106), along posterior margin with 11 transverse rows of setae (fig. 2E); palm slightly convex, inclined nearly half of propodus-length, defined on outer face by one corner S-spine accompanied laterally by 2 L-spines (close to S-spine) and 3 long facial M-setae, on inner face by one subcorner R-spine (fig. 2F). Dactylus reaching posterior margin of propodus, along outer margin with 5 median setae, along inner margin with 5 short setae (fig. 2E).

Pereopods 3 and 4 moderately slender, scarcely setose. Pereopod 3: article 2 along anterior margin with several long proximal setae and several short distal setae (fig. 3B), along posterior margin setae are longer than these of anterior margin. Articles 4-6 of unequal length (ratio: 61:35:44); article 4 along posterior margin with 5-6 single or paired setae (the longest seta exceeding diameter of article itself); articles 5 and 6 along posterior margin with single or paired short spines. Dactylus short and strong, much shorter than article 6 (ratio: 17:44), with one strong spine at inner margin and one median plumose seta at outer margin (fig. 3C), nail shorter than pedestal (ratio: 24:33).

Pereopod 4: article 2 pilosity is similar to that of pereopod 3; articles 4-6 of unequal length (ratio: 55:34:43); article 4 at anterior margin with 3 single slender spines, along posterior margin with 5 single or paired setae (the longest setae reaching diameter of article itself); article 5 at posterior margin with single spines and setae; article 6 along posterior margin with 4 groups of short spines (fig. 3D). Dactylus short and strong, at inner margin with one spine near basis of the nail, along outer margin with one median plumose seta; nail slightly shorter than pedestal (ratio: 25:35) (fig. 3E).

Pereopods 5-7 are moderately slender. Pereopod 5 is remarkably shorter than pereopods 6 and 7, with article 2 longer than broad (ratio: 72:46), along anterior margin with 9 groups of setae, along posterior convex margin with nearly 10 seta of unequal length (fig. 4A), ventroposterior lobe not fully developed, distoanterior corner is not produced. Articles 4-6 of unequal length (ratio: 45:51:57); article 4 at anterior margin with row of short setae, along posterior margin with one median and one distal spine; articles 5 and 6 along both margins with groups of spines and single short setae. Article 2 is longer than article 6 (ratio:72:57). Dactylus is short and strong, much shorter than article 6 (ratio: 18:57), at inner margin with one strong spine, along outer margin with one median plumose seta; nail is shorter than pedestal (ratio: 22:40) (fig. 4B).

Pereopod 6: article 2 longer than broad (ratio: 86:50), along anterior margin with 8 groups of strong setae, along posterior poorly convex margin with row of nearly 12 setae, ventroposterior lobe shallow (fig. 4C). Articles 4-6 of unequal length (ratio: 55:69:87), article 4 along anterior margin with bunches of

setae, along posterior margin with 3 spines; articles 5-6 along both margins with short spines; article 2 nearly as long as article 6. Dactylus strong and short, much shorter than article 6 (ratio: 23:87), along inner margin with one strong spine near basis of the nail, along outer margin with one median plumose seta; nail is shorter than pedestal (ratio: 26:44).

Pereopod 7: article 2 is much longer than broad (ratio: 88:48), along anterior margin with row of 6-7 spine-like setae, along posterior poorly convex margin with nearly 11 setae and 2 spine-like setae (fig. 4E), ventroposterior lobe shallow. Articles 4-6 of unequal length (ratio: 50:65:86); article 4 along anterior margin with 3 bunches of spines and setae, along posterior margin with 3 groups of spines; articles 5 and 6 along anterior and posterior margin with bunches of spines usually shorter than diameter of articles themselves. Article 6 is almost as long as article 2 (ratio: 86:88), much longer than dactylus (ratio: 86:27). Dactylus strong, along inner margin with one strong spine near basis of the nail, along outer margin with one median plumose seta (fig. 4F); nail is shorter than pedestal (ratio: 55:26).

Pleopods 1-3 with 2 retinacula each. Peduncle of pleopod 1 along anterior margin with 5 unequal setae; peduncle of pleopod 2 is naked; peduncle of pleopod 3 along posterior margin with 3 strong setae (fig. 7F, G, H).

Uropod 1: peduncle with dorsoexternal row of strong spines and dorsointernal row of spine-like setae (except distal spine) (fig. 5E). Outer ramus as long as inner ramus but shorter than peduncle (fig. 5E), along lateral margins appear 3 pairs of spines accompanied by 2 bunches of simple setae, at the tip are attached 4-5 unequal distal spines. Inner ramus along margins with 3 spines and one bunch of simple setae, at tip appear 4-5 short spines.

Uropod 2: both rami of the same length, bearing several lateral and distal spines, setae are absent (fig. 5D).

Uropod 3 long and slender: peduncle much longer than broad (ratio: 38:24), with several distal short spines (fig. 5F); inner ramus shorter than peduncle, scale-like, with 3 distal spines. Outer ramus 2-articulated, first article along both margins with 7 bunches of short spines; 1-2 plumose setae appears along inner margin (fig. 5F). Second article much shorter than first one (ratio: 40:140), bearing along both lateral margins 3-4 groups of simple setae (fig. 5F).

Telson slightly longer than broad (ratio: 75:66), rather gaping, incised nearly $\frac{3}{4}$ of telson-length; each lobe with 3-4 distal and one outer marginal spine (fig. 1 I); a pair of short plumose setae appear at outer margin near the middle of each lobe.

Coxal gills on gnathopod 2, pereopods 3 and 4 are ovoid, nearly reaching distal tip of corresponding article 2 (figs. 2D, 3B, D); coxal gills on pereopods 5 and 6 are shorter (fig. 4A, C).

Oostegites very broad, appear on gnathopod 2 and pereopods 3-5, provided with long and short marginal setae (figs. 2D, 4A).

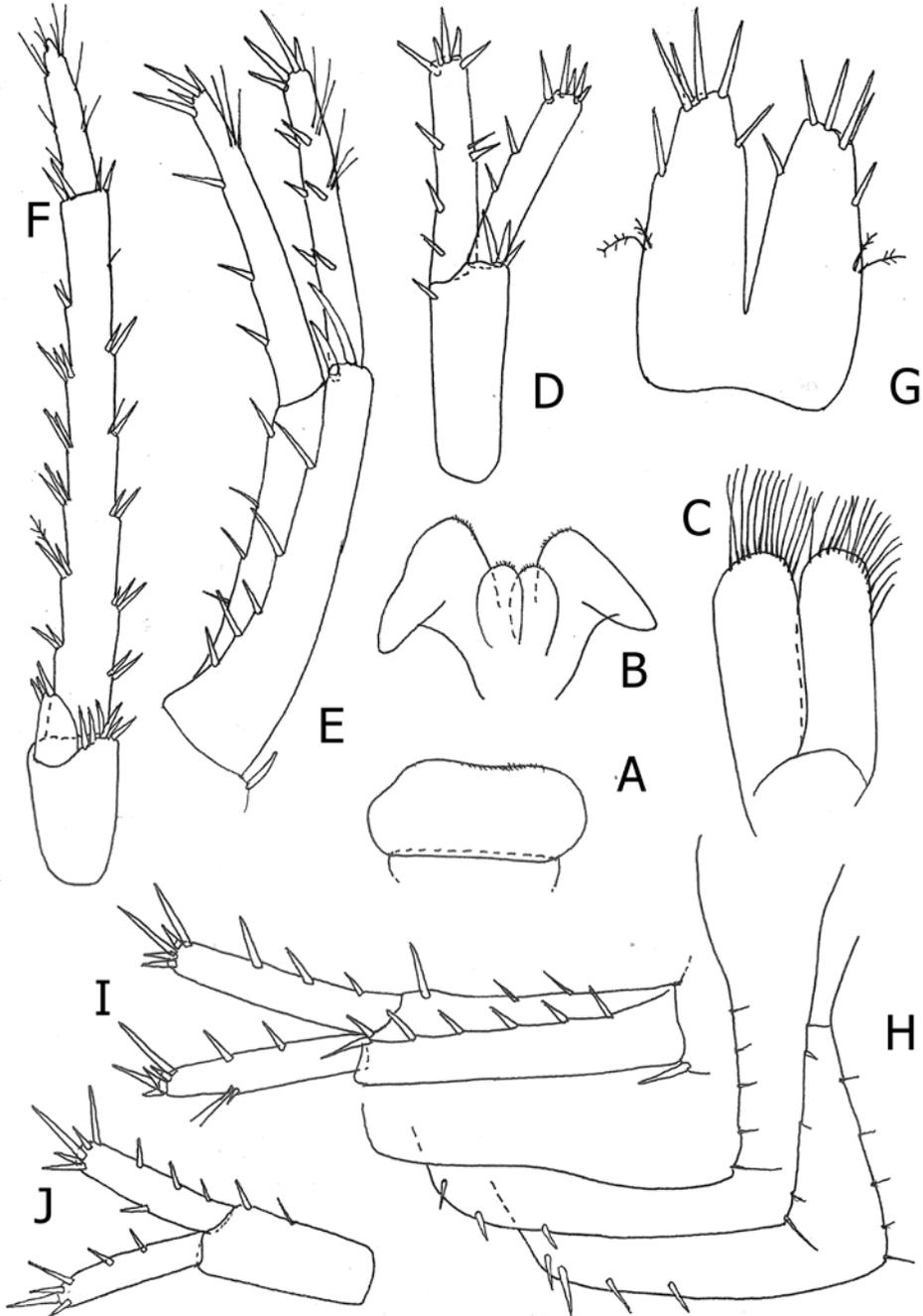


Fig. 5. *Niphargus rhodi* S. Karaman, 1950, Gaidouras, Rhodos island, female 7.5 mm: A= labrum; B= labium; C= maxilla 2; D= uropod 2; E= uropod 1; F= uropod 3. G= female 5.8 mm, telson.

Male 5.3 mm: H= epimeral plates 1-3; I= uropod 1; J= uropod 2

MALE 5.3 mm (probably not quite adult): is very similar to adult females.

Metasomal segments 1-3 along dorsoposterior margin with 2-4 short setae; urosomal segment 1 with one seta on each dorsolateral side, urosomal segment 2 on each dorsolateral side with 2 spines, urosomal segment 3 naked.

Epimeral plate 1 angular, with poorly concave ventral margin and poorly convex posterior margin bearing several posterior setae (fig. 5H); epimeral plate 2 angular, with straight posterior margin bearing several setae; epimeral plate 3 angular with inclined posterior margin bearing several setae; epimeral plate 2 is provided with 3 subventral spines, epimeral plate 3 is provided with 4 subventral spines (fig. 5H).

Head and antennae 1-2 like these in female. Antenna 1 hardly exceeding half of the body, consisting of 21 articles (most of them with one aesthetasc); accessory flagellum short, 2-articulated. Flagellum of antenna 2 longer than last peduncular article and consisting of 7 articles.

Mouthparts like these in female. Mandibular palpus article 2 with 6-7 setae; palpus article 3 longer than article 2, falciform, provided with 5 A-setae, 4-5 B-setae, nearly 17 D-setae and 4 E-setae.

Maxilla 1 inner plate with 2 setae, outer plate with 7 spines (6 with one lateral tooth, one spine with 3-4 lateral teeth); palpus not reaching distal tip of outer plate spines and bearing 5-6 setae. Maxilla 2 with subequal both lobes bearing marginal setae only. Maxilliped inner plate reaching outer tip of palpus article 1, bearing 5 pointed teeth, outer plate with 9-10 spines; palpus article 3 along outer margin with 1-2 median and one distal group of setae, article 4 at inner margin with 2 setae near basis of the nail.

Coxa 1 hardly broader than long (ratio: 44:40), with subrounded ventroanterior margin and provided with 5 setae (fig. 6A). Coxa 2 longer than broad (ratio: 56:52) (fig. 6B). Coxa 3 longer than broad (ratio: 62:52) (fig. 6C). Coxa 4 hardly longer than broad (ratio: 56:52) (fig. 6D). Coxae 5-7 short. Coxa 5 is broader than long (ratio: 52:32) (fig. 6E). Coxa 6 is broader than long (ratio: 45:26) (fig. 6F). Coxa 7 shallow, entire, broader than long (ratio: 43:18) (fig. 6G).

Gnathopods 1-2 with articles 2-5 like these in female. Gnathopod 1 propodus trapezoid, longer than broad (ratio: 77:70), along posterior margin with 4 transverse rows of setae (fig. 7A); palm inclined slightly less than half of propodus-length, defined on outer face by 1 S-spine, 2 lateral slender L-spines and 3 facial M-setae (fig. 7A), on inner face by one R-spine; dactylus reaching posterior margin and provided along outer face with 4 median setae.

Gnathopod 2 propodus remarkably larger than that of gnathopod 1, trapezoid, slightly longer than broad (ratio: 92:84), along posterior margin with 7 transverse groups of setae; palm slightly convex, inclined slightly less than half of propodus-length, defined on outer face by 1 corner S-spine, accompanied laterally by 2 L-spines and 3 facial M-setae (fig. 7B), along inner face by one R-spine; dactylus reaching posterior margin of propodus and along outer margin provided with 4 median setae (fig. 7B).

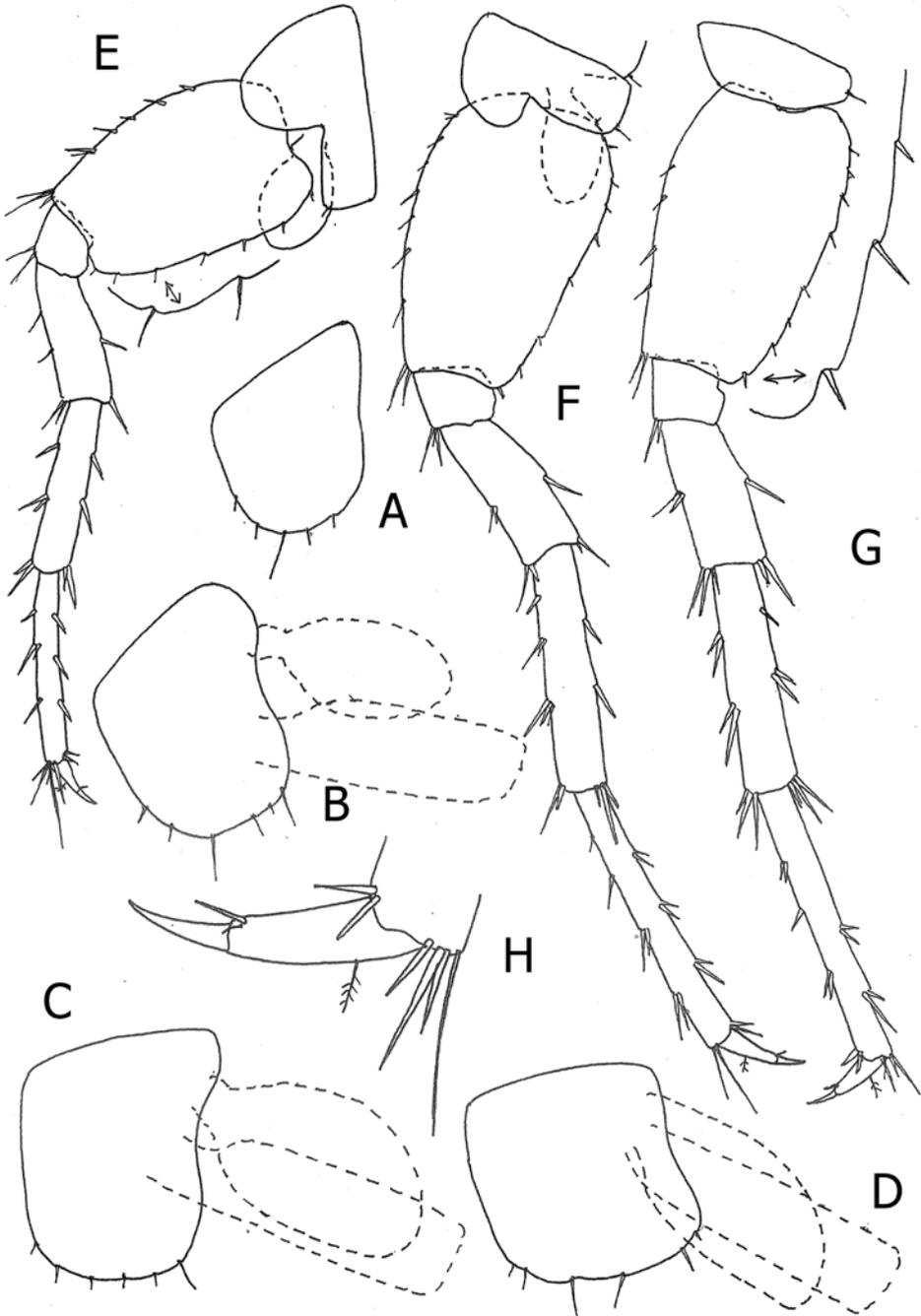


Fig. 6. *Niphargus rhodi* S. Karaman, 1950, Gaidouras, Rhodos island, male 5.3 mm: A= coxa 1; B= coxa 2; C= coxa 3; D= coxa 4; E= pereopod 5; F= pereopod 6; G-H= pereopod 7.

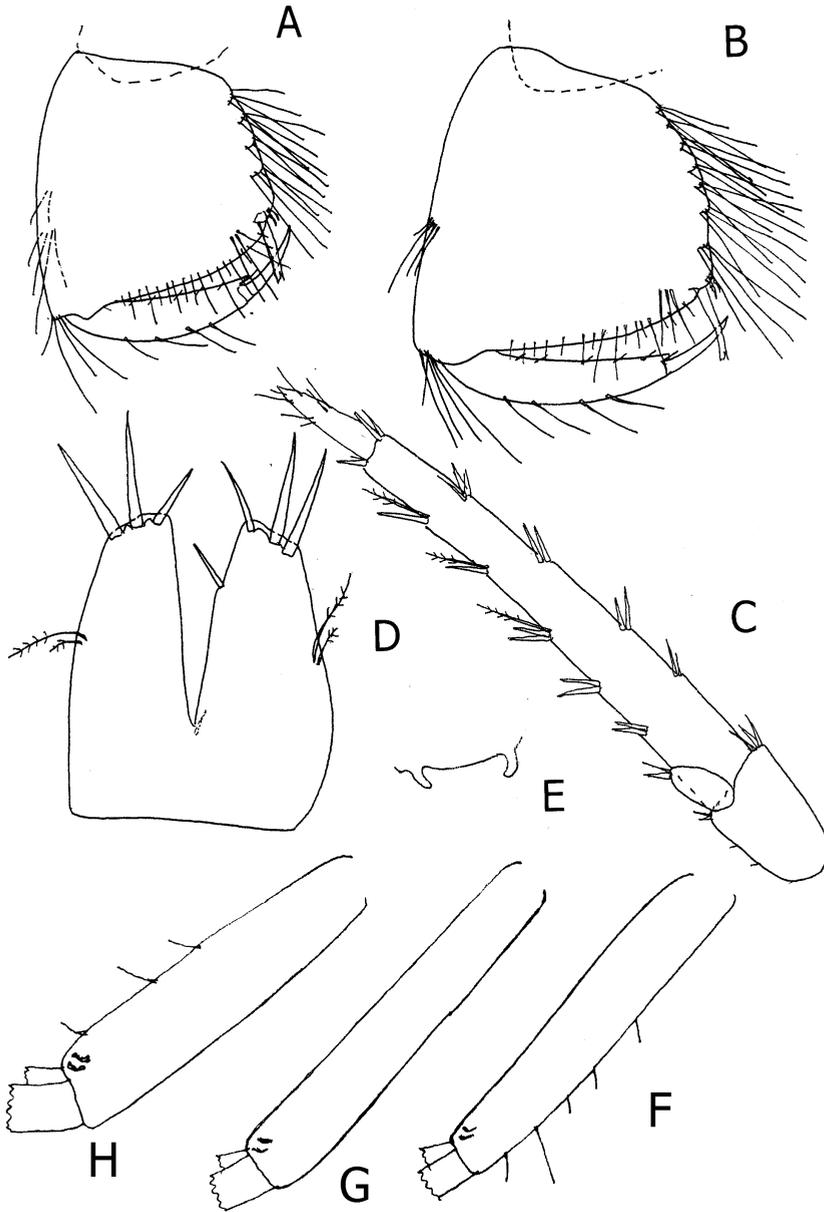


Fig. 7. *Niphargus rhodi* S. Karaman, 1950, Gaidouras, Rhodos island, male 5.3 mm: A= propodus of gnathopod 1, outer face; B= propodus of gnathopod 2, outer face; C= uropod 3; D= telson; E= ventral sexual tubercle on last mesosomal segment. **Female 7.5 mm.**: F= peduncle of pleopod 1; G= peduncle of pleopod 2; H= peduncle of pleopod 3.

Pereopods 3-4 like these in female, with dactylus bearing one spine or spine-like-like seta at inner margin near basis of the nail.

Pereopods 5-7 moderately slender. Pereopod 5 remarkably shorter than pereopods 6 or 7. Article 2 dilated, longer than broad (ratio: 62:43), anterior margin with row of spine-like setae (fig. 6E), posterior poorly convex margin is provided with nearly 7 setae (fig. 6E), ventroposterior lobe not developed; articles 4-6 of unequal length (ratio: 37:46:50, along both margins mainly with short spines. Article 6 is shorter than article 2 (ratio: 50:62); dactylus slender, much shorter than article 6 (ratio: 15:50), at inner margin with one spine-like seta near basis of the nail.

Pereopod 6 with article 2 longer than broad (ratio: 78:49), along anterior margin with 8-9 spine-like setae, along posterior margin with 6 setae and 2 short spines, ventroposterior corner not developed (fig. 6F); articles 4-6 of unequal length (ratio: 43:63:75), articles along both margins with spines (fig. 6F). Article 2 slightly longer than article 6 (ratio: 78:75); dactylus moderately slender, much shorter than article 6 (ratio: 23:75), at inner margin with one spine-like seta near basis of the nail and one median plumose seta at outer margin.

Pereopod 7: article 2 is longer than broad (ratio: 76:47), along anterior margin with several spine-like setae, along posterior convex margin with 8-9 short spine-like setae and setae (fig. 6G), ventroposterior lobe indistinct. Articles 4-6 of unequal length (ratio: 41:60:76), along both margins with bunches of spines (fig. 6G). Article 6 is as long as article 2. Dactylus is much shorter than article 6 (ratio:24:76), at inner margin with one slender spine near basis of the nail, along outer margin with one median plumose seta (fig. 6H), nail shorter than pedestal (ratio: 28:53).

Pleopods 1-3 with 2 retinacula each; pilosity of pleopod's peduncles like that in female.

Uropod 1: peduncle longer than rami, with dorsoexternal row of spines and dorsointernal row of spine-like setae (except distal spine), distal tubercle absent (fig. 5 I); rami of equal length, bearing several lateral and 5 distal spines; outer ramus with one median group of simple setae only (fig. 5 I).

Uropod 2: rami of equal length, provided with lateral and distal spines, simple setae absent (fig. 5J).

Uropod 3 like that in female: peduncle short, with several distal spines; inner ramus short, scale-like, with one distal spine and seta (fig. 7C); outer ramus 2-articulated: first article long, along outer margin with 5 bunches of short spines, along inner (=mesial) margin with 6 bunches of short spines mixed often with one longer plumose seta (fig. 7C); distal article much shorter than first one (ratio: 34:142), provided with several short simple setae along both margins.

Telson slightly longer than broad (ratio: 88:78), incised slightly over 2/3 of telson-length; each lobe is provided with 3 distal spines and 0-1 spine at mesial margin (fig. 7D); a pair of unequal plumose setae is attached near the external side of each lobe.

Coxal gills on gnathopod 2 and pereopods 3-4 are much longer than these of pereopods 5-6 (figs. 6B-F).

Males of 5.8 mm like these of 5.3 mm.

VARIABILITY.

All our specimens in hands (females up to 7.5 mm and males up to 5.8 mm) agree mainly with description of holotype (female 7.0 mm) of Stanko Karaman (1950b); non quite adult males in hands (up to 5.8 mm long) are similar to the females, including uropods 1-3 and gnathopods.

Lobes of telson are provided with 3-4 distal spines and 0-2 spines at dorsolateral and/or at mesial margin (figs. 1 I, 5G, 7D).

Basipodit (article 2) of pereopod 7 along posterior margin often with short small spines and setae. Inner plate of maxilliped is provided with 4-5 distal spines. Peduncle of uropod 1 is with dorsointernal row of spine-like setae or spines.

The stable characters: short distal article of uropod 3 outer ramus more than twice longer than diameter of first article, equal rami of uropod 1, basipodit of pereopods 5-7 without lobe, dactylus of pereopods with one spine or spine-like seta at inner margin; epimeral plates angular or obtusely angular; telson with 3-4 distal and 0-2 lateral and/or mesial spines, facial spines absent; propodus of gnathopods 1 and 2 with L-spines sitting laterally of corner S-spine; number of facial M-setae is low (3-4 M-setae). Propodus of gnathopod 1 in males with 4-5 transverse rows of setae. Dactylus of gnathopods 1 and 2 is provided with low number (3-5) single median setae along outer margin.

HOLOTYPE: female 7.0 mm, -688 (incl. 2 slides No. 688/1, 688/2); holotype is deposited in Karaman's Collection in Podgorica, Montenegro.

LOCUS TYPICUS: Spring Nimpha on Propheta Mt. (Eliasberg?) Mt., Rhodos Island, Greece.

DISTRIBUTION. Known from Rhodos Island only (fig. 8).

LOCALITIES CITED ON RHODOS ISLAND:

S. Karaman (1950b): Spring Nimpha on Propheta Mt. (? Elias Mt., Profitis Ilias);

Pesce & Maggi (1983): Road Rodi-Kamiroi (near Tolos); road Fane-Kalavarda; road Kamiroi-Mandriko; road Petaloudes-Rodi (near Damatria); Kremasti, airport; Harakion (?=Haraki)].

Present work: see sub "Material examined".

REMARKS AND AFFINITY

Niphargus rhodi is the single known *Niphargus* taxon from Rhodos island, and its closer relation to other taxa of genus *Niphargus* is difficult to establish without the knowledge of adult males. As the ovigerous females are observed already on size of 6.0 mm, and males in hands of 5.8 mm, the adult males are

probably with the similar shortened second article of uropod 3 outer ramus and equal rami of uropod 1.



Fig. 8. Distribution of *Niphargus rhodi* S. Karaman, 1950 in Rhodes Island, Greece (black circles).

Among known *Niphargus* species from Greece, provided with a row of setae along outer margin of gnathopods 1-2 dactylus, there are several taxa with uropod 1 rami of equal length (*N. rhodi*, *N. lindbergi*, *N. lourensis*, *N. impexus*, *N. koukourasi*).

N. impexus G. Karaman 2016a, described from Creta Island is rather similar to *N. rhodi*, but females of *N. impexus* differ from these of *N. rhodi* by higher number of setae on maxilla 1 inner plate, by low number of spines on maxilliped inner plate as well as by long uropod 3 outer ramus article 2 in all males, etc.

N. koukourasi, Ntakos et al. 1915, described from Springs of Louros River, Vouliasta, Ioannina (continental Greece) differs from *N. rhodi* by highly

spiniferous telson provided with facial spines, by higher number of setae on maxilla 1 inner plate, etc.

Niphargus lourensis Fiser et al. 2006, described from Spring of Louros River, Vouliasta, Ionannina, continental Greece, differs by shorter and more spiniferous outer ramus of uropod 3 having very short distal article, by telson with long distal spines only, etc.

Niphargus lindbergi S. Karaman 1956, described from Cave Draconera (Attique), continental Greece, differs by elevated number of retinacula on pleopods 1-3, etc.

The recently discovery of numerous *Niphargus* taxa by various scientists in Turkey [*Niphargus anatolicus* S. Karaman, 1950a from Emirgan, N of Istanbul; *N. religious* G. Karaman 2012a from Uravavaz Gecidi, Ballidag (Kastamonu), 1350 m. a.s.l., etc.], from Iran [*Niphargus hakani* Esmaeili-Rineh et al. 2017 from Kheder-Goli spring, Razan city, Hamedan Province, etc.], and Iraq [*Niphargus nadarini iraquensis* G. Karaman, 2012b from Haditha (El Hadithah), etc.] show the large distribution of genus *Niphargus* in entire SE Europe, Asia Minor and Near East, and the further investigations of this genus in these regions will help to understand the real taxonomical position of taxa from Greece and adjacent regions.

CONCLUSIONS

Niphargus rhodi S. Karaman, 1950, known from Rhodos island (Greece) only, is redescribed and figured based on numerous localities from Rhodos island (adult females up to 7.5 mm and non quite adult males of up to 5.8 mm.). The males in hands are similar to females, including uropods and gnathopods. Within nearly 15 known *Niphargus* taxa from Greece, *N. rhodi* is well distinguished by various taxonomical characters (uropods 1-3, telson, gnathopods, mouthparts, etc). The exact position of *N. rhodi* within genus *Niphargus* is not possible to determine without knowledge of final adult males.

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REFERENCES

- Barnard, J.L & Barnard, C.M. 1983. Freshwater amphipods of the World. I. Evolutionary patterns. II. Handbook and bibliography.- *Hayfield Associates: Mt. Vernon, Virginia*, 1983, pp. XIX +849 pages, 50 figs., 7 graphs, 98 maps, 12 tables.
- Esmaeili-Rineh, S., Mirghaffari, S.A. & Sharifi, M. 2017. The description of a new species of *Niphargus* from Iran based on morphological and molecular data.- *Subterranean Biology* 22: 43–58.

- Fišer, C., Trontelj, P. & Sket, B. 2006. Phylogenetic analysis of the *Niphargus orcinus* species-aggregate (Crustacea: Amphipoda: Niphargidae) with description of new taxa.- *Journal of Natural History* 40 (41-43): 2265-2315, 23 figs, 1 pl.
- Karaman, G. 1969. XXVII Beitrag zur Kenntnis der Amphipoden. Arten der Genera *Echinogammarus* Stebb. und *Chaetogammarus* Mart. aus der jugoslawischer Adriaküste. *Glasnik Republičkog zavoda za zaštitu prirode i Prirodnjačke zbirke u Titogradu*, 2, 59-84, 51 figs.
- Karaman, G. 1972. Le probleme du Genre *Niphargus* en Yougoslavie.- Actes du Ier Colloque International sur le genre *Niphargus*-Verona, 15-19 Aprile 1969, *Museo Civico di Storia Naturale, Verona, Memorie fuori serie*, 5: 1-10.
- Karaman, G. & Ruffo, S. 1986. Amphipoda: *Niphargus*-Group (Niphargidae sensu Bousfield, 1982), in: Botosaneanu, L. (edit.): *Stygofauna Mundi, A Faunistic, Distributional, and Ecological Synthesis of the World Fauna inhabiting Subterranean Waters (including the Marine Interstitial)*, Leiden, E. J. Brill/ Dr. W. Backhuys, pp. 514-534.
- Karaman, G. 2012a. New species *Niphargus religiosus*, sp. n. (Fam. Niphargidae), with remarks to *Amathillina cristata* G.O. Sars, 1894 (Fam. Gammaridae) in Turkey - Contribution to the Knowledge of the Amphipoda 257 - *Agriculture & Forestry*, Podgorica, 53 (07) (1-4): 49-76, 11 figs.
- Karaman, G. 2012b. Further studies on genus *Niphargus* Schiödte, 1849 (Fam. Niphargidae) from the Near East (Contribution to the Knowledge of the Amphipoda 260).- *Agriculture & Forestry*, Podgorica, 55 (09) (1-4): 49-74, 7 figs.
- Karaman, G. 2012c. Further investigations of the subterranean genus *Niphargus* Schiödte, 1849 (fam. Niphargidae) in Serbia. (Contribution to the Knowledge of the Amphipoda 264). - *Agriculture and Forestry*, Podgorica, 58 (2): 45-64, 7 figs.
- Karaman, G. 2016a. On two new or interesting species of the family Niphargidae from Greece and Croatia. (Contribution to the Knowledge of the Amphipoda 286).- *Ecologica Montenegrina*, Podgorica, 5: 1-17, 9 figs.
- Karaman, G. 2016b. Two new genera of the family Niphargidae from Greece (Contribution to the Knowledge of the Amphipoda 287). - *Agriculture & Forestry*, Podgorica, 62 (1): 7-27, 8 figs.
- Karaman, S. 1934. Weitere Beiträge zur Kenntnis griechischer Süßwasser-Amphipoden.- *Zoologischer Anzeiger*, Leipzig, 105 (7/8): 215-219, figs. 1-2.
- Karaman, S. 1950a. Amphipoda Male Azije I. (= Die Amphipoden Kleinasiens I.).- *Srpska Akademija Nauka, Posebna Izdanja knj. 158, Odeljenje Prirodno-matematičkih nauka*, Beograd, 2: 33-46, figs. 1-18.
- Karaman, S. 1950b. Novi amfipodi podzemne faune Grčke.[Neue Amphipoden der unterirdischen Fauna Griechenlands]- *Rad, Jugoslavenska Akademija znanosti i umjetnosti*, 280 (*Odjel za prirodne i medicinske nauke*), Zagreb, 3: 106-114, figs. 1-20 (pp. 43-50, figs. 1-20).
- Karaman, S. 1956. III Beitrag zur Kenntnis griechischer Niphargiden.- *Folia Balcanica, Zavod za Ribarstvo na N. R. Makedonija*, Skopje, 1 (1): 1-8, figs. 1-9.
- Ntakis, A., Anastasiadou, A., Zakšek, V. & Fišer, C. 2015. Phylogeny and biogeography of three new species of *Niphargus* (Crustacea: Amphipoda) from Greece.- *Zoologische Anzeiger*, 255: 32-46, 16 figs.
- Pesce, G.L. & Maggi, D. 1983. Ricerche faunistiche in acque sotterranee freatiche della Grecia Meridionale ed insulare e stato attuale delle conoscenze sulla stygofauna di Grecia.- *Natura*, Milano, 74 (1-2): 15-73.