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On two new *Niphargus* species (Fam. Niphargidae) from Italy (Contribution to the Knowledge of the Amphipoda 288)

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Abstract

Two new taxa of the family Niphargidae (Crustacea Amphipoda) from Italy are presented. *Niphargus rotundus*, sp. n., described and figured from Montelupo Albeze, 450 m a.s.l. (Cuneo, Piemonte), and *Niphargus sestaputeanus*, sp. n., described and figured from Sesta Godano, Passo del Rastrello, 1000 m a.s.l. (La Spezia). The both taxa, based on the morphological characters, are close to the *Niphargus puteanus* Koch- Complex and its taxonomical position within genus *Niphargus* is discussed.

Key words: Taxonomy, Amphipoda, new taxa, *Niphargus*, *rotundus*, *sestaputeanus*, Italy.

Introduction

The fauna of the subterranean family Niphargidae (Amphipoda, Gammaridea) in Italy is presented by nearly 60 known taxa, collected in the subterranean waters in the caves, springs, lakes, hyporheic waters and other subterranean fresh- and brackish waters. The large variability of relief and geomorphology, different ecological conditions in various localities and quality of waters at one side, and highly diverse geological and zoogeographical history of Italy at the other side, has enabled the creation of a great diversity of species, most of them usually limited on the relatively restricted area.

The relatively limited distributional possibility of the animals in the subterranean waters conduct to development of numerous cryptic and pseudocryptic populations and species, where the recognition of real cryptic taxa become very difficult and often questionable.

On the other side, the similar ecological conditions in various localities, often very distant to each other, conduct to formation of similar morphological characters by very different species. In this light, the combination of use of morphological, genetical, ecological, physiological, anatomical and other studies can resolve the problem of recognition of single different taxa and its position within the family Niphargidae.

Our studies were limited on the morphological, ecological and zoogeographical data only, based on which we recognized and described two different taxa of the genus *Niphargus* from northern Italy, very close to *Niphargus puteanus* Koch, 1836. The further various studies and new samples of these taxa from other localities will show its exact taxonomical position.

Material and Methods

The collected material was preserved in the 70% ethanol. The specimens were dissected using a WILD M20 microscope and drawn using camera lucida attachment. All 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 formulae follows Karaman's terminology (Karaman, G. 1969; 1970; 2012).

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. The results are established based on provided morphological, ecological and zoogeographical investigations and data.

Taxonomical part

Family Niphargidae

Niphargus rotundus sp. n.

Figures 1-4

Niphargus puteanus (part.) G. Karaman, 1993: 239, fig. 117.

Material examined

ITALY: -- Well in Montelupo Albeze, 450 m a.s.l. (Cuneo, Piemonte), 4 spec. (leg. O. Cavallo).

Diagnosis (Partially, only males)

Antenna 1 shorter than half of body, peduncular articles progressively shorter, peduncular article 3 short; antenna 2 flagellum longer than last peduncular article. Mandible palpus with elevated number of B, D and E-setae. Maxilla 1 inner plate with 3 setae, outer plate with 7 spines (6 spines with one lateral tooth each), palpus not exceeding distal tip of outer plate spines. Maxilliped inner plate with 3 distal spines, palpus article 4 with 2 setae at inner margin near basis of the nail. Epimeral plates 1-3 with almost subrounded ventroposterior corner and convex posterior margin bearing many very short setae. Coxae 1-4 relatively short, coxa 4 without ventroposterior lobe, coxa 1 with subrounded ventroanterior corner

Gnathopods 1-2 relatively small, remarkably setaceous, with trapezoid propodus having inclined palm, dactylus with several bunches of setae. Pereopods 3-7 stout, strong, with additional spines along inner margin. Pereopods 5-7 stout, with unlobed article 2 bearing numerous setae along posterior margin. Pleopods with 2 retinacula each. Uropod 1 elongated, with dorsointernal row of setae and dorsoexternal row of spines, inner ramus is twice as long as outer ramus, both with numerous setae and short spines. Uropod 3 elongated, inner ramus slender and elongated, outer ramus 2-articulated, second article exceeding half of first article. Telson with numerous short distal, lateral and facial spines.

Description

Male 21.0 mm (holotype): Body slender, metasomal segments 1-3 with 4-5 dorsoposterior setae each (fig. 3G). Urosomal segment 1 on each dorsolateral side with 1 seta; urosomal segment 2 on each dorsolateral side with 1 spine accompanied by 1-2 setae; urosomal segment 3 naked (fig. 4E).

Urosomal segment 1 at each ventroposterior corner with one short spine (fig. 4E).

Epimeral plates 1 and 2 nearly subrounded, with poorly marked ventroposterior corner seta, and with convex posterior margin bearing 8-9 short setae (fig. 3G). Epimeral plate 3 with almost angular ventroposterior corner defined by one short corner strong seta, and along posterior poorly convex margin with 8 short setae. Epimeral plate 2 with 5 subventral spines, epimeral plate 3 with 3 subventral spines (fig. 3G).

Head with short rostrum and short subrounded lateral cephalic lobes and distinct ventroanterior excavation (fig. 1A), eyes missing.

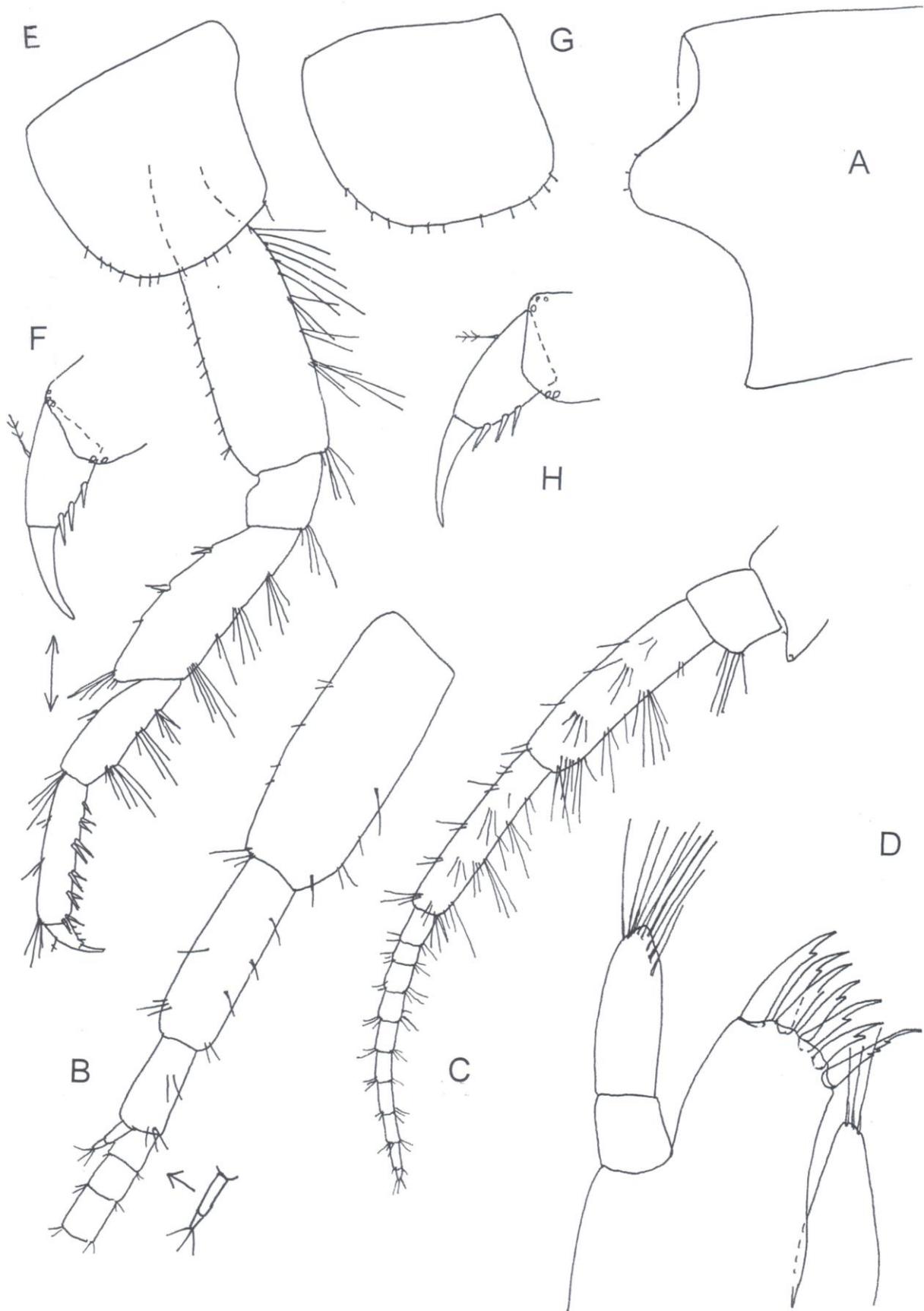


Figure 1. *Niphargus rotundus*, sp. n., Montelupo Albeze, Piemonte, male 21.0 mm: A= head; B= antenna 1; C= antenna 2; D= maxilla 1; E-F= pereopod 3; G= coxa 4; H= dactylus of pereopod 4.

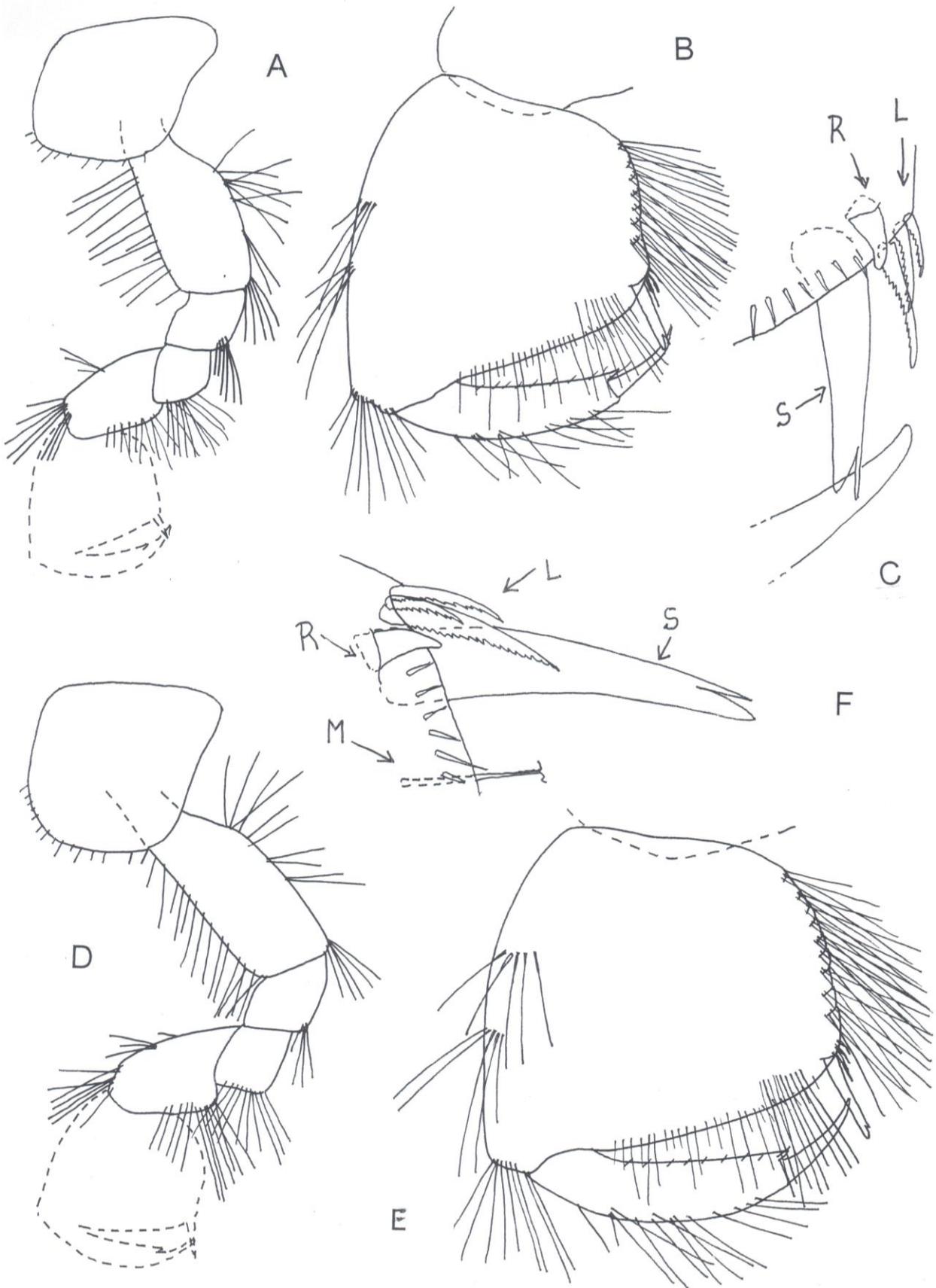


Figure 2. *Niphargus rotundus*, sp. n., Montelupo Albeze, Piemonte, male 21.0 mm: A-B= gnathopod 1, outer face; C= distal corner of gnathopod 1 propodus, inner face [S= corner spine; L= lateral spines; R= subcorner spine]; D-E= gnathopod 2, outer face; F= distal corner of gnathopod 2 propodus, inner face [S= corner spine; L= lateral spines; R= subcorner spine; M= facial M-setae].

Antenna 1 reaching 1/3 of body-length; peduncular articles 1-3 progressively shorter (ratio: 72:51:23), scarcely setaceous (fig. 1B); setae are much shorter than diameter of articles themselves. Peduncular article 3 nearly twice longer than broad; with single median and distal short setae; main flagellum scarcely setaceous, consisting of 24 articles (most of them with one short aesthetasc). Accessory flagellum 2-articulated, not exceeding half of article 3-length (fig. 1B).

Antenna 2 well developed but relatively short. Peduncular article 3 short, with distal ventral bunch of setae as long as or longer than width or article itself (fig. 1C); article 4 slightly longer than article 5 (ratio: 55:49), with 3-4 ventral bunches of setae (the longest setae are longer than diameter of article itself), along lateral and dorsal side with single or bunches of short setae; article 5 at ventral margin with bunches of setae (the longest setae are longer than diameter of article itself), along lateral and dorsal side with single or bunches of short setae (fig. 1C); flagellum slender, moderately setaceous, consisting of 10 articles bearing setae not exceeding diameter of articles themselves. Antennal gland cone short (fig. 1C).

Mouthparts well developed. Labrum broader than long, convex distally. Labium broader than long, with short inner lobes, outer lobes entire, with convex distal margin.

Mandibles with triturative molar. Right mandible: molar with one long subdistal seta, incisor with 4 teeth, lacinia mobilis bifurcate, serrate, accompanied by 8 rakers. Left mandible: molar without long seta, incisor with 5 teeth, lacinia mobilis with 4 teeth, accompanied by several rakers. Mandible palpus 3-articulate: first article short and naked; second article bearing 14 setae (fig. 4A); third article subfalciform, nearly as long as second article, bearing nearly 25 D-setae and 7 distal E-setae; along outer face of article 3 is attached one group of 8 A-setae, on inner face are attached 4 groups of B-setae (1-2-2-2) (fig. 4A).

Maxilla 1: inner plate with 3 distal setae, outer plate with 7 spines [6 spines are with one lateral tooth, one spine is with 3 lateral teeth (fig. 1D)]; palpus 2-articulate, short, not exceeding distal tip of outer plate spines and provided with 10 setae (fig. 1D).

Maxilla 2: both plates with marginal setae only.

Maxilliped: inner plate short, with 3 distal spines and single setae (fig. 4B), outer plate reaching half of palpus article 2 and bearing a row of 12 distolateral spines and distal setae; palpus article 3 at 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 setae near basis of the nail (fig. 4C).

Coxae relatively short, not exceeding the height of the body. Coxa 1 slightly broader than long (high) (ratio: 43:37), with subrounded ventroanterior corner and provided with nearly 10 short marginal setae (fig. 2A). Coxa 2 as long as broad, bearing nearly 15 short marginal setae (fig. 2D). Coxa 3 slightly broader than long (ratio: 59:55), with nearly 13 short marginal setae (fig. 1E). Coxa 4 broader than long (ratio: 55:51), without posterior lobe (fig. 1G), bearing 12 short marginal setae (fig. 1G). Coxae 5-7 much shorter than coxa 4, coxae 5 and 6 with short subrounded anterior lobe; coxa 7 entire, with convex ventral margin.

Gnathopods 1 and 2 relatively small but remarkably setaceous, and with propodus not larger than corresponding coxa. Gnathopod 1: article 2 along anterior margin with row of long single setae, along posterior margin with several bunches of long setae (fig. 2A); article 3 at posterior margin with one bunch of setae. Article 5 slightly shorter than propodus (ratio: 32:38), along anterior margin with 2 groups of setae (fig. 2A). Propodus trapezoid, slightly longer than broad (ratio: 89:80), along posterior margin with 7 transverse groups of setae (fig. 2B); palm slightly convex, inclined almost half of propodus-length, defined on outer face by one corner S-spine accompanied laterally by 3 slender serrate L-spines and 8 facial M-setae, on inner face by one subcorner R-spine (fig. 2C); dactylus reaching posterior margin of propodus, with row of 7 bunches of setae along outer margin (1-2-3-1-2-2-2), and with row of over 11 short setae at inner margin (fig. 2B).

Gnathopod 2: article 2 along anterior margin with row of single long setae, along posterior margin with bunches of long setae (fig. 2D); article 3 at posterior margin with one bunch of setae. Article 5 nearly as long as propodus, at anterior margin with 3 bunches of setae. Propodus trapezoid, only slightly larger than that of gnathopod 1, trapezoid nearly as long as broad, along posterior margin with 9 transverse groups 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 3 serrate L-spines and 10 facial M-setae (fig. 2F), on inner face by one subcorner R-spine; dactylus reaching posterior margin of propodus, along outer margin with several bunches of median setae (14 setae), at inner margin with row of numerous short setae (fig. 2E).

Pereopods 3 and 4 similar to each other, moderately stout. Pereopod 3: article 2 along anterior margin with row of short setae, along posterior margin with several bunches of long setae (fig. 1E); articles 4-6 of unequal length (ratio: 52:36:38), article 2 at posterior margin with 4 bunches of setae (the longest

setae reaching the diameter of article itself), at anterior margin with single short spines and setae (fig. 1E); article 5 at posterior margin with 3 bunches of setae (the longest setae exceeding the diameter of article itself) and single spine; article 6 along posterior margin with 6 bunches of short spines and single setae, along anterior margin 3 bunches of short setae; dactylus short and stout, much shorter than article 6 (ratio: 17:38), along inner margin with 3 single spines, at outer margin with one median seta (fig. 1F); nail shorter than pedestal (ratio: 26:32).

Pereopod 4 like pereopod 3, dactylus short and stout, along inner margin with 3 strong spines, at outer margin with one median seta (fig. 1H); nail shorter than pedestal (ratio: 29:34).

Pereopods 5-7 relatively short and stout, progressively longer towards pereopod 7 (fig. 3A, C, E). Pereopod 5: article 2 dilated, longer than broad (ratio: 63:43), along anterior convex margin with several short spine-like setae, along posterior almost straight margin with 18 short setae (fig. 3A), ventroposterior lobe absent. Articles 4-6 of unequal length (ratio: 39:40:36), article 4 at anterior margin with 4 groups of very short bunches of setae, at posterior margin with 2 groups of short spines (fig. 3A); article 5 at anterior and posterior margin with several groups of very short spines and single short setae; article 6 at both margins with bunches of very short spines. Article 6 is shorter than article 2 (ratio: 36:63). Dactylus short and stout, much shorter than article 6 (ratio: 15:36), along inner margin with 2 spines, at outer margin with one median plumose seta (fig. 3B); nail shorter than pedestal (ratio: 20:25).

Pereopod 6 remarkably longer than pereopod 5, its article 2 dilated, longer than broad (ratio: 74:50), along anterior slightly convex margin are attached several single or bunches of short spine-like setae, along posterior nearly straight margin appear 14-15 short setae, ventroposterior lobe absent (fig. 3C). Articles 4-6 of unequal length (ratio: 48:56:53), article 4 at anterior margin with 4 bunches of short setae and distal short spine, along posterior margin with 3 bunches of short spines and setae; article 5 at anterior margin with short setae and spines, along posterior margin bearing 3 groups of short spines and setae (fig. 3C); article 6 shorter than article 2 (ratio: 53:74), along both margins with several bunches of short spines and with distal spines and setae. Dactylus strong and stout, much shorter than article 6 (ratio: 18:53), at inner margin with 3 strong spines, at outer margin with one median plumose seta (fig. 3D), nail shorter than pedestal (ratio: 22:33).

Pereopod 7: article 2 longer than broad (ratio: 80:51), along anterior margin with 6 single spine-like setae and with distal group of short setae (fig. 3E), along posterior margin with nearly 22 short setae, margin in distal part of article 2 is almost straight, ventroposterior lobe absent. Articles 4-6 of unequal length (ratio: 43:56:66), article 2 along anterior margin with 3 bunches of very short setae, at posterior margin with 3 bunches of short spines (fig. 3E); articles 5 and 6 along both margins with 3-5 bunches of very short spines and single short setae. Article 2 is longer than article 6 (ratio: 80:66). Dactylus short and strong, much shorter than article 6 (ratio: 22:66), at inner margin with 4 spines (fig. 3F), at outer margin with one median plumose seta; nail is shorter than pedestal (ratio: 27:39).

Pleopods 1-3 with 2 retinacula each. Peduncle of pleopod 1 along anterior margin with 2 distal setae; peduncle of pleopod 2 naked; peduncle of pleopod 3 along posterior margin with 4 short setae.

Uropod 1 slender, peduncle without distal tubercle, but with dorsoexternal row of short spines and dorsointernal row of setae (except distal spine) (fig. 4E); inner ramus only slightly longer than peduncle, with several short lateral and distal spines as well as with 6 bunches of lateral simple setae longer than spines; outer ramus reaching only half of inner ramus-length, with 3-4 distal sport spines and 4 lateral bunches of simple setae (fig. 4E).

Uropod 3 slender and long; peduncle nearly twice longer than broad, with several short lateral setae and single distal short spines and setae (fig. 4F); inner ramus elongated, much longer than broad (ratio: 45:10), with several very short lateral and distal setae. Outer ramus 2-articulated, long, first article slender, along outer ramus with 6 bunches of very short spines (fig. 4F), along inner margin with 5 bunches of very short spines accompanied by single plumose setae not exceeding the diameter of the article itself; second article shorter than first one (ratio: 75:118), along both margins with several very short simple setae and with distal bunch of 4-5 simple setae.

Telson slightly gapping, nearly as long as broad, incised nearly 2/3 of telson-length (fig. 4D); each lobe with 3-4 distal short spines as well as with 2 outer marginal short spines and single setae; two pairs of short facial spines accompanied by 0-1 short seta are attached on each lobe; a pair of short plumose setae is attached near the middle of lobes outer margin (fig. 4D).

Female: unknown.

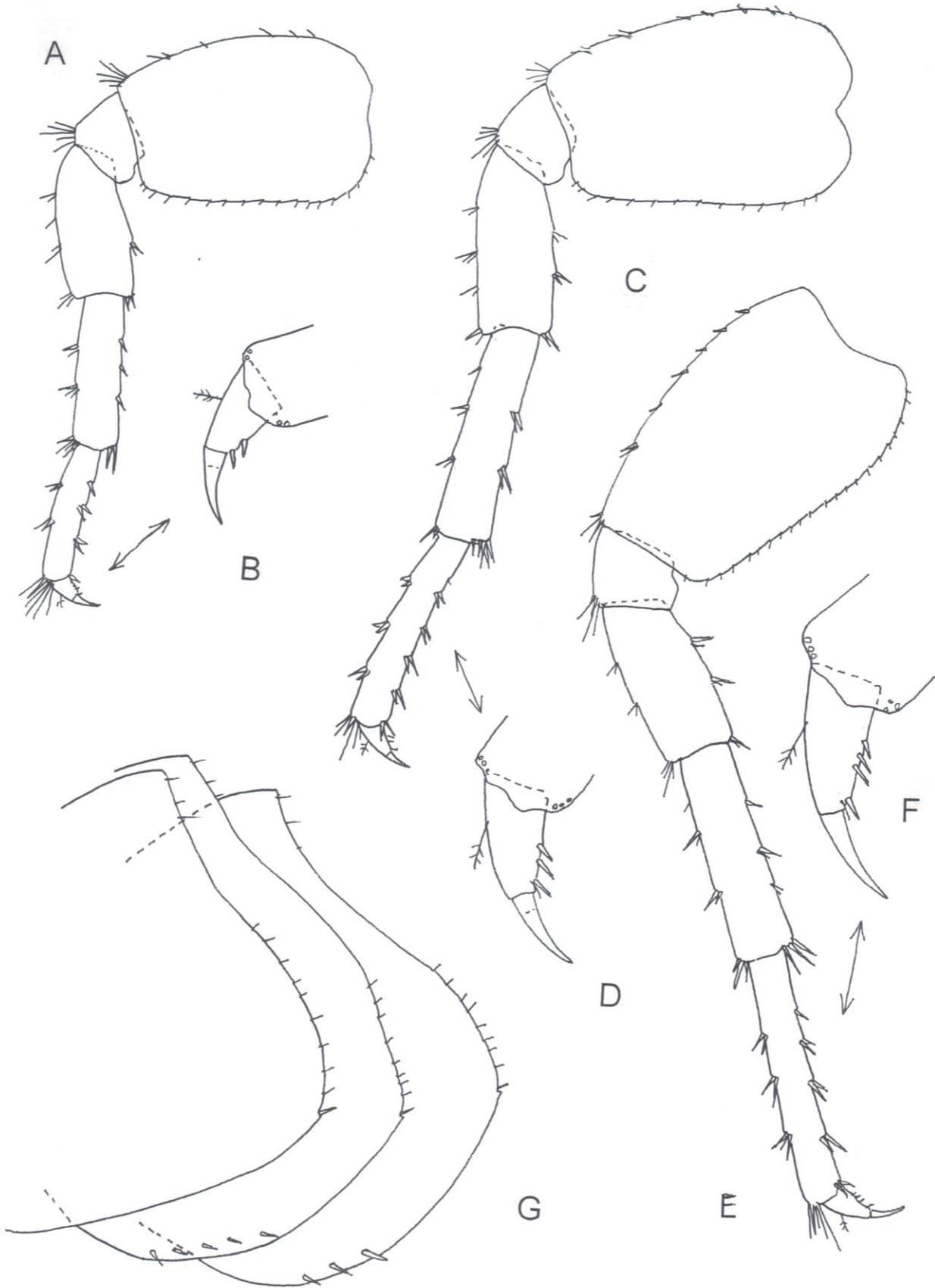


Figure 3. *Niphargus rotundus*, sp. n., Montelupo Albeze, Piemonte, male 21.0 mm: A-B= pereopod 5; C-D= pereopod 6; E-F= pereopod 7; G= epimeral plates 1-3.

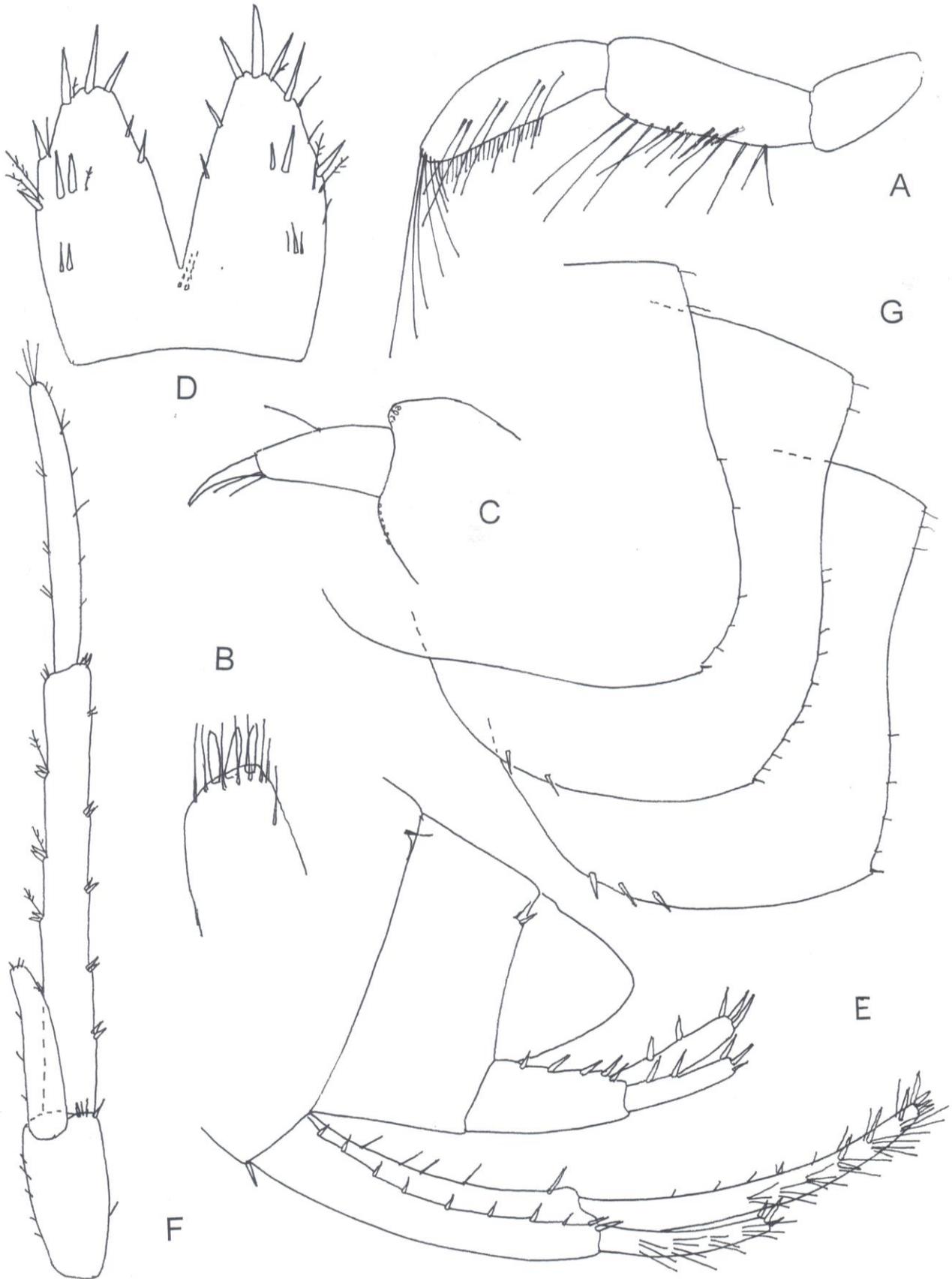


Figure 4. *Niphargus rotundus*, sp.n., Montelupo Albeze, Piemonte, male 21.0 mm: A= mandible palpus, inner face; B= inner plate of maxilliped; C= distal article of maxilliped palpus; D= telson; E= urosome with uropods 1-2; F= uropod 3. Male 24.0 mm: G= epimeral plates 1-3.

Variability

The male of 24.0 mm is very similar to the holotype, with scarce number of dorsoposterior setae on metasomal segments 1-3 and with subrounded epimeral plates 1-2 bearing a row of short setae along posterior margin and with short ventroposterior corner seta (fig. 4E). Epimeral plate 3 is more quadrate, with marked ventroposterior corner defined by stronger corner seta and provided with several short setae along posterior poorly convex margin. Epimeral plate 2 is provided with 2 subventral spines, epimeral plate 3 is provided with 3 subventral spines (fig. 4E).

Holotype: Male 21.0 mm. Holotype and paratype are preserved in the Karaman's Collection in Podgorica, Montenegro.

Locus typicus: Montelupo Albeze, Piemonte, Italy.

Derivatio nominis: The name "rotundus" is in association with the subrounded epimeral plates.

Remarks and affinities

The specimens from Montelupo Albeze are rather similar to *Niphargus puteanus* (Koch, in Panzer, 1836) [loc. typ.: Regensburg, Germany] based on various characters (shape of gnathopods, shape of uropods 1-3, etc.). As the original description of this species was very poor, various taxa in different localities over Europe have been designated to this species, often erroneously.

Stock redescribed this species again from Regensburg (Stock, 1974). The comparison of the specimens from this type-locality with our specimens from Montelupo, show that *N. puteanus* from type-locality (Regensburg) differs from specimens from Montelupo (*N. rotundus*) by more angular or slightly pointed epimeral plates 1-3, by longer pereopods, more narrowed coxae, by less spiniferous dactylus of pereopods 3-7, by less setaceous gnathopods 1-2, less inclined palm of propodus in gnathopods 1 and 2, more setaceous inner plate of maxilla 1, more spiniferous inner plate of maxilliped, by presence of dorsointernal row of spines on uropod 1 peduncle, etc.

From Italy is known also species with additional spines on dactylus of pereopods, *Niphargus elegans* Garbini, 1894 [loc. typ.: S. Pancrazio near Verona, Italy], but it differs distinctly from *N. rotundus* by high number of additional spines on dactylus of pereopods 3-7, by presence of tubercle on peduncle of uropod 1 in males, by different shape of gnathopods 1-2, by very acute epimeral plates 1-3, etc.

Several species of genus *Niphargus* with elevated number of spines on dactylus are known from France also. Most of these taxa are poorly described with unknown numerous characters, what made very difficult recognition of differences between various species.

The species *Niphargus plateaui* Chevreux, 1901 [loc. typ.: well in Nantes, France] is rather similar to *N. rotundus*, (subrounded epimeral plates, etc) but differs by less spinose dactylus of pereopods 3-7, etc.

Niphargus robustus Chevreux, 1901 [loc. typ.: Grotte de Sare, Basses Pyrenees, France] differs from *N. rotundus* by slender dactylus of pereopods, less inclined palm of gnathopods 1-2, etc.

Niphargus ciliatus Chevreux, 1906 [loc. typ.: Grotte de Meailles [Valee de la Vaire, affluent du Var, France] is also with subrounded epimeral plates and elevated number of spines on dactylus of pereopods, but it differs from *N. rotundus* by narrowed and less spinose telson, etc.

Niphargus admiraulti Chevreux, 1901 [loc. typ.: Nantes, France] is with additional number of spines on dactylus of pereopods, but differs from *N. rotundus* by distinctly angular epimeral plates, less incised telson bearing less number of spines and setae, by slightly unequal rami of uropod 1 in males, etc.

Niphargus corsicanus Schellenberg, 1950 [loc. typ.: Vornaccia springs, Solaro, Ordinacio Mt., Corsica island] is provided with angular epimeral plates and slightly unequal rami of uropods 1-2, but it differs from *N. rotundus* by different telson, less elongated inner ramus of uropod 1, lower number of additional spines on pereopods, etc.

In Slovenia appears *Niphargus illidzensis slovenicus* S. Karaman, 1932 [loc. typ.: Stražišče near Kranj], with elevated number of spines on dactylus, but it differs from *N. rotundus* by absence of additional spines on dactylus of pereopods 5-7, less spinose telson, etc.

In Croatia is known *Niphargus castellanus* S. Karaman, 1960 [loc. typ.: spring above Kaštel Stari near Split] with elevated number of spines on dactylus of pereopods, but it differs remarkably from *N. rotundus* by acute epimeral plates, etc.

Niphargus illidzensis Schäferna, 1922- Complex of taxa [S. Karaman, 1950) differs distinctly from our species by acute epimeral plates, dactylus of pereopods, mouthparts, etc.

Niphargus sestaputeanus, described here, differs from *N. rotundus* by acute epimeral plates, coxae, etc. (see below).

Niphargus sestaputeanus, sp. n.

Figure 5-10

Niphargus puteanus (part.) G. Karaman, 1993: 239, fig. 116.

Material examined

ITALY: - Sesta Godano, Passo del Rastrello, 1000 m a.s.l. (N. of La Spezia), 6.7.1969, 6 spec. (leg. N. Sanfilippo);

--Spring in Monte Gottero, Pien di Messo (NE of La Spezia), 1000 m a.s.l., 18.5.1975, 6 spec. (leg. N. Sanfilippo).

-- Val' Aveto, springs, Rezzoaglio (Genova), 24.10.1958, 3 exp. (leg. M. Mariani);

-- Appenino Emigliano, Bedonia, springs of torrent Lecce, 1300 m a.s.l. 12.8.1976 2 spec. (leg. Rovizza).

Diagnosis

Body slender, in male's urosomal segment 1 with 1 seta on each side, urosomal segment 2 with 2 spines. Epimeral plate 3 distinctly acute, with concave posterior margin. Coxae 1-4 shallow in males; Maxilla 1 inner plate with 3-4 setae, 6 spines of outer plate with 1 lateral tooth, one spine with 2-3 teeth. Maxilliped inner plate with 4 spines. Propodus of gnathopods 1-2 longer than broad with dactylus bearing row of single and bunches of setae; L-spines are sitting laterally of S-spine.

Dactylus of pereopods 3-7 with 2-3 spines at inner margin. Article 2 of pereopods 5-7 without ventroposterior lobe. Pleopods with 2 retinacula. Uropod 1 peduncle with dorsoexternal row of short spines and dorsointernal row of setae (except distal spine), inner ramus twice as long as outer one, with lateral and distal spines and simple setae. Uropod 1 peduncle with dorsointernal row of setae (except distal spine). Uropod 2 inner ramus longer than outer one, with longer distal spines. Uropod 3 in males long, outer ramus 2-articulated, second article slightly shorter than first article; in females much shorter than first article. Telson with long distal, lateral and facial spines.

Description

Male 10.0 mm, Sesta Godano (holotype): Body slender, metasomal segments 1-3 with 3-4 dorsoposterior longer marginal setae each. Urosomal segment 1 on each dorsolateral side with 1 seta (fig. 7F); urosomal segment 2 on each dorsolateral side with 2 spines (fig. 1F); urosomal segment 3 naked. Urosomal segment 1 at each ventroposterior corner with one short slender spine near basis of the uropod 1 peduncle (fig. 7F)

Epimeral plates 1-2 poorly angular, with marked ventroposterior corner and convex posterior margin bearing several short setae (fig. 9B); epimeral plate 3 distinctly acute, with concave posterior margin bearing several short marginal setae (fig. 9B); epimeral plates 2 and 3 with 3 subventral spines each.

Head with short rostrum and short subrounded lateral cephalic lobes and ventroanterior excavation, eyes absent.

Antenna 1 reaching nearly half of body, peduncular articles 1-3 progressively slender (ratio: 81:51:22), bearing several short setae only (fig. 5A); flagellum consisting of 24 articles (most of them with one short aesthetasc each) (fig. 5A); accessory flagellum short, 2-articulated (fig. 5A).

Antenna 2 moderately slender; peduncular article 3 short, with distoventral bunch of setae (the longest setae reaching the diameter of article itself). Peduncular article 4 slightly longer than article 5 (ratio: 63:57), along ventral margin with bunches of short and long straight setae (the longest setae exceeding the diameter of article itself (fig. 5B), along dorsal margin with several groups of short setae; article 5 along ventral margin with 4 bunches of long setae (the longest setae remarkably exceeding the diameter of article itself), along dorsal margin with 4-5 groups of shorter setae (fig. 5B). Flagellum remarkably longer than last peduncular article (ratio: 93:57), consisting of 11 articles bearing longer setae along ventral margin and short setae along dorsal margin; antennal gland cone short (fig. 5B).

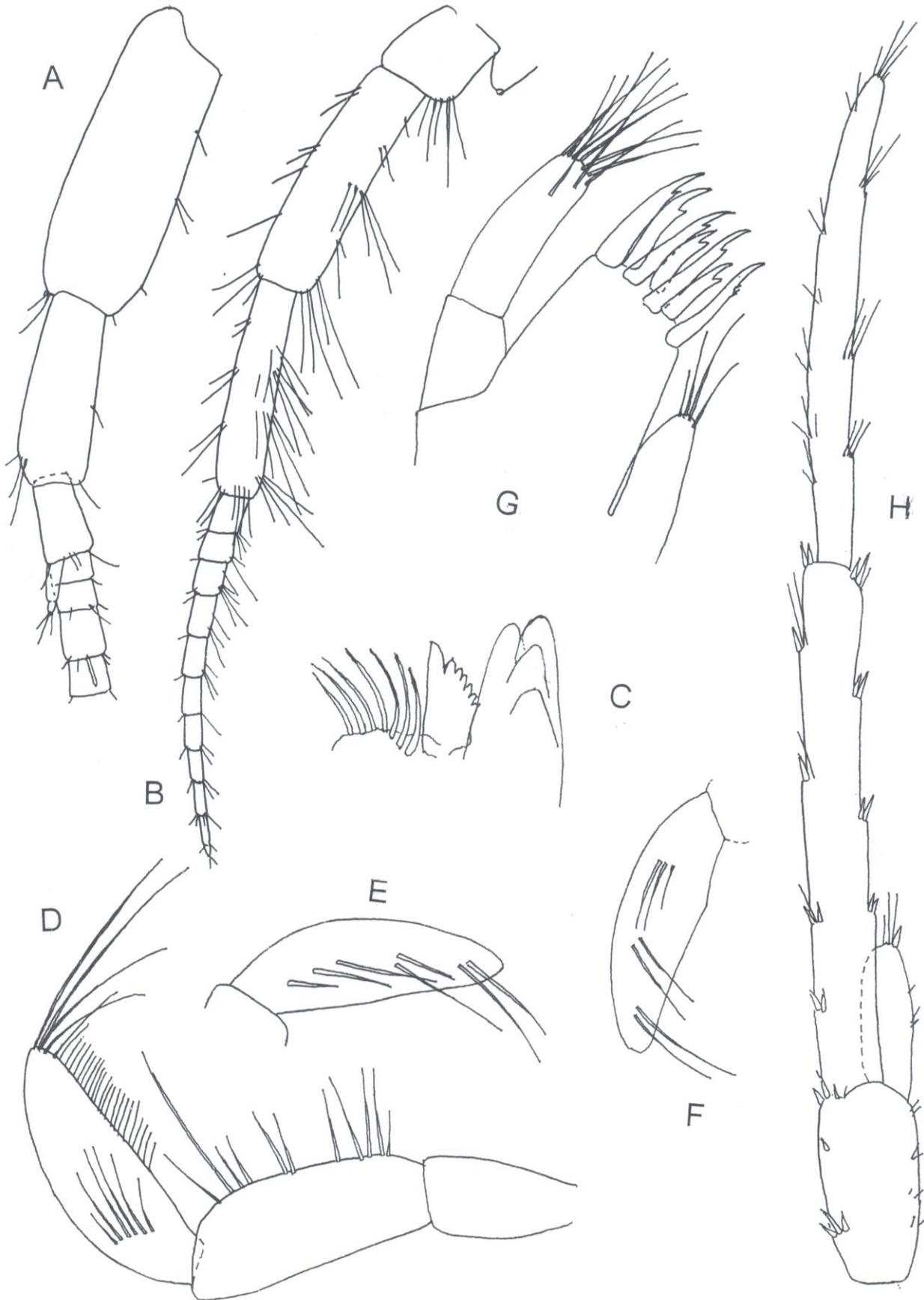


Figure 5. *Niphargus sestaputeanus*, sp. n., Sesta Godano, La Spezia, male 10.0 mm. A= antenna 1; B= antenna 2; C= right mandible, incisor and lacinia mobilis with rakers; D= mandible palpus, outer face; E= third article of left mandible palpus, inner face; F= third article of right mandible palpus, inner face; G= maxilla 1; H= uropod 3.



Figure 6. *Niphargus sestaputeanus*, sp. n., Sesta Godano, La Spezia, male 10.0 mm. A-B= gnathopod 1' C-D= gnathopod 2' E= distal corner of gnathopod 2 propodus, inner face [S= corner spine; L= lateral spine; R= subcorner spine]; F= maxilla 2.

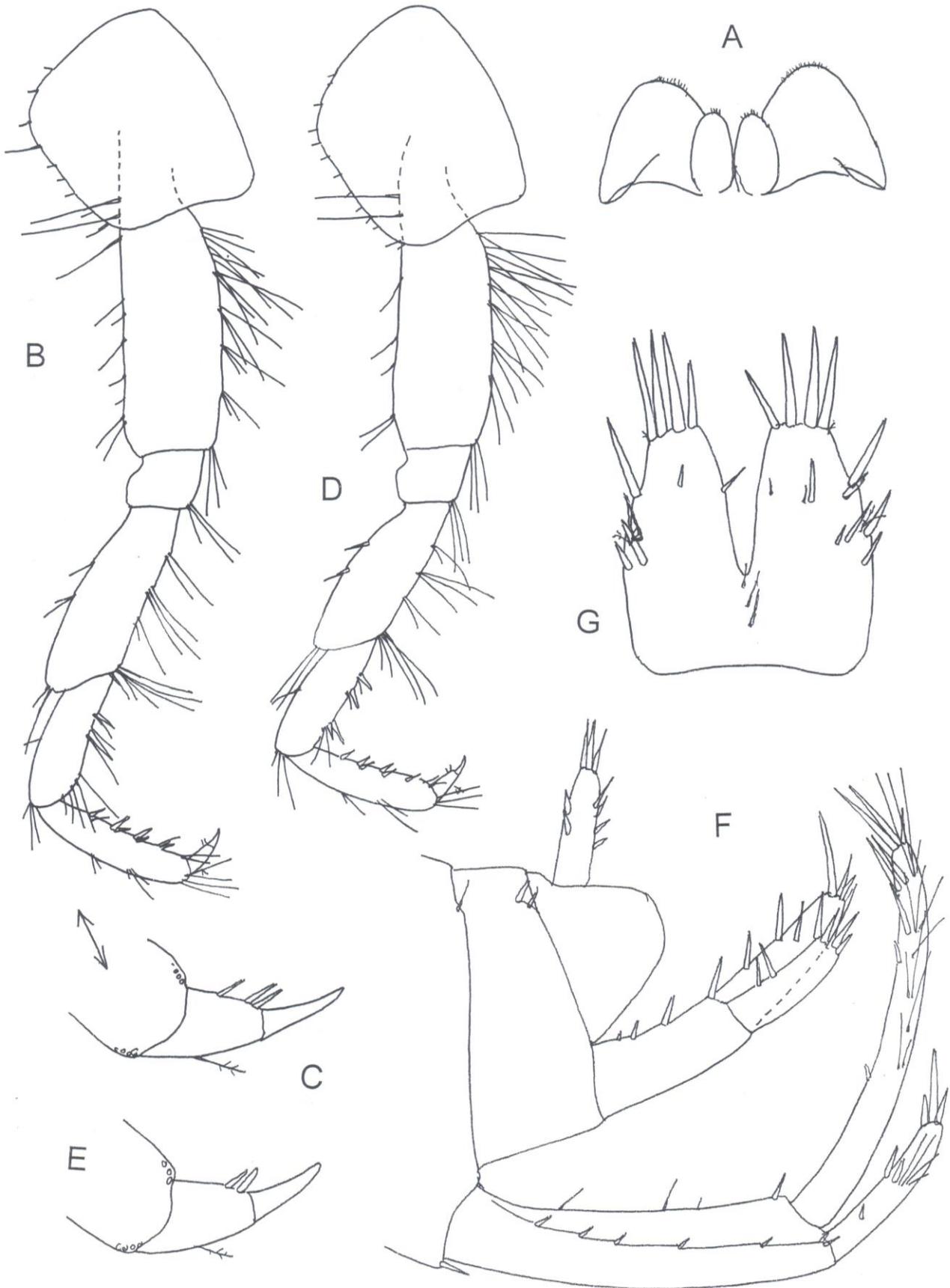


Figure 7. *Niphargus sestaputeanus*, sp. n., Sesta Godano, La Spezia, male 10.0 mm. A= labium; B-C= pereopod 3; D-E= pereopod 4; F= urosome with uropods 1-2; G= telson.

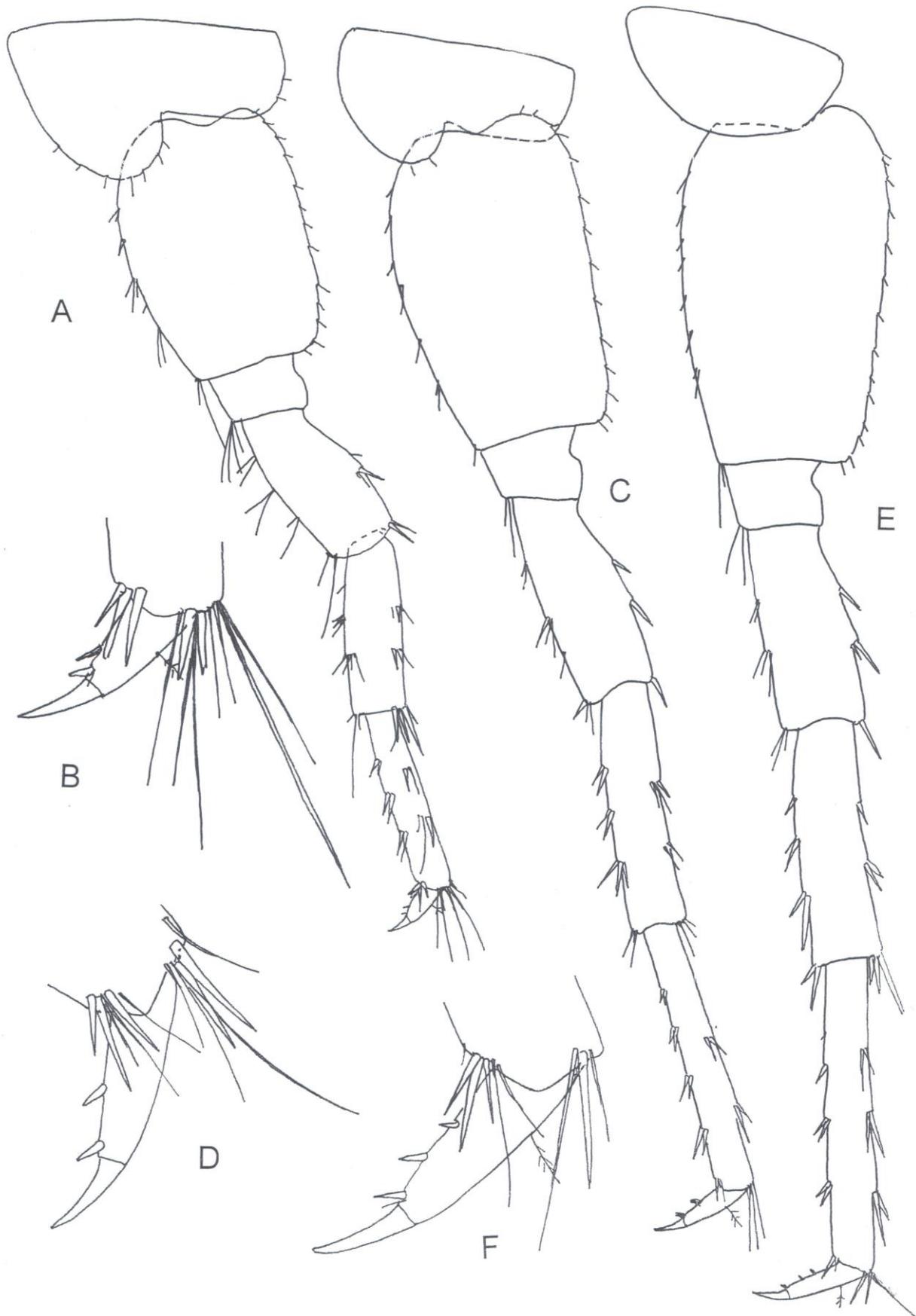


Figure 8. *Niphargus sestaputeanus*, sp. n., Sesta Godano, La Spezia, male 10.0 mm. A-B= pereopod 5; C-D= pereopod 6; E-F= pereopod 7.

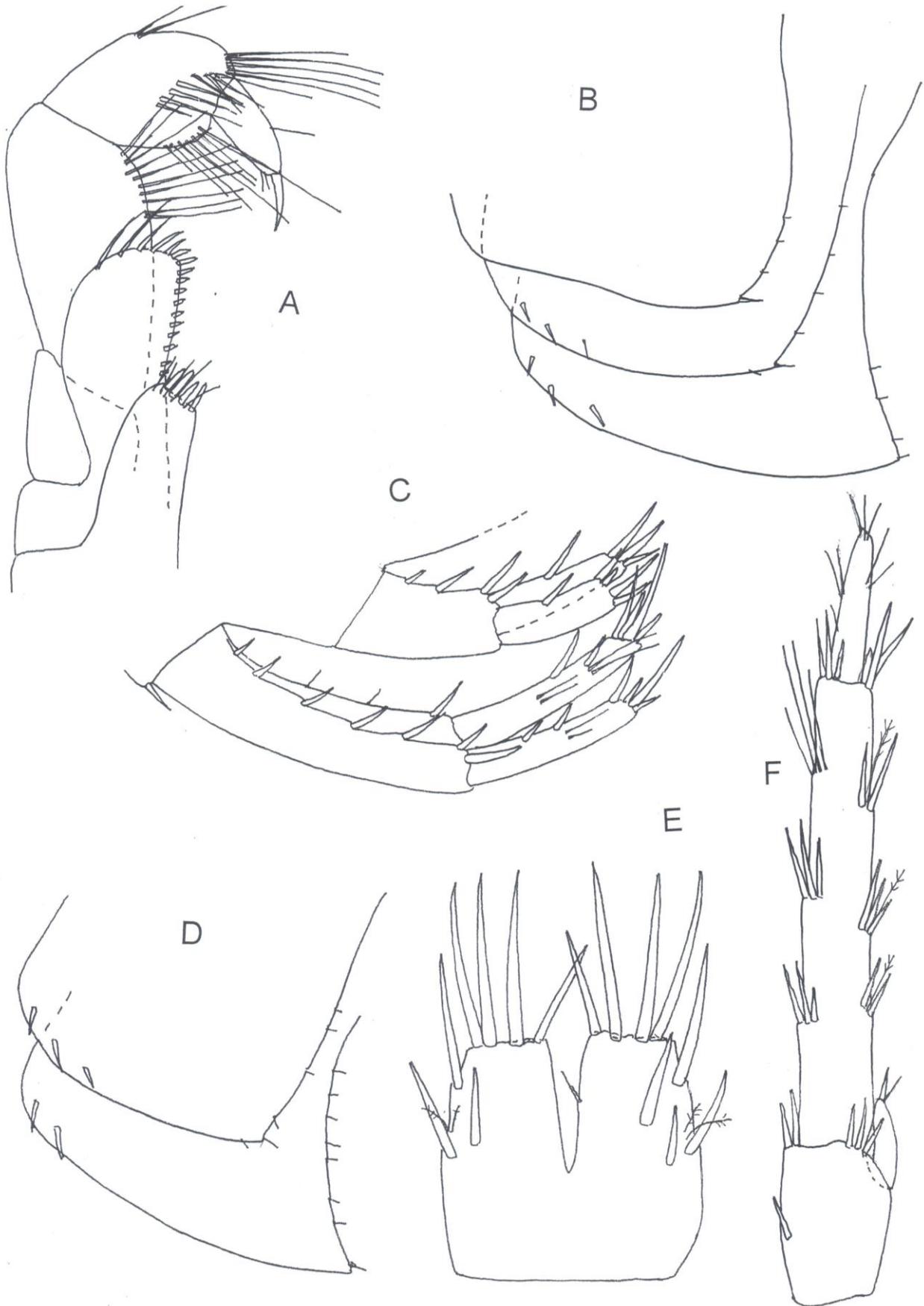


Figure 9. *Niphargus sestaputeanus*, sp. n., Sesta Godano, La Spezia, male 10.0 mm. A= maxilliped; B= epimeral plates 1-3. Female 7.0 mm: C= urosome with uropods 1-2; D= epimeral plates 2-3; E= telson; F= uropod 3.

Mouthparts well developed. Labrum broader than long, with convex distal margin. Labium broader than long, inner lobes well developed, outer lobes subrounded distally (fig. 7A).

Mandibles: molar triturative. Right mandible incisor with 4 teeth and serrate lacinia mobilis accompanied by 7 rakers (fig. 5C). Left mandible: incisor with 5 teeth, lacinia mobilis with 4 teeth accompanied by 6 rakers. Palpus 3-articulated: first article naked; second article bearing 11 setae (fig. 5D); third article subfalciform, longer than second article (ratio: 74:63), bearing nearly 22 D-setae and 5-6 E-setae (fig. 5D), on outer face is attaches one row of 6 facial A-setae (fig. 5D), on inner face appear 7 B-setae distributed into 3-5 groups of B-setae (fig. 5E, F).

Maxilla 1: inner plate is provided with 3-4 setae, outer plate bearing 7 spines (6 spines with one lateral tooth, one spine with 2-3 lateral teeth); palpus 2-articulated, bearing 9-10 distal setae (fig. 5G), palpus reaching distal tip of outer plate spines.

Maxilla 2: inner plate is rather smaller than outer one, both plates with distomarginal setae (fig. 6F).

Maxilliped: inner plate short, with 4 distal smooth spines (fig. 9A), outer plate nearly reaching half of palpus article 2, bearing distolateral row of smooth spines; palpus article 3 at 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 setae near basis of the nail (fig. 9A).

Coxae 1-4 relatively short. Coxa 1 remarkably broader than long (ratio: 50:38), with subrounded ventroanterior corner and provided with 9 marginal setae (fig. 6A).

Coxa 2 slightly broader than long (ratio: 50:46), subrounded ventrally and provided with 13 marginal setae (fig. 6C). Coxa 3 broader than long (ratio: 54:47), with 9 marginal setae (fig. 7B). Coxa 4 distinctly broader than long (ratio: 57:46), without distinct ventroposterior lobe and provided with nearly 12 marginal setae (fig. 7D).

Coxa 5 much broader than long (ratio: 70:41), with anterior subrounded lobe almost as long as coxa 4 and provided with several marginal setae, posterior lobe shallow (fig. 8A). Coxa 6 shorter than coxa 5, much broader than long (ratio: 61:34), with anterior subrounded lobe (fig. 8C). Coxa 7 shallow, much broader than long (ratio: 58:30), with subrounded ventral margin (fig. 8E).

Gnathopods 1 and 2 relatively small, with propodus nearly as large as corresponding coxa (fig. 6A, C). Gnathopod 1: article 2 stout, along anterior margin with row of numerous long single setae, along posterior margin with several bunches of long setae; article 3 at posterior margin with one bunch of setae; article 5 slightly shorter than propodus (ratio: 35:45), at anterior margin with one distal bunch of setae (fig. 6A). Propodus trapezoid, slightly longer than broad (ratio: 89:75), along posterior margin with 8 transverse rows of setae (fig. 6B); palm inclined almost half of propodus-length, poorly convex, defined on outer face by one corner S-spine accompanied laterally by 2-3 slender L-serrate spines and 6 long facial M-setae (fig. 6B), on inner face by one short subcorner R-spine. Dactylus reaching posterior margin of propodus, along outer margin with row of single and bunches of median setae (1-2-2-2-1-2), along inner margin with row of several short setae (fig. 6B).

Gnathopod 2 rather larger than gnathopod 1 (fig. 6A, C), with article 2 bearing along anterior margin a row of longer setae, along posterior margin with several groups of single or bunches of long setae (fig. 6C); article 3 at posterior margin with one bunch of setae; article 5 shorter than propodus (ratio: 42:48), along anterior margin with one distal bunch of setae (fig. 6C). Propodus trapezoid, slightly longer than broad (ratio: 94:82), along posterior margin with 10 transverse rows of setae (fig. 6D). Palm slightly convex, inclined almost to the half of propodus-length, defined on outer face by one S-spine accompanied laterally by 2 L-spines and 6-7 facial M-setae (fig. 6E), on inner face by one R-spine (fig. 6E). Dactylus reaching posterior margin of propodus, along outer margin with row of 11 median setae sitting alone or in bunches (1-2-3-2-1-2), along inner margin with row of short setae (fig. 6D).

Pereopods 3 and 4 moderately slender. Pereopod 3: article 2 at anterior margin with 3 long proximal setae and row of 7-8 short laterodistal setae (fig. 7B), along posterior margin with several bunches of longer setae; article 3 at posterior margin with one distal bunch of setae. Articles 4-6 of unequal length (ratio: 52:38:43), article 4 at posterior margin with 4 bunches of setae (the longest setae are longer than diameter of article itself); article 5 along posterior margin with 2 spines and 3 bunches of setae (fig. 7B); article 6 at posterior margin with 5-6 pairs of short spines and single setae; dactylus much shorter than article 6 (ratio: 13:43), short and strong, at inner margin with 3 strong median spines, along outer margin with one median seta; nail is shorter than pedestal (ratio: 25:32) (fig. 7C).

Pereopod 4: article a at anterior margin with row of shorter setae, along posterior margin with bunches of long and short simple setae (fig. 7D); articles 4-6 of unequal length (ratio: 44:35:40), article 4 at

posterior margin with 4 bunches of long setae; article 5 at posterior margin with 3 groups of short spines and single setae; article 6 at posterior margin with 5 groups of short spines and single setae (fig. 7D). Dactylus short and strong, much shorter than article 6 (ratio: 14:40), at inner margin with 2 strong spines, at outer margin with one median seta; nail shorter than pedestal (ratio: 22:31) (fig. 7E).

Pereopods 5-7 progressively longer (fig. 8A, C, E). Pereopod 5: article 2 longer than broad (ratio: 69:48), along anterior margin with 6 groups of short setae or spine-like setae (fig. 8A), along posterior margin with 13 short setae, ventroposterior lobe not developed. Articles 4-6 of unequal length (ratio: 45:46:48); article 2 at anterior margin with 4 groups of setae, at posterior margin with 2 bunches of spines (fig. 8A); article 5 and article 6 along both margins with short setae and short spines. Article 6 is distinctly shorter than article 2 (ratio: 69:48), bearing at anterior and posterior margin groups of short spines and setae, and with distal very long simple setae. Dactylus strong, much shorter than article 6 (ratio: 12:48), at inner margin with 2 median spines, at outer margin with one median seta (fig. 8B), nail shorter than pedestal (ratio: 33:23).

Pereopod 6: article 2 remarkably longer than broad (ratio: 83:50), along anterior margin with 7 spine-like setae, along posterior almost straight margin with 14 short setae (fig. 8C), ventroposterior short dilatation developed, but without lobe; articles 4-6 of unequal length (ratio: 58:63:73), along both margins with bunches of short setae and short spines (fig. 8C). Article 6 shorter than article 2 (ratio: 73:83). Dactylus strong, much shorter than article 6 (ratio: 27:73), at inner margin with 2 strong spines, at outer margin with one median plumose seta (fig. 8D); nail shorter than pedestal (ratio: 25:55).

Pleopods 1-3 with 2 retinacula. Peduncle of pleopod 1 at anterior margin with 2-3 median setae and 5-6 distal setae; peduncle of pleopod 2 along anterior margin with 1-2 median setae and 2-3 distal setae, along posterior margin with 1-2 setae; peduncle of pleopod 3 along posterior margin with 3-4 strong setae.

Uropod 1 elongated; peduncle as long as inner ramus and provided with dorsoexternal row of short spines and dorsointernal row of 3 setae and one distal spine (fig. 7F); inner ramus long and slightly bent, bearing several lateral and distal spines and 6 bunches of simple setae longer than spines; spines are longer towards distal tip of the ramus (fig. 7F). Outer ramus is shorter than half of inner ramus, bearing 2 laterals and one distal group of spines, as well as one group of lateral simple setae longer than spines (fig. 7F).

Uropod 3 long and slender (fig. 5H); peduncle nearly twice as long as broad, bearing single lateral and distal short spines; inner ramus unarticulated, almost as long as peduncle, with single lateral very short setae and distal bunch of spine and short setae. Outer ramus 2-articulated, linear: first article along both margins with 4-5 bunches of very short spines and single short setae. Second article slightly shorter than first one (ratio: 128:140), along both margins with several bunches of simple setae, as well as with distal bunch of simple setae (fig. 5H).

Telson nearly as long as broad (fig. 7G), each lobe with 4 distal and several lateral and facial spines.

Coxal gills ovoid occur on body-segments 2-6.

Female 7.0 mm bearing 6 eggs in oostegites. Very similar to the male with small differences. Coxae 1-4 poorly longer: Coxa 1 broader than long (ratio: 45:39), poorly rhomboid, with subrounded ventroanterior corner and bearing 15 short marginal setae (fig. 10A). Coxa 2 slightly longer than broad (ratio: 53:48), with 15 short marginal setae (fig. 10B). Coxa 3 longer than broad (ratio: 57:50), bearing 14 marginal setae (fig. 10C). Coxa 4 as long as broad, without ventroposterior lobe and bearing 11 short marginal setae (fig. 10D).

Epimeral plates 1-2 angular, with poorly convex posterior margin bearing a row of short setae; epimeral plate 3 strongly produced, acute, with concave posterior margin bearing a row of short setae (fig. 9D); epimeral plate 2 with 3 subventral spines, epimeral plate 3 with 2 subventral spines (fig. 9D).

Urosomal segment 1 on each dorsolateral side with 1 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 short slender spine (fig. 9C). Pleopods 1-3 with 2 retinacula each and poorly setaceous peduncle.

Uropod 1: peduncle with dorsoexternal row of strong spines, and with dorsointernal row of setae (except distal spine) (fig. 9C); Inner ramus is remarkably shorter than peduncle (ratio: 52:87), bearing 2 lateral spines and 2 pairs of simple setae, as well as 3-4 long and short distal spines (the longest spine reaching half of ramus length (fig. 9C); outer ramus distinctly shorter than inner one, bearing 2 lateral and 4 distal spines (the longest spine reaching half of ramus-length), as well as 2 simple lateral setae (fig. 9C).

Uropod 3 short (fig. 9F); peduncle slightly longer than broad, bearing one lateral and 2 bunches of distal spines; inner ramus is short, scale-like, shorter than peduncle, bearing one distal spine (fig. 9F). Outer

ramus 2-articulated: first article at outer margin with 3 bunches of long spines and one median bunch of simple setae (fig. 9F); along inner margin appear 4 bunches of long spines; accompanied by one plumose seta; second article much shorter than first one (ratio: 40:122), bearing at margin and tip short simple setae.

Telson nearly as long as broad, incised slightly over half of telson-length (fig. 9E); each lobe obtuse distally, bearing 4 long distal spines exceeding half of telson length (ratio: 45:65); along outer margin of each lobe are attached 2 single spines, along inner margin appears 0-1 slender small spine; on the face of the lobes appear 1-2 facial spines (fig. 9E).

Coxal gills ovoid, of the moderate size. Oostegites large, with setaceous margins.

Variability

The length and number of spines on telson in males and females are rather variable: along outer margin of each lobe can be 2-4 spines. Inner plate of maxilla 1 is with 3-4 setae.

The number of spines on dactylus in pereopods 3-7 is 2-3; rarely single dactylus can have only one spine; dactyls can be more or less slender. Epimeral plate 3 is always with concave posterior margin.

The female of 8 mm from spring in Monte Gottero: Epimeral plate 2 poorly pointed and bearing 3 subventral setae (fig. 10F); epimeral plate 3 strongly pointed, with concave posterior margin bearing several marginal setae and with 2 subventral spines (fig. 10F)

Telson as long as broad, incised slightly over half of telson length; lobes slightly tapering distally and bearing 4 long distal spines (the longest spine hardly exceeding half of telson-length (ratio: 37:67), along outer margin appear 1-2 long spines; facial spines and spines at inner margin of the lobes are absent (fig. 10E).

Holotype: Male 10.0 mm. Holotype is deposited in Karaman's Collection in Podgorica.

Locus typicus: Sesta Godano, Passo del Rastrello, 1000 m a.s.l. (N. of La Spezia), Italy.

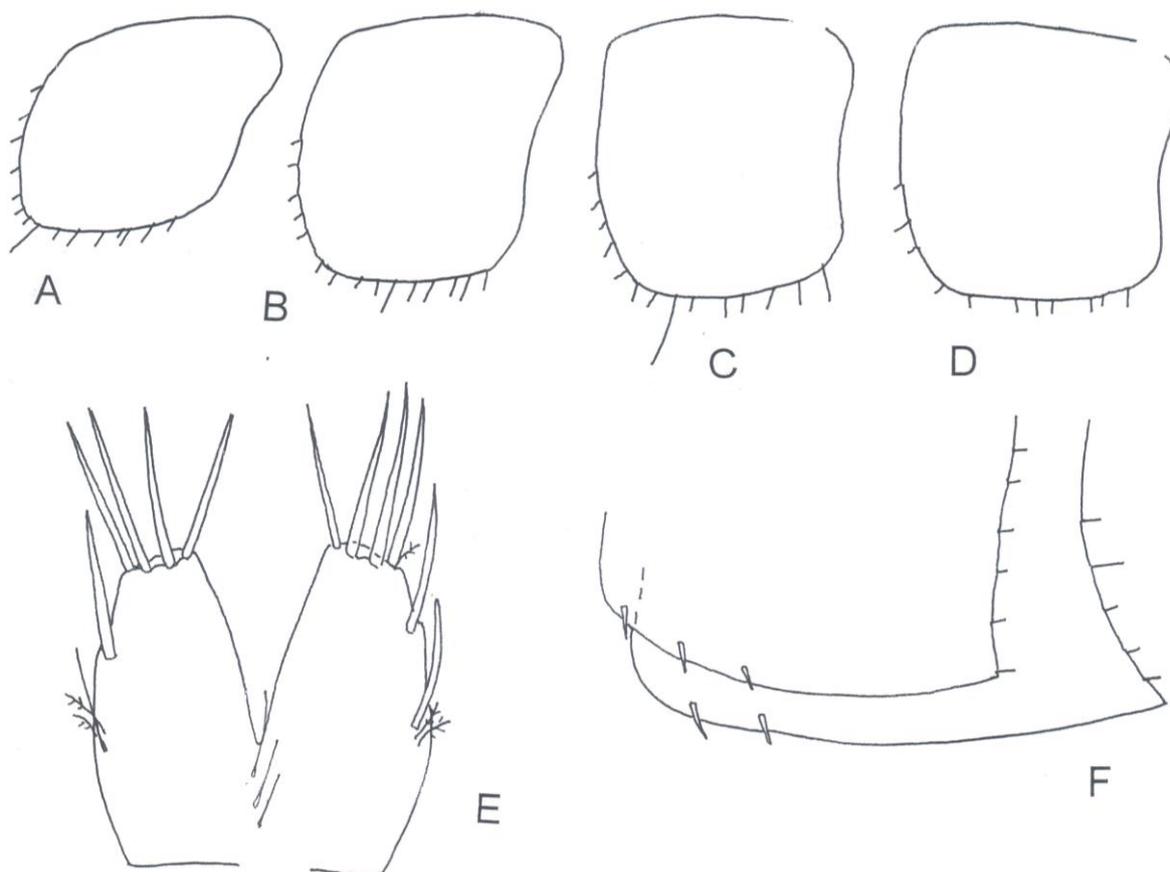


Figure 10. *Niphargus sestaputeanus*, sp. n., Sesta Godano, La Spezia, female 7.0 mm: A= coxa 1; B= coxa 2; C= coxa 3; D= coxa 4. Female 8.0 mm from Monte Gottero, Pien di Messo: E= telson; F= epimeral plates 2-3.

Distribution: Area of La Spezia, Northern Italy.

Remarks and Affinities

Niphargus sestaputeanus belongs to *Niphargus puteanus*- Complex of taxa, the variability of *N. puteanus* Koch was never studied in detail, and it is poorly known. Probably under the name of *Niphargus puteanus* several different species are hidden.

Niphargus puteanus Koch, 1836 from type locality (Regensburg, Germany) is rather similar to *N. sestaputeanus* by presence of additional spines on dactylus of pereopods 3-7, elongated inner ramus of uropod 1 and uropod 3, shape of propodus of gnathopods 1-2, etc., but the specimens from Regensburg differs from *N. sestaputeanus* by elongated coxae 1-4 in males, by broader propodus of gnathopods 1-2 bearing row of single setae on dactylus of propodus in gnathopods 1-2, by uropod 1 peduncle bearing dorsointernal row of spines, by stronger spines on dactylus of pereopods 3-7, etc.

Niphargus rotundus is similar to *N. sestaputeanus* by presence of additional spines on dactylus of pereopods 3-7, elongated uropod 1 and uropod 3, etc., but differs from it by almost subrounded epimeral plate 3 in males, by higher coxae in males, broader propodus of gnathopods, by presence of 3 distal spines on maxilliped inner plate, etc.

Because of the limited number of specimens in hands of both species, the real variability of taxonomic characters of each of these two taxa is not known, and we cannot exclude the possibility that both species represent populations with extreme variable characters of one species only.

Niphargus elegans Garbini, 1894 [loc. typ.: S. Pancrazio near Verona, Italy] is also rather similar to *N. sestaputeanus* (additional spines on dactylus of pereopods 3-7, small gnathopods, pointed epimeral plate 3, elongated uropods 1 and 3, etc.) but it differs from *N. sestaputeanus* by higher number of spines on dactylus of pereopods 3-7, by presence of distal tubercle on uropod 1 peduncle in males, more trapezoid propodus of gnathopods 1-2, etc.

Conclusions

The *Niphargus puteanus* –Complex is composed of more taxa known under the general name “*Niphargus puteanus* (Koch, 1836)”. As the detailed study of the variability of taxonomic characters of this complex was never made, the limits of variability of taxonomic characters of this species are unknown, what made recognition of different taxa within this complex very difficult and hazardous. The further studies of morphological, genetical, anatomical, physiological, embryological and other studies on this group will help to recognize distinct taxa of this Complex. We tried to put more light on this Complex describing two distinct taxa of *N. puteanus* Complex differing to each other and to other members of *N. puteanus* Complex based on known taxonomical characters.

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