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REVISION OF THE *NIPHARGUS STYGIUS* - GROUP
IN VENETIA AND TRENTINO (NORTHEASTERN ITALY),
WITH DESCRIPTION OF THREE NEW SPECIES
(Crustacea, Amphipoda, Niphargidae)

ABSTRACT. The first results of a revision of the species of the *Niphargus stygius* - group from Venetia and Trentino (caves and sources in the karstic massifs between Adige and Piave valleys) is presented; all the taxa were previously included in the species *Niphargus stygius* (Schiodte, 1847). A detailed description is given for the following species: *Niphargus costozzae* Schellenberg, 1935 from Berici mountains, *Niphargus lessiniensis* n. sp. from Lessinian Mountains, *Niphargus tridentinus* n. sp. from the "Altopiano dei Sette Comuni" along the Brenta valley, and *Niphargus montellianus* n. sp. from the isolated karstic massif of Montello. The exact taxonomic status of other populations from Lessinian Mountains (referred herein as *Niphargus* cf. *costozzae* and *Niphargus* cf. *lessiniensis*) require further analyses and will be defined in another paper.

Key words: Crustacea, Amphipoda, *Niphargus stygius* - group, northern Italy

RIASSUNTO. Vengono riportati i primi risultati di una revisione del gruppo di specie di *Niphargus stygius* del Veneto e del Trentino, prendendo in esame grotte e sorgenti dei massicci carsici compresi tra le valli dei fiumi Adige e Piave; tutti i taxa illustrati erano sinora inclusi nella specie *Niphargus stygius* (Schiodte, 1847). Una dettagliata descrizione viene fornita per le seguenti specie: *Niphargus costozzae* Schellenberg, 1935 dei Monti Berici, *Niphargus lessiniensis* n. sp. dei Monti Lessini, *Niphargus tridentinus* n. sp. dell'Altopiano dei Sette Comuni lungo la valle del Brenta, e *Niphargus montellianus* n. sp. del massiccio carsico isolato del Montello. Lo status tassonomico di altre popolazioni dei Monti Lessini e dell'Altopiano dei Sette Comuni (riferite nel presente lavoro a *Niphargus* cf. *costozzae* e *Niphargus* cf. *lessiniensis*) richiede ulteriori indagini per essere precisato e verrà trattato in un successivo lavoro.

Parole chiave: Crustacea, Amphipoda, *Niphargus* gruppo *stygius*, Italia settentrionale

INTRODUCTION

Niphargus stygius (Schiodte, 1847) has long been considered a polytypic species (D'Ancona, 1939, 1942, 1942a; Karaman S., 1952, 1954), widely distributed in sources and cave waters from Serbia to central Italy (Karaman G., 1993). Since the papers of D'Ancona (1942) and Karaman S. (1952, 1954), almost all researchers have stressed its morphological variability, but Vigna Taglianti (1972) suggested that the conclusions reached by the former authors were

unreliable. In this author's opinion, *Niphargus stygius* s.l. includes several good species and subspecies, at least in Italy, which could be attributed to the following groups: the *Niphargus stygius* - group (distributed from Slovenia to Lombardy, constituted by the subspecies or species *stygius*, *d'anconae* Karaman, 1954 = *N. dolenianensis*? Lorenzi, 1898, *costozzae* Schellenberg, 1935 and *brixianus* Ruffo, 1937) and the "group *pedemontanus* Ruffo, 1937 - *speziae* Schellenberg, 1936 - *romuleus* Vigna Taglianti, 1968" (distributed from Piedmont to central Italy, and related to *Niphargus tatrensis* Wrzesniowsky, 1888). Finally Karaman G. (1993) concluded that the morphological differences observed between the species of the *Niphargus stygius* - group were small, and synonymized all the species reported by Vigna Taglianti (1972) from Italy with *Niphargus stygius* (Schiödte, 1847, as redescribed by Sket, 1974).

During recent stygobiological investigations in caves and sources in northern Italy and Slovenia, I collected large samples of *Niphargus*, including specimens from the type-localities of all the species and subspecies of the group. Moreover, through the kindness of prof. Sandro Ruffo (Museum of Natural History, Verona) I had the opportunity to study the large *Niphargus* collection of the Museum, including the material examined by D'Ancona (1942), as well as hundreds of samples from Italy and Slovenia. The first results (Stoch, 1997) suggested that at least some of the taxa synonymized by Karaman G. (1993) with *Niphargus stygius* are valid species; in the same paper *Niphargus julius* Stoch, 1997 (nom. nov. for *Niphargus stygius d'anconae* Karaman S., 1954) was raised to specific rank, and *N. dolenianensis* Lorenzi, 1898 was considered a good species.

Considering the interesting and complex taxonomic problems *Niphargus stygius* gives rise to, a detailed morphological study and a taxonomic revision of this polytypic species has been carried out during the last two years. The first results of the research, reported herein, indicate that several different species are concealed under the name *Niphargus stygius*. On the other hand some taxa considered as subspecies or forms of *Niphargus stygius* belong to other groups; this is the case of *Niphargus dolenianensis* Lorenzi, 1898 and *Niphargus pedemontanus* Ruffo, 1937, which are close to the *Niphargus longicaudatus* - group.

The present paper reports the results of the taxonomic analysis carried out on the material from Venetia and Trentino; the study

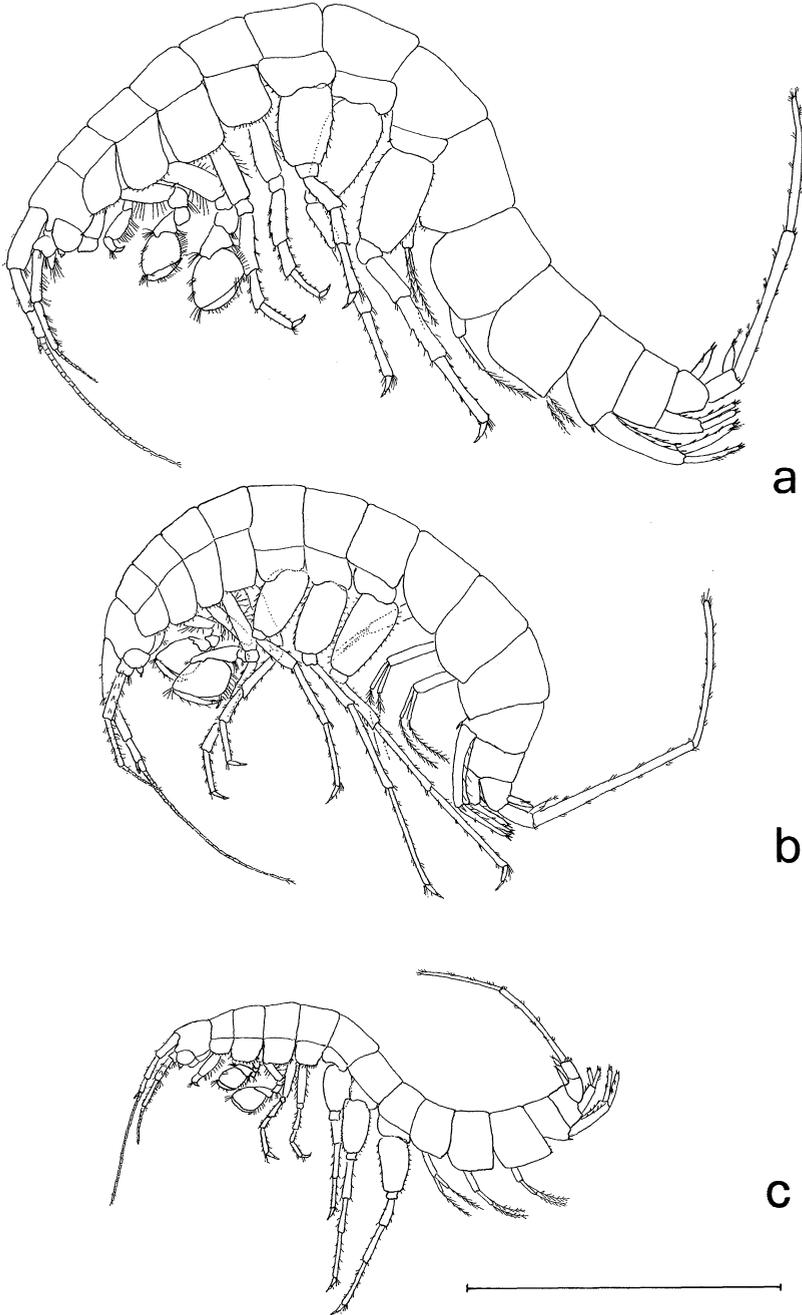


Fig. 1 - Habitus of: a) *Niphargus costozzae* Schellenberg; b) *Niphargus tridentinus* n. sp.; c) *Niphargus lessiniensis* n. sp. Scale bar = 10 mm.

area includes the karstic massifs between the rivers Adige and Piave, where the species of the *Niphargus stygius* - group are widespread in almost all kinds of karstic groundwater environments (sources, vadose zone of caves, hypogean brooks and streams). The specimens examined can be attributed to at least four different species, three of which are new to science, while typical *Niphargus stygius* is not recorded from this area, being restricted to western Slovenia and the Karst near Trieste (Stoch, 1997).

MATERIALS AND METHODS

The specimens were collected from karstic groundwaters using a hand net or baited traps and stored in 70% ethanol with 10% glycerine added. Additional material comes from the amphipod collection of S. Ruffo (Museum of Natural History, Verona) and several samples were kindly put at my disposal by E. Piva (Speleoclub Proteus, Vicenza).

Selected specimens were partly dissected in glycerine, and the appendages permanently mounted on slides in Faure's medium. A Zeiss Axioskop microscope fitted with a drawing tube was used to study the details at 50-400X. The terminology suggested by Stachowitsch (1992) is adopted in the taxonomic descriptions.

All the material examined was deposited in the Museum of Natural History, Verona, Italy.

TAXONOMIC ACCOUNT

Family Niphargidae Karaman G., 1962

Genus *Niphargus* Schiödte, 1849

Niphargus costozzae Schellenberg, 1935

SYNONYMY:

Niphargus stygius costozzae: Schellenberg, 1935: 209; Schellenberg, 1936: 18; Ruffo, 1937: 161; Benedetti, 1942: 11.

Niphargus (Stygoniphargus) costozzae: Karaman S., 1954: 166.

Niphargus (Stygoniphargus) costozzae f. *unisetosa*: Karaman S., 1954: 166.

Nyphargus stygius (partim): Karaman G., 1993: 263.

MATERIAL EXAMINED - Venetia, Province of Vicenza, massif of Berici Mountains (the Italian names are retained; the numbers refer to the regional cadastre of caves): Grotta della Guerra (127 V/VI), Lumignano, Longare (topotypes): 17/04/1937 leg. Ruffo S., many spec.; 16/10/1955 leg. Busulini E., many spec.; 22/12/1967 leg. Boscolo L., many spec.; leg. (?) 09/1930, many spec.; 09/1941 ex coll. D'Ancona, many spec.; leg. Trevisiol G.G., many spec.; 22/05/1937 leg. Ruffo S., 3 spec.; 14/05/1953 leg. Ruffo S., many spec.; 23/02/1965 leg. Boscolo L., many spec.; 30/10/1914 leg. Menozzi C., 1 spec.; 09/10/1938 ex coll. D'Ancona, 1 spec.; 18/07/1993 leg. Gasparo F., Piva E., Stoch F., 55 spec., 15 pulli; 09/01/1993 leg. Piva E., 45 spec. Cogolo delle Tette (36 V/VI), Val Pizzarda, Lonigo: 30/07/1971 leg. Rallo, 5 spec.; 25/04/1982 leg. Ferrari I., 1 spec.; 21/06/1985 leg. Piva E., Ferrari I., Damen A., 7 spec.; 18/07/1993 leg. Gasparo F., Piva E., Stoch F., 24 spec., 14 pulli. Covolo delle Tette di Fimon (203 V/VI), Arcugnano: 08/03/1997 leg. Piva E., Ferrari I.; 9 spec.; 09/03/1997 leg. Piva E., 3 juv. Fontana delle Fade o Grotta di San Gottardo (186 V/VI), Zovencedo: 08/04/1989 leg. Piva E., 58 spec.; 23/05/1997 leg. Piva E., Stoch F., 4 juv. Galleria di Villa (305 V/VI), Arcugnano: 02/09/1984 leg. Piva E., Ferrari I., 8 spec.; 06/08/1984 leg. Piva E., Ferrari I., 3 spec. Grotta dei Mulini di Alonte (350 V/VI), I Molini, Alonte: 24/09/1961 leg. Bartolomei G., 3 spec.; 01/04/1989 leg. Piva E., 2 spec.; 23/05/1997 leg. Piva E., Stoch F., 1 ♂, 2 juv. Grotta Nuova di San Gottardo (4000 V/VI), Zovencedo: 23/05/1997 leg. Piva E., Stoch F., 7 juv.; 19/02/1989 leg. Piva E., Ferrari I., 3 spec.; 11/03/1989 leg. Piva E., Ferrari I., 2 spec.; 17/02/1990 leg. Piva E., Ferrari I., 3 spec. Source in Valle Gazzo, Zovencedo: 28/03/1992 leg. Peretto G., Piva E., 3 spec. Spruggia dei Cavani (114 V/VI), Arcugnano: 06/01/1993 leg. Piva E., 1 spec. Voragine Sprugione (323 V/VI), Valle Bassona, Altavilla Vicentina, leg. (?), 1 ♂. Voragine Zannini (n.c. V/VI), Longare: 23/02/1997 leg. Piva E., 3 juv.

TYPE LOCALITY - Cave named "Grotta della Guerra" (cadastre number 127 V/VI), Lumignano (Berici Mountains), Longare, province of Vicenza; it is one of the caves named "Covoli di Costozza" from which the specific name was derived by Schellenberg (1935).

DESCRIPTION - Male, body length 25 - 29 mm (topotypes); habitus as in fig. 1a; dorsal surface of somites sparsely covered with very short setules. Metasomites 1-3 with 6-7 short dorsoposterior setae (fig. 5e);

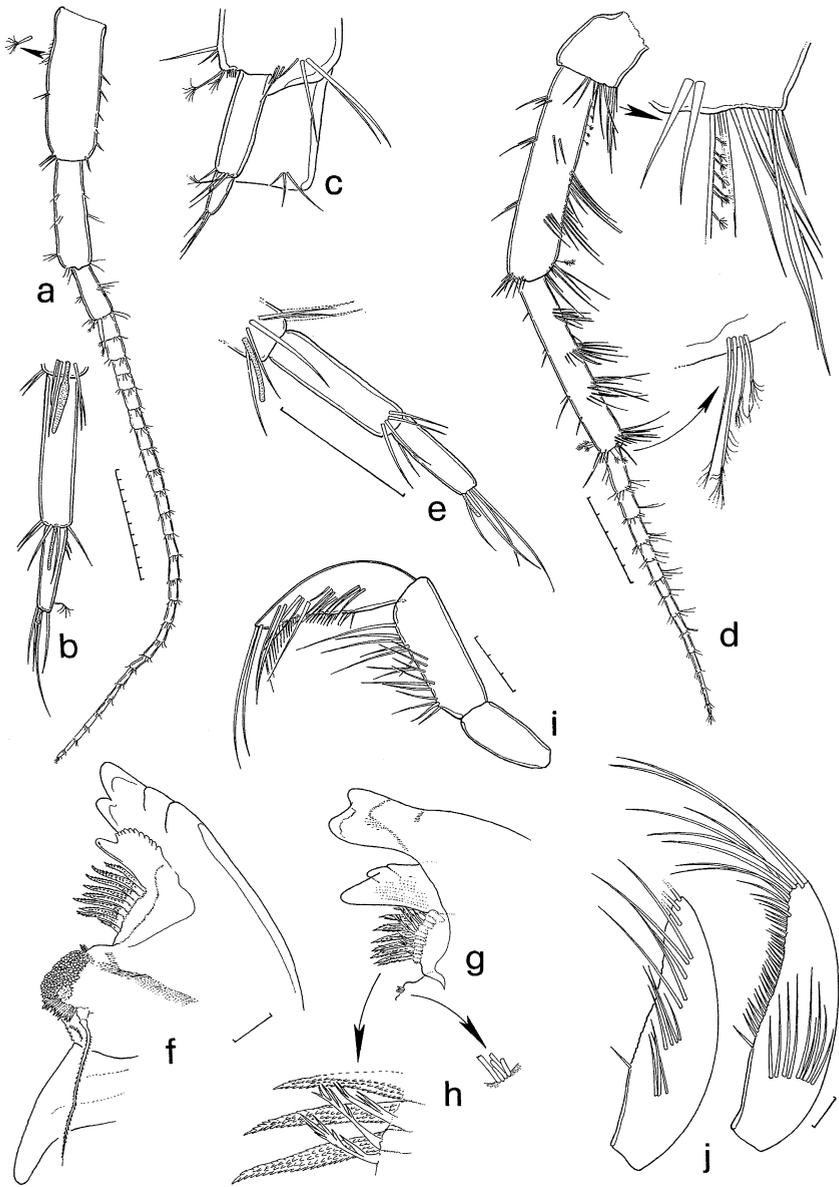


Fig. 2 - *Nipbargus costozzae* (topotype ♂ mm 29): a) antenna 1; b) distal articles of primary flagellum of antenna 1; c) accessory flagellum of antenna 1; d) antenna 2, with details of setation; e) distal articles of flagellum of antenna 2; f) right mandible; g) left mandible; h) details of spine row and sensory setae of left mandible; i) mandibular palp; j) distal article of mandibular palp. Scale bars = 10 μ m

urosomite 1 with 3 setae on each side, urosomite 2 with lateral groups of 3 setae and 2 spines (fig. 5e).

Antenna 1 (fig. 2a) slightly shorter than 40% length of body, with peduncle articles 1-3 progressively shorter; peduncle article 1 bearing a row of short proximal sensorial setae on dorsal margin (fig. 2a, arrow). Primary flagellum with up to 25 articles, usually bearing 1 aesthetasc; distal article with a short truncated aesthetasc, a lateral plumose seta and 4 long distal naked setae (fig. 2b). Accessory flagellum (fig. 2c) 2-articulate, slightly longer than article 1 of primary flagellum; article 1 bearing 1 plumose seta; article 2 shorter than half of article 1, with 3 distal setae and a short blunt aesthetasc.

Antenna 2 (fig. 2d) with peduncle articles 4 and 5 subequal in length; peduncle article 4 bearing a proximal row of short sensorial setae on ventral margin; peduncle article 5 with 4 transversal rows of setae and 2 groups of distal plumose setae (fig. 2d). Flagellum longer than peduncle article 5, consisting of up to 13 articles bearing short setae (fig. 2e).

Labrum and labium as in figs. 3 d-e.

Right mandible (fig. 2f) with incisor process consisting of 4 stout teeth; other details as in fig. 2f. Spine row consisting of 9 serrate spines accompanied by 7-8 sensorial setae (fig. 2h). Molar process accompanied by 1 basal seta and 1 group of short sensorial structures (fig. 2h). Left mandible with basal seta shorter than in right mandible; other details as in fig. 2g. Mandibular palp 3-articulate (fig. 2i); article 1 without setae; article 2 densely setose. Article 3 (fig. 2j) with 1 group of up to 9 A setae, not reaching the distal margin of the article, 4 groups of 2-4 B setae, more than 30 D setae and 8 E setae.

Maxilla 1 (fig. 3b): inner lobe bearing 4 distal setae; outer lobe with 7 distal spines (6 spines with 1 lateral tooth, innermost spine with several small teeth). Palp 2-articulate, longer than outer lobe; distal article of palp bearing 11 setae in the specimens examined.

Maxilla 2 (fig. 3c) with lobes sparsely covered by hairs; distal setae as in fig. 3c.

Maxilliped typical of the genus; details of setation in fig. 3a; inner lobe bearing a row of 6 bladespines accompanied by 8 setae; palp 4-articulate, armed as in fig. 3a.

Gnathopod 1 (fig. 3f): coxal plate less than 2 times longer than wide; distal margin setose; basis short and stout; propodus (fig. 4a)

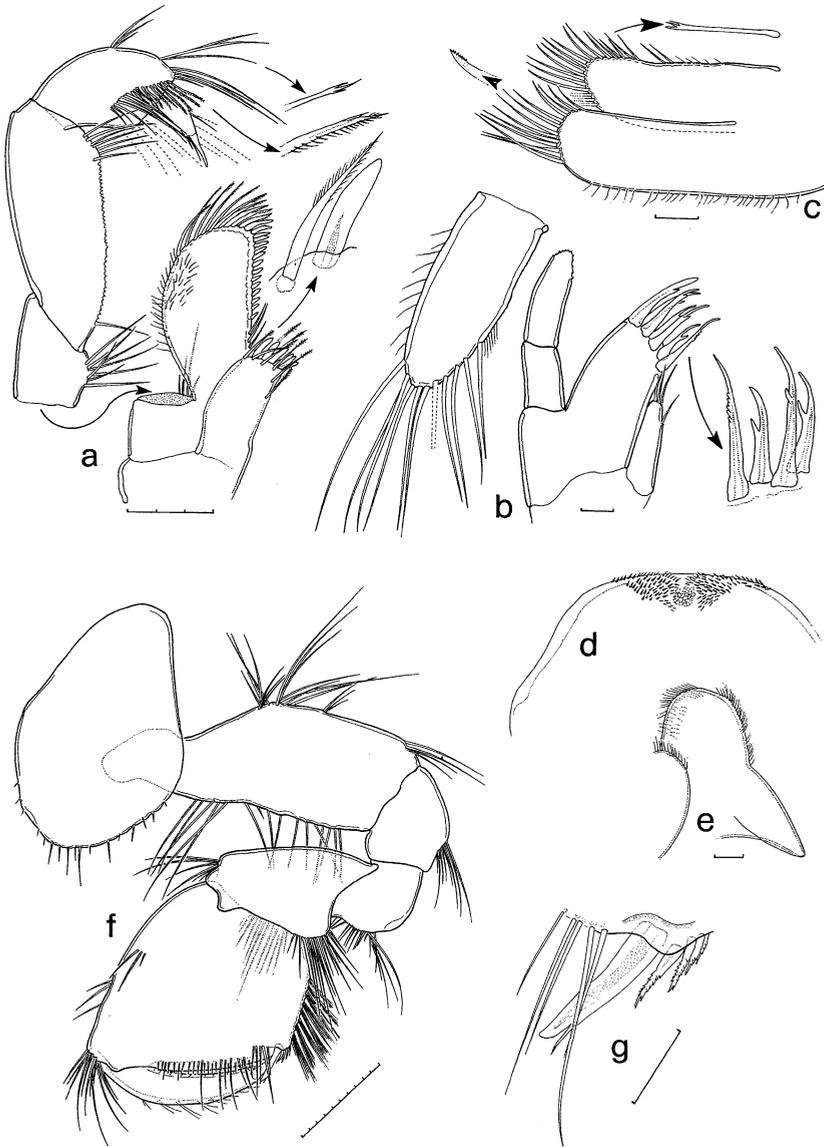


Fig. 3 - *Nipbargus costozzae* Schellenberg (topotype ♂ mm 29): a) maxilliped, with details of setation; b) maxilla 1, with details of distal article of palp and spines of outer lobe; c) maxilla 2, with details of setae; d) labrum; e) labium; f) gnathopod 1; g) detail of palmar corner. Scale bars = 10 μ m

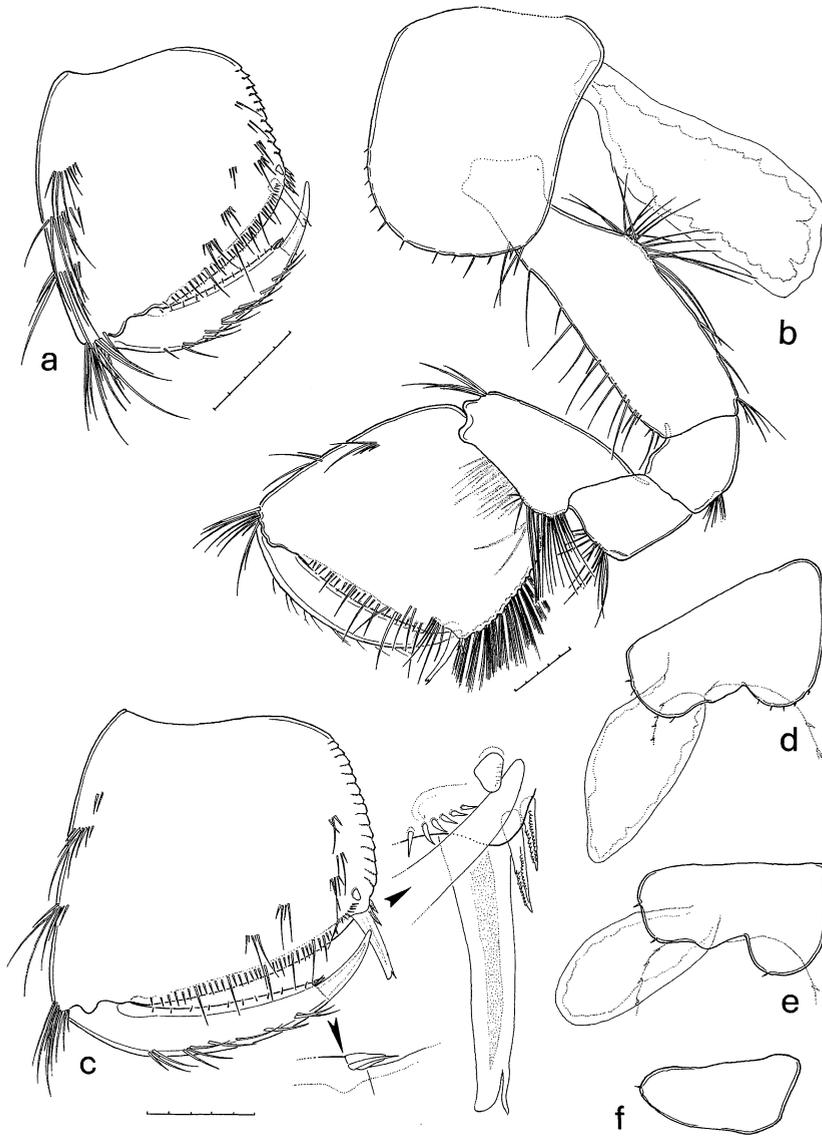


Fig. 4 - *Niphargus costozzae* (topotype ♂ mm 29): a) propodus of gnathopod 1; b) gnathopod 2; c) propodus of gnathopod 2 with details of spines; d) coxal plate and gill of pereopod 5; e) coxal plate and gill of pereopod 6; f) coxal plate of pereopod 7. Scale bars = 10 μ m

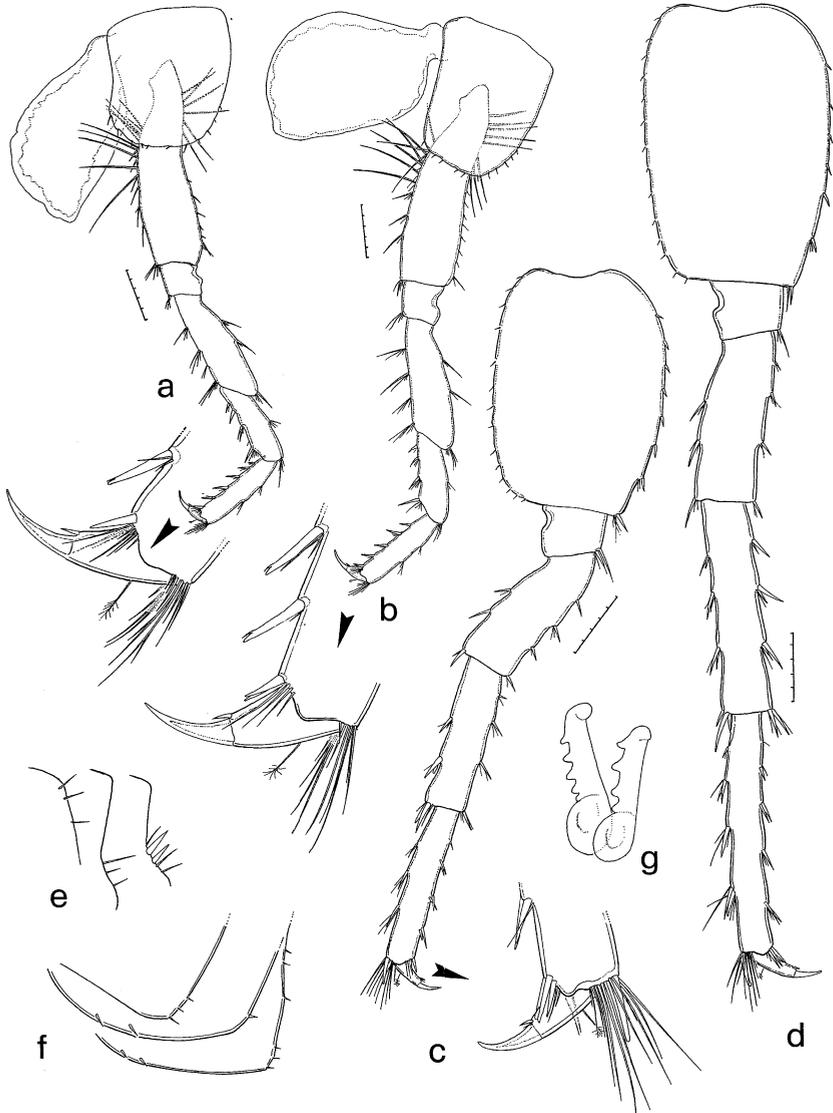


Fig. 5 - *Nipbargus costozzae* (topotype ♂ mm 29): a) pereopod 3, with detail of dactylus; b) pereopod 4, with detail of dactylus; c) pereopod 5, with detail of dactylus; d) pereopod 6; e) setae and spines of metasomite 3 and urosomites 1 - 2; f) epimeral plates; g) retinacula of pleopod 3. Scale bars = 10 μ m

slightly longer than wide, with 4 anterior rows of setae; palm slightly inclined as in fig. 4a, bearing 1 spine near the posterodistal corner accompanied by 5 facial setae and 4 shorter serrate spines on outer surface (fig. 3g) and a short blunt spine on inner surface; dactyl with an anterior row of single setae and groups of 2 setae.

Gnathopod 2 (fig. 4b): coxal plate approximately twice longer than wide, distal margin setose; coxal gill narrow and longer than coxal plate; propodus (fig. 4c) slightly wider than long, with 3 main rows of setae on anterior margin; palm slightly inclined as in fig. 4c, with 6 facial setae; posterodistal corner armed with a long stout spine accompanied by 2 serrate spines on outer surface (fig. 4c) and a short blunt spine on inner surface; dactyl with an anterior row of 6 groups of 1-3 setae.

Pereopods 3 and 4 as in figs. 5a-b. Coxal plates longer than wide, with distal margin setose. Basis of both pereopods bearing long setae on posterior margins; other details as in figs. 5a-b.

Pereopods 5-7 short and stout, as in figs. 5c-d e 6a; pereopod 5 remarkably shorter than pereopod 6 (fig. 5c-d); pereopod 7 (excluding coxal plate) slightly shorter than 40% length of body. Coxal plates and gills as in figs. 4d-f; basis ovoid and broad, posterior lobe absent; dactyls short (figs. 5c-6a), bearing 1 plumose seta on posterior margin and 1 subungual spine accompanied by 2 short setae; no other spines are present on anterior margin; unguis stout, shorter than dactyl.

Epimeral plates 1-3 as in fig. 5f, posterior margins with short setae; epimeral plate 3 slightly rounded in older males.

Pleopods 1-3 with 2 retinacula each (fig. 5g).

Urosomite 1 with 1 short spine near peduncle of uropod 1 (fig. 6c).

Uropod 1 (fig. 6c) with peduncle bearing 2 rows of dorsal spines; rami subequal in length, outer one only slightly shorter than inner one, bearing 2 ventral rows of setae; setae of distal row of inner ramus overreaching the end of ramus but not the tip of distal spines (fig. 6d).

Uropod 2 (fig. 6e) shorter and stouter than uropod 1; rami subequal in length, outer one only slightly shorter than inner one in older males.

Uropod 3 (fig. 6f) with inner ramus (fig. 6g) short, subrounded; inner margin armed with a short proximal seta and a medial row of spines and setae; distal margin bearing 3 spines, a short spiniform seta and a long plumose seta, its length being twice that of distal

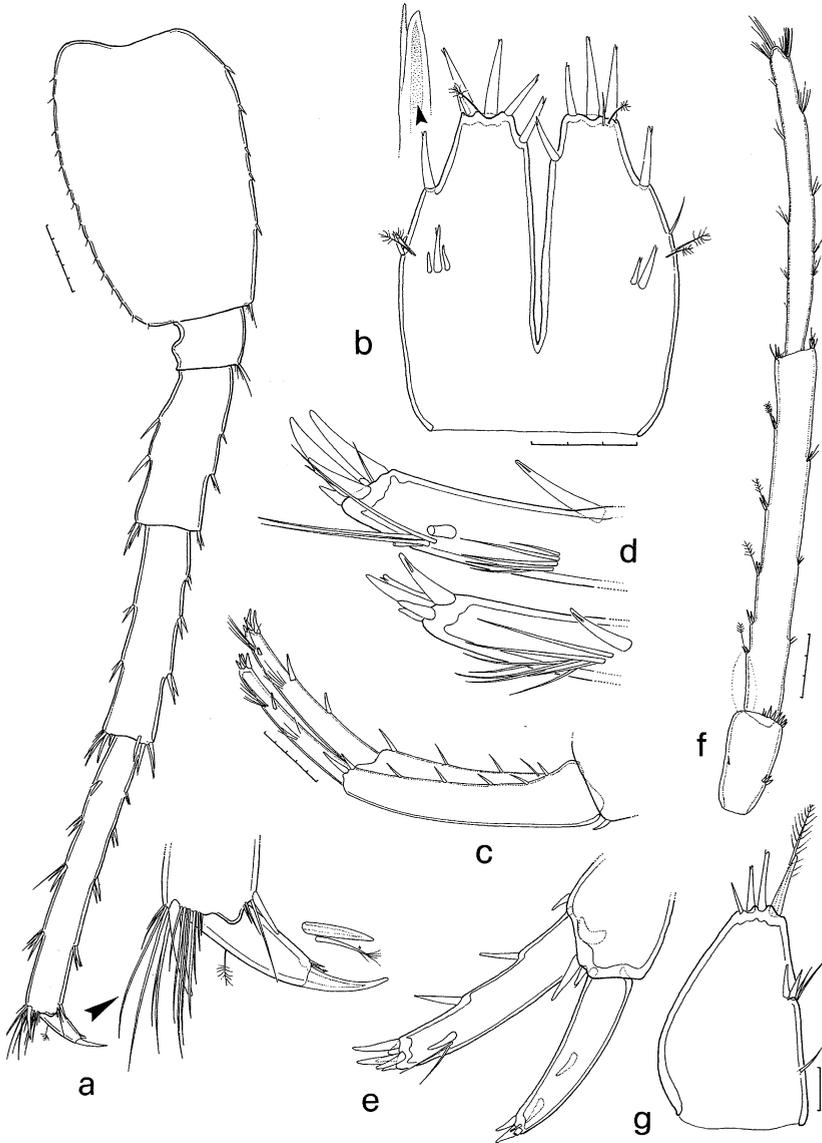


Fig. 6 - *Niphargus costozzae* (topotype ♂ mm 29): a) pereopod 7 and dactylus; b) telson (dorsal view); c) uropod 1; d) distal part of rami of uropod 1; e) uropod 2; f) uropod 3; g) inner ramus of uropod 3. Scale bars = 10 μ m

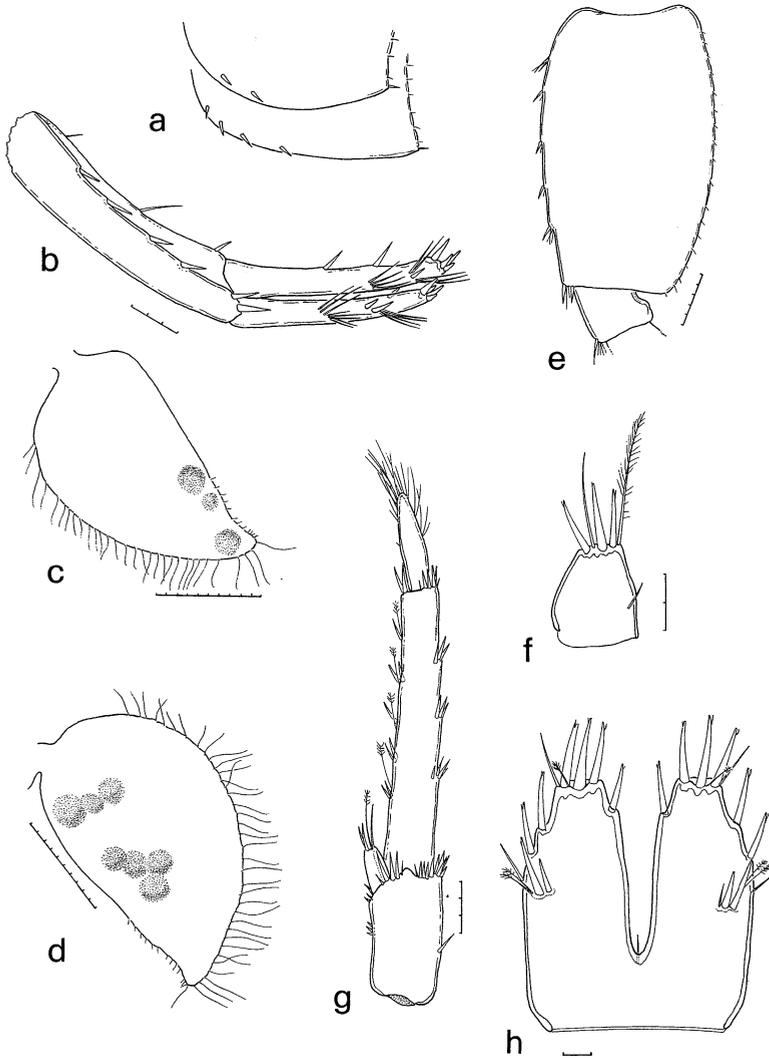


Fig. 7 - *Niphargus costozzae* (topotype ♀ mm 24): a) epimeral plates 2-3; b) uropod 1; c) oostegite of gnathopod 2; d) oostegite of pereopod 3; e) basis of pereopod 7; f) inner ramus of uropod 3; g) uropod 3; h) telson (dorsal view). Scale bars = 10 μ m

spines. Outer ramus long, 2-articulate; distal article shorter than article 1 even in older males; setation as in fig. 6f.

Telson (fig. 6b) longer than wide, incised more than $3/4$ of its length; lobes not divergent; each lobe with 3 distal spines accompanied by a plumose seta (sometimes another smooth short seta may be present), 1 subdistal inner spine, usually 2 lateral outer spines, 2-3 dorsal spines and 2 lateral plumose setae (close to the proximal outer lateral spine). All the spines are very short (fig. 6b).

Female smaller than male (body length 21-23 mm), with epimeral plates (fig. 7a) slightly pointed. Oostegites like in fig. 7c-d; antennae, mouthparts, gnathopods and pereopods (fig. 7e) like in male. Uropod 1 (fig. 7b) like in male, with outer ramus slightly shorter than inner one, showing no sexual dimorphism. Uropod 3 (fig. 7g) short; inner ramus (fig. 7f) subrounded, shorter than in male, without medial row of spines on inner margin; distal armature like in male, with longer setae; article 2 of outer ramus shorter than $1/3$ length of article 1. Telson (fig. 7h) with spines slightly longer than in male, each lobe bearing an additional spine on outer margin; small thin additional spines may be present on dorsal or ventral surfaces.

VARIABILITY - Several characters (number of articles of flagellum of antenna 1 and antenna 2, number of setae on mandibular palp and maxillipedal palp, shape of basis of pereopods 5-7, broader in juveniles, shape of epimeral plates and length of rami of uropods 1-3) vary with the age of the specimens, as correctly pointed out by D'Ancona (1939, 1942, 1942a); the description reported above refers to adult males and females, including the older males (i.e. the larger specimens), known as "terminal" or "senile" males (Stock, 1996). The morphological characters of the specimens from Berici mountains are quite homogeneous, and the differential details of the population described by Karaman S. (1954) as *Niphargus costozzae* f. *unisetosa* from "Cogolo delle Tette" are included within this small range of variability. The constancy of some characters, such as the number of aesthetascs on distal peduncle articles of antennae and the number of setae on palps of mandible, maxilla 1 and maxilliped was not checked, considering their moderate taxonomic interest.

REMARKS AND AFFINITIES - *Niphargus costozzae* can be easily distinguished from *Niphargus stygius* by its possession of the following cha-

racters: shape of propodus of gnathopods 1-2 with more inclined palm and higher number of setal rows on anterior margin; shorter and stouter pereopods 5-7; presence of dorsal spines on telson; absence of sexual dimorphism in uropod 1 (typical *N. stygius* older males have a sexually dimorphic outer ramus of uropod 1 remarkably shorter than inner ramus); shape of inner ramus of uropod 3; less elongated outer ramus of uropod 3; number of lateral setae of urosomites 1-2.

DISTRIBUTION AND HABITAT - The species is widely distributed in caves of the isolated karstic massif of Berici Mountains, where it inhabits both hypogean brooks and pools of percolating water; in the type locality ("Grotta della Guerra") it is fairly abundant.

Niphargus cf. *costozzae* Schellenberg, 1935

SYNONYMY:

Niphargus stygius (partim): Caoduro et al., 1994: 41

MATERIAL EXAMINED - Buso dei Pisaroti (1438 V/VR), Roncari (Lessinian Mountains), Selva di Progno, prov. Verona: 22/09/1978 leg. Rossi G., 2 ♂♂, 1 juv.; 15/12/1979 leg. Caoduro G., 1 ♂, 1 juv.; 20/02/1996 leg. Tomelleri N., 4 spec. Buso del Becco d'Oro (154 V/VI), S. Tomio (Lessinian Mountains), Malo, prov. Vicenza: 03/06/1986 leg. Ferrari I., 1 juv.; 17/07/1993 leg. Stoch F., 62 juv.; 07/02/1997 leg. Piva E., Ferrari I., 448 spec. (baited traps). Buso della Rana (40 V/VI), Maddalena (Lessinian Mountains), Monte di Malo, prov. Vicenza: leg. Bonometti, 4 spec.; 18/08/1972 leg. Corradi F., 3 spec.; 18/08/1972 leg. Corradi F., many spec.; 12/06/1982 leg. Ferrari I., 2 spec.; 03/10/1982 leg. Piva E., 1 spec.; 06/05/1984 leg. Damen A., 1 ♀; 20/08/1994 leg. Gasparo F., Stoch F. (brook between "Sala Vigna" and "Sala Trivio"), 6 juv. Buso delle Volpi (542 V/VI), Isola Vicentina (Lessinian Mountains), prov. Vicenza: 4/02/1985 leg. Piva E., 2 spec. Buso I di Sarcedo (?), Sarcedo (Altopiano dei Sette Comuni), prov. Vicenza: 03/07/1966 leg. Paoletti M., 2 spec.; 03/07/1966 leg. Paoletti M., 2 spec. Galleries near S. Anna, Sarcedo (Altopiano dei Sette Comuni), prov. Vicenza: 23/08/1971 leg. Grottolo, 5 spec. Covolo della Nogara (525 V/VI), Sarcedo (Altopiano dei Sette Comuni), prov. Vicenza: 19/03/1984 leg. Piva E., Ferrari I., 2 spec.; 19/04/1984 leg. Piva E., Ferrari I., 10 spec.

Grotta d'Inverno (1978 V/VI), Marostica (Altopiano dei Sette Comuni), prov. Vicenza: 27/03/1984 leg. Ferrari I., 3 spec.; 25/04/1984 leg. Piva E., Ferrari I., 1 juv. Grotta dei Fontana (4 V/VI), Fontana (Lessinian Mountains), Chiampo, prov. Vicenza: leg. Fracasso, 2 spec. Grotta della Lora (169 V/VI), Sarcedo (Altopiano dei Sette Comuni), prov. Vicenza: 10/12/1961 leg. Bartolomei G., 1 ♂; 16/03/1984 leg. Piva E., Ferrari I., 3 spec.; 19/04/1984 leg. Piva E., Ferrari I., 8 spec. Grotta della Poscola (136 V/VI), Priabona (Lessinian Mountains), Monte di Malo, prov. Vicenza: 27/11/1955 leg. Bartolomei G., 7 spec.; 12/01/1991 leg. Peretto G., 5 spec.; 17/07/1993 leg. Gasparo F., Piva E., Stoch F., 12 spec. Grotta di San Giorgio (1656 V/VI), Sarcedo (Altopiano dei Sette Comuni), prov. Vicenza: 13/03/1984 leg. Piva E., Ferrari I., 3 spec.; 12/04/1984 leg. Piva E., Ferrari I., 10 spec.; 24/05/1997 leg. Piva E., Stoch F., 9 spec. Grotta Fantasma (4605 V/VI), Cornedo Vicentino (Lessinian Mountains), prov. Vicenza: 13/10/1990 leg. Ferrari I., Peretto G., Piva E., 1 ♂, 1 juv.; 01/11/1990 leg. Peretto G., 1 ♀. Mine of lignite (8 art V/VI), Lovatini (Lessinian Mountains), Crespadoro, prov. Vicenza: 16/01/1983 leg. Ferrari I., 2 spec.; 13/02/1983 leg. Ferrari I., 2 spec.; 27/09/1983 leg. Ferrari I., 3 spec.; 24/10/1983 leg. Piva E., Ferrari I., 4 spec. Mine of lignite (art. V/VI), Monteviale (Lessinian Mountains), prov. Vicenza: 14/03/1983 leg. Ferrari I., 1 juv.

REMARKS AND AFFINITIES - The populations from Lessinian Mountains and "Altopiano dei Sette Comuni" are slightly different from typical *Niphargus costozzae* from Berici Mountains; this fact may be related to the geographical isolation of the two karstic massifs. The specimens from Lessinian caves are smaller (body length in adult males 18 - 24 mm) and more slender than those from Berici Mountains, with the following morphological differences: smaller gnathopods; more elongated pereopods; inner ramus of uropod 3 longer, bearing an additional inner row of spines; outer ramus of uropod 3 thin and long, article 2 being as long as article 1.

The analysis carried out on the populations of Lessinian Mountains and "Altopiano dei Sette Comuni" does not allow their clear separation from those of Berici Mountains as a distinct species or subspecies. However, in this context it is important to realize that these conclusions are reached on morphological grounds alone; a wider approach using non-morphological techniques (like enzyme electrophoresis: see Sbordoni et al., 1979, as regards the *Niphargus lon-*

gicaudatus - group) could provide much better means to understand the genetic interrelationships of the populations examined and to clarify their taxonomic status. An attempt using a more detailed study using morphometric techniques will be reported in another paper; for this reason the above mentioned populations are reported provisionally as *Niphargus* cf. *costozzae*.

The range of the species on Lessinian Mountains is restricted to the southeastern area; it is replaced by *N. lessiniensis* n. sp. in the western caves and by *N. tridentinus* n. sp. in the northeastern caves and resurgences drained by the Brenta river.

Niphargus lessiniensis n. sp.

SYNONYMY:

Niphargus stygius stygius (partim): Ruffo, 1937: 160.

Niphargus stygius (partim): Karaman G., 1993: 263; Caoduro et al., 1994: 41.

MATERIAL EXAMINED - Venetia, Lessinian Mountains, province of Verona: Grotta A del Ponte di Veja (117 V/VR), Veja, S. Anna d'Alfaedo: ex coll. D'Ancona, 1940-41, many spec.; 08/1963, leg. (?), 6 spec.; 08/1965, leg. (?), 5 spec.; 04/06/1933 leg. Ruffo S., 8 spec.; 03/12/1933 leg. Ruffo S., 4 spec.; 09/01/1936 leg. Ruffo S., 9 spec.; 09/09/1939 ex coll. D'Ancona, 13 spec.; 19/09/1939 ex coll. D'Ancona, many spec.; 23/09/1939 ex coll. D'Ancona, many spec.; 13/01/1946 leg. Battisti, 1 spec.; 16/06/1946 leg. Ruffo S., 9 spec.; 19/08/1964 leg. Palminteri R., 18 spec.; 19/08/1964 leg. Palminteri R., 1 spec.; 19/08/1964 leg. Palminteri R., 3 spec.; 19/08/1964 leg. Palminteri R., many spec.; 02/10/1969 leg. Vigna Taglianti A., 3 spec.; 08/07/1972 leg. Palminteri R., 7 spec.; 05/02/1978 leg. Caoduro G., 2 spec.; 14/04/1985 leg. Caoduro G., 3 spec.; 16/02/1991 leg. Peretto G., Piva E., 7 spec.; 23/08/1992 leg. Caoduro G., Gasparo F., Stoch F., 41 spec. Grotta C del Ponte di Veja (466 V/VR), Veja, S. Anna d'Alfaedo: 02/10/1969 leg. Tezza L., 1 spec.; 02/10/1969 leg. Zanetti A., 1 spec.; 16/11/1978 leg. Caoduro G., 1 spec.; 24/12/1984 leg. Caoduro G., 7 spec.; 29/09/1985 leg. Caoduro G., 1 spec. Grotta del Semalo (445 V/VR), S. Anna d'Alfaedo: 25/09/1971 leg. Corradi F., 2 ♂♂. Mine of lignite (22 art V/VR), Ponte Anguillara, Erbez-
zo: 29/07/1967 leg. Krapp F., many spec.; 18/07/1968; leg. Ruffo S., Vigna Taglianti A., many spec. Spluga del Torrente (407 V/VR), Ave-

sa, Verona: 19/07/1993 leg. Caoduro G., Gasparo F., Stoch F., 3 spec. Bus del Meo di Grobe (160 V/VR), Grobe, Boscochiesanuova: 24/02/1946 leg. Ruffo S., 5 juv.; 27/04/1973 leg. Rossi G., 5 spec. Quarry loc. Brentani (1 art/VR) or Quarry of Monte Solane, S. Ambrogio di Valpolicella: 29/04/1997 leg. Piva E., 1 ♀; Covolo dell'Acqua (42 V/VR), Covoli, Velo Veronese: 02/10/1969 leg. Vigna Taglianti A., 1 ovigerous ♀; Fontana di Lovaccio, Canello, 11/1938 leg. Cartolari, many spec. Il Busetto (457 V/VR), Quinzano (Lessinian Mountains), Verona, prov. Verona: 09/1949 leg. Ruffo S., 9 spec.

TYPE LOCALITY - Cave named "Grotta A del Ponte di Veja" (cadastre number 117 V/VR), Veja (Lessinian mountains), S. Anna d'Alfaedo, province of Verona.

TYPE MATERIAL - Holotype, 1 ♂ mm 15; paratypes, 20 ♂♂, 13 ♀♀, 23/08/1992, leg. Caoduro G., Gasparo F., Stoch F.

ETYMOLOGY - The specific name is derived from the Lessinian Mountains, where the new species was discovered.

DESCRIPTION - Male, body length 13-15 mm; habitus as in fig. 1c. Dorsal surface of somites sparsely covered with short plumose setules, longer than in the other species described herein (fig. 10b). Metasomites 1-3 with up to 8 short dorsoposterior setae (fig. 10b); urosomite 1 with 2 setae on each side; urosomite 2 without lateral spines, armed with lateral groups of 4 setae (fig. 10c).

Antenna 1 (fig. 8a) slightly shorter than 40% length of body, with peduncle articles 1-3 progressively shorter; peduncle article 1 bearing a row of short proximal sensorial setae on dorsal margin (fig. 8a, detail); peduncle article 3 with a row of sensorial setae close to the insertion of accessory flagellum (fig. 8c). Primary flagellum with 21 articles, usually bearing 1 aesthetasc (penultimate article bearing 2 aesthetascs of different length: fig. 8b); distal article with 2 short truncated aesthetascs in the holotype, a lateral plumose seta and 4 distal naked setae (fig. 8b). Accessory flagellum (fig. 8c) 2-articulate, longer than article 1 of primary flagellum; article 2 shorter than half of article 1, with 3 distal setae and a short blunt aesthetasc.

Antenna 2 (fig. 8d) with peduncle articles 4 and 5 subequal in length; peduncle article 4 bearing a proximal row of short sensorial

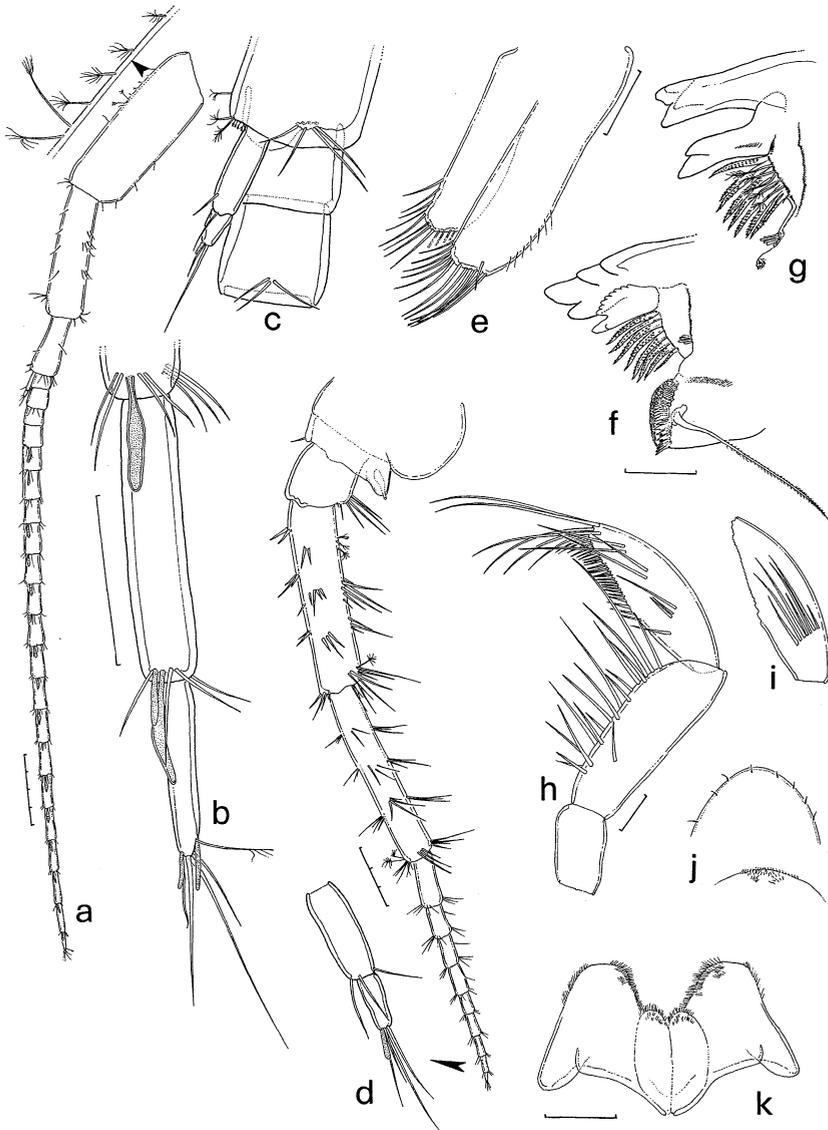


Fig. 8 - *Nipbargus lessiniensis* n. sp. (holotype ♂ mm 15): a) antenna 1 with details of sensory setae; b) distal articles of primary flagellum of antenna 1; c) accessory flagellum of antenna 1; d) antenna 2 and distal articles of flagellum; e) maxilla 2; f) right mandible; g) left mandible; h) mandibular palp; i) A - setae of distal article of mandibular palp; j) rostrum and labrum; k) labium. Scale bars = 10 μ m

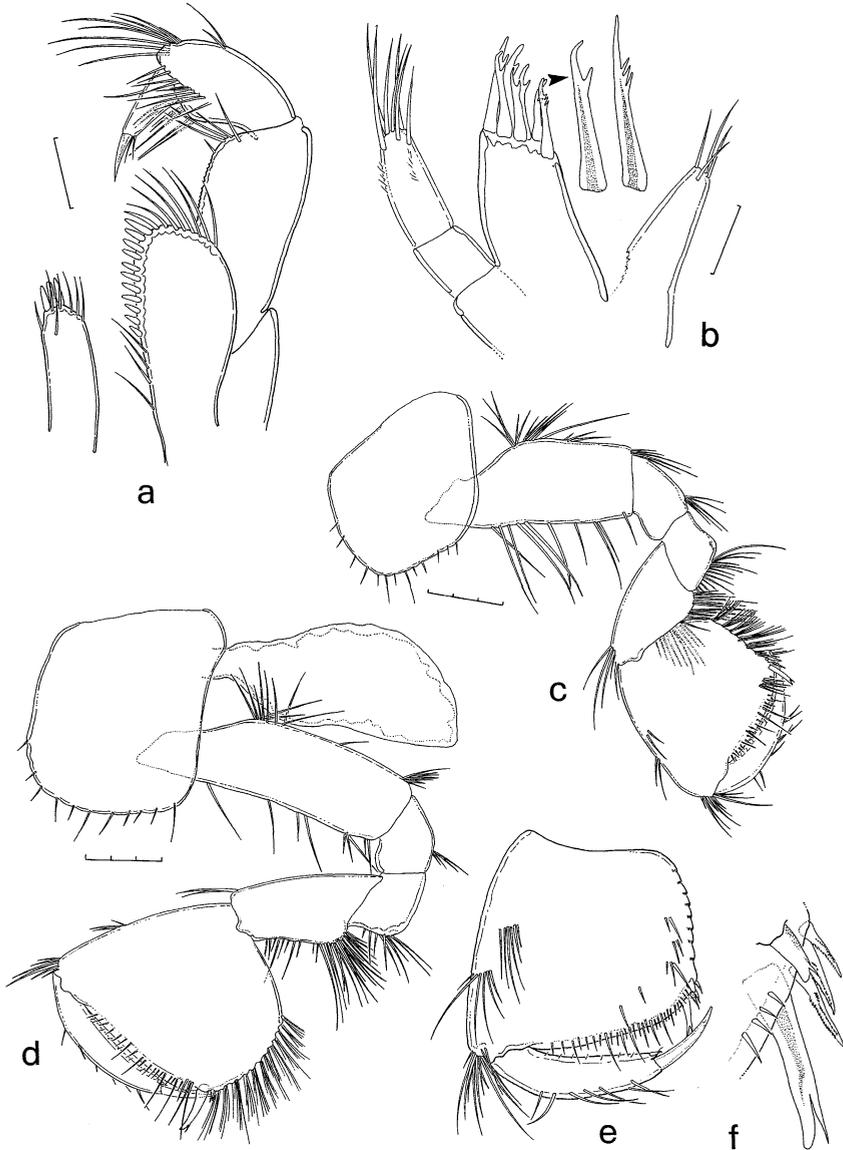


Fig. 9 - *Nipbargus lessiniensis* n. sp. (holotype ♂ mm 15): a) maxilliped; b) maxilla 1; c) gnathopod 1; d) gnathopod 2; e) propodus of gnathopod 1; f) spines of palmar corner. Scale bars = 10 μ m

setae on ventral margin; peduncle article 5 with 4 transversal rows of setae and some distal plumose setae. Flagellum slightly longer than peduncle article 5, consisting of 9 articles bearing short setae.

Rostrum, labrum and labium as in figs. 8j-k.

Right mandible (fig. 8f) with incisor process consisting of 4 stout teeth; other details as in fig. 8f. Spine row consisting of 8 serrate spines accompanied by 5 sensorial setae. Molar process accompanied by 1 basal seta and 1 group of short sensorial structures. Left mandible with basal seta shorter than in right mandible and spine row with 9 spines; other details as in fig. 8g. Mandibular palp 3-articulate (fig. 8h); article 1 without setae; article 2 densely setose. Article 3 with 1 group of up to 9 A setae (fig. 8i), longer than in *Niphargus costozzae*, not reaching the distal margin of the article, 4 groups of 1-3 B setae, 25 D setae and 6 E setae.

Maxilla 1 (fig. 9b): inner lobe bearing 4 distal setae; outer lobe with 7 distal spines (6 spines with 1 lateral tooth, innermost spine with 3 teeth). Palp 2-articulate, as long as outer lobe; distal article of palp bearing 7 setae.

Maxilla 2 (fig. 8e) with lobes sparsely covered by hairs; distal setae as in fig. 8e.

Maxilliped as in fig. 9a; inner lobe bearing a row of 3 bladespines accompanied by 7 setae; palp 4-articulate, armed as in fig. 9a.

Gnathopod 1 (fig. 9c): coxal plate approximately as long as wide; distal margin setose, with setae longer than in *Niphargus costozzae*; basis short and stout; propodus (fig. 9e) slightly longer than wide, with 3 anterior rows of setae; palm slightly inclined as in fig. 9e, bearing 1 spine near the posterodistal corner accompanied by 5 facial setae and 3 shorter serrate spines on outer surface (fig. 9f) and a short blunt spine on inner surface; dactyl with an anterior row of 7 single setae.

Gnathopod 2 (fig. 9d): coxal plate slightly longer than wide, distal margin setose; coxal gill narrow and longer than coxal plate; propodus (fig. 10a) slightly wider than long, with 2 rows of setae on anterior margin; palm slightly inclined as in fig. 10a, with 3 facial setae; posterodistal corner armed with a long stout spine accompanied by 2 serrate spines on outer surface and a short blunt spine on inner surface; dactyl with an anterior row of 6 single setae.

Pereopods 3 and 4 as in figs. 10 e-f. Coxal plates longer than wide, with distal margin setose. Basis of both pereopods bearing long setae on posterior margins; other details as in figs. 10 e-f e 10h.

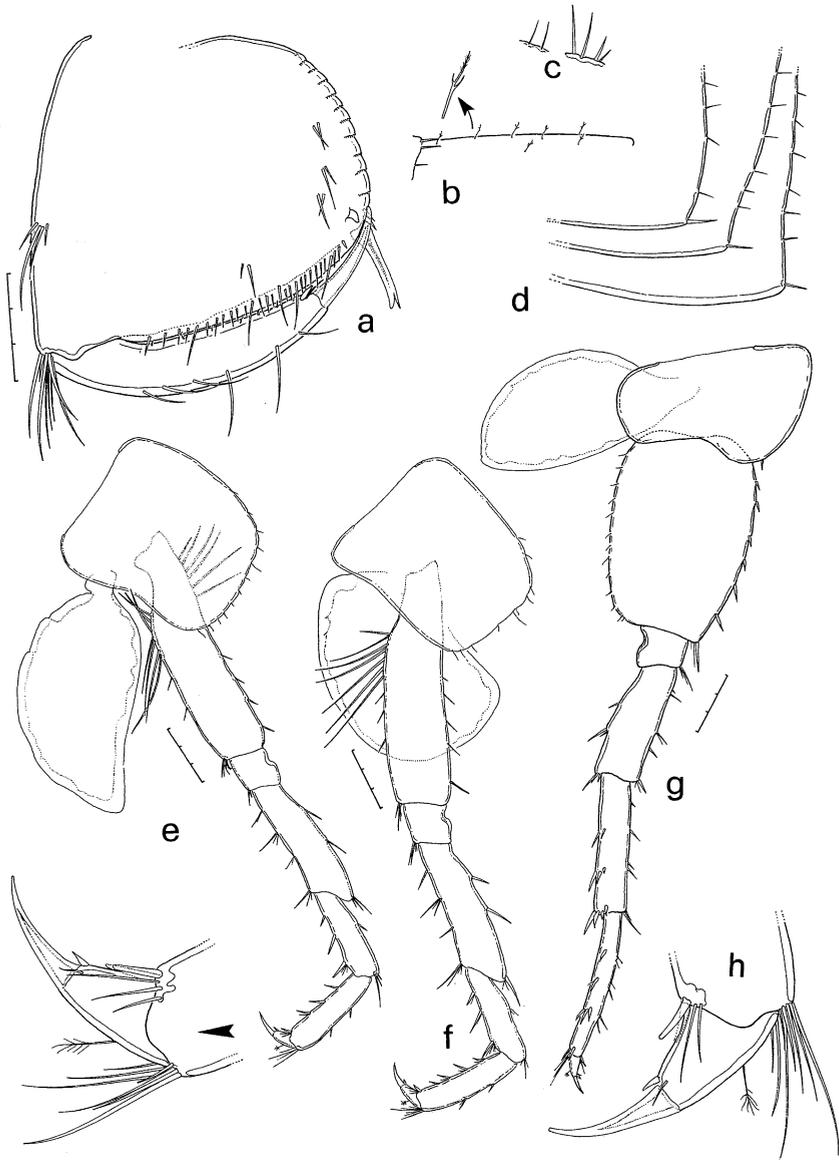


Fig. 10 - *Niphargus lessiniensis* n. sp. (holotype ♂ mm 15): a) propodus of gnathopod 2; b) dorsal setules of metasomite 3; c) lateral spines and setae of urosomites 1-2; d) epimeral plates; e) pereopod 3 and dactylus; f) pereopod 4; g) pereopod 5; h) dactylus of pereopod 4. Scale bars = 10 μ m

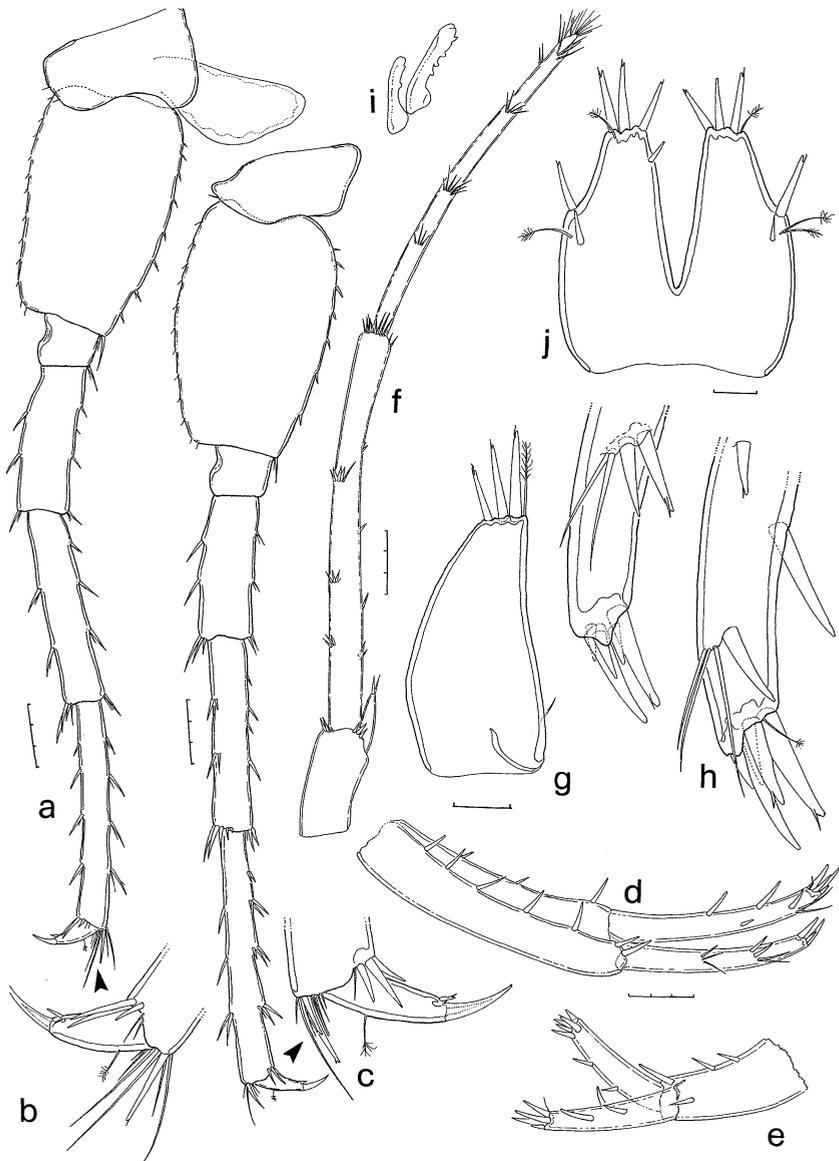


Fig. 11 - *Niphargus lessiniensis* n. sp. (holotype ♂ mm 15); a) pereopod 6; b) dactylus of pereopod 6; c) pereopod 7 and dactylus; d) uropod 1; e) uropod 2; f) uropod 3; g) inner ramus of uropod 3; h) distal part of rami of uropod 1; i) retinacula of pleopod 3; j) telson (dorsal view). Scale bars = 10 μ m

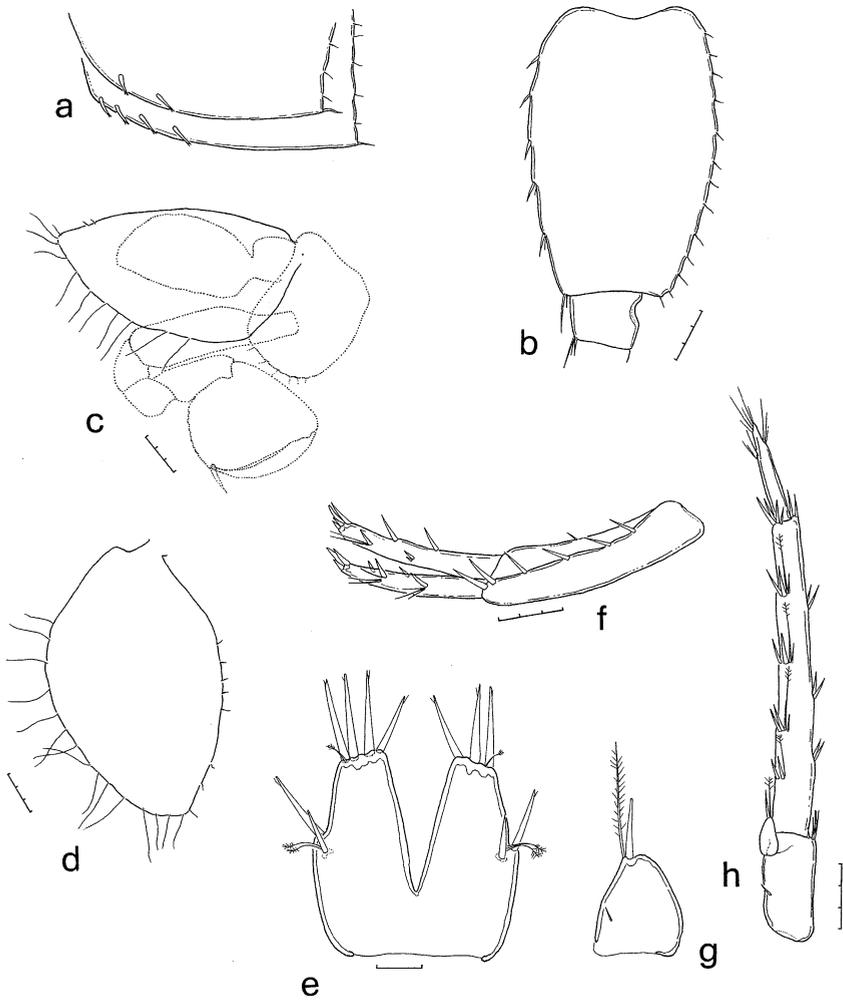


Fig. 12 - *Nipbargus lessiniensis* n. sp. (paratype ♀ mm 12): a) epimeral plates 2-3; b) basis of pereopod 7; c) gnathopod 2 with oostegite; d) oostegite of pereopod 3; e) telson (dorsal view); f) uropod 1; g) inner ramus of uropod 3; h) uropod 3. Scale bars = 10 μ m

Pereopods 5-7 stout, as in figs. 10g - 11 a-c; pereopod 5 (fig. 10g) remarkably shorter than pereopod 6; pereopod 7 (excluding coxal plate) approximately 40% length of body. Coxal plates and gills as in figs. 10g, 11a, 11c; basis ovoid, posterior lobe absent; dactyls short (figs. 11 b-c), bearing 1 plumose seta on posterior margin and 1 subungual spine accompanied by 2 short setae; no other spines are present on anterior margin; unguis stout, shorter than dactyl.

Epimeral plates 1-3 with right angles (fig. 10d), posterior margins with short setae.

Pleopods 1-3 with 2 retinacula each (fig. 11i).

Urosomite 1 with 1 short spine near peduncle of uropod 1.

Uropod 1 (fig. 11d) with peduncle bearing 2 rows of dorsal spines; rami subequal in length, outer one only slightly shorter than inner one in older males, bearing 2 ventral rows of spines and setae; setae of distal row of inner ramus overreaching the end of ramus but not the tip of distal spines (fig. 11h), shorter than in *Niphargus costozzae*.

Uropod 2 (fig. 11e) shorter and stouter than uropod 1; rami subequal in length.

Uropod 3 (fig. 11f) with inner ramus (fig. 11g) short, subrounded; inner margin armed with a short proximal seta; distal margin bearing 3 spines and 1 plumose seta, as long as or shorter than distal spines. Outer ramus long, 2-articulate; article 2 approximately as long as article 1 in older males; setation as in fig. 11f.

Telson (fig. 11j) longer than wide, incised more than 2/3 of its length; lobes slightly divergent; each lobe with 3 distal spines accompanied by 1 plumose seta, 1 subdistal inner spine (which lacks in the right lobe of holotype), 1 lateral outer spine, 1 short dorsal spine and 1-2 lateral plumose setae. All the spines are short (fig. 11j).

Female smaller than male (body length 11-13 mm), with epimeral plates (fig. 12a) slightly pointed. Oostegites like in fig. 12c-d; antennae, mouthparts and gnathopods like in male; basis of pereopods (fig. 12b) slightly broader than in male. Uropod 1 (fig. 12f) like in male, with rami subequal in length or with outer ramus slightly shorter than inner one. Uropod 3 (fig. 12h) short; inner ramus (fig. 12g) subrounded, shorter than in male, with 1 distal spine and 1 long plumose seta; article 2 of outer ramus shorter than 30% length of article 1. Telson (fig. 12e) with spines longer than in male.

VARIABILITY - The material is rather homogeneous as regards morphological characters, and the variability with age is the same as for *Niphargus costozzae*, except for epimeral plates that are never rounded. In a population from a source near Canello, Verona, the older males are very small (length 8-9 mm).

REMARKS AND AFFINITIES - The species can be distinguished from *Niphargus costozzae* by its smaller size, longer A-setae on article 3 of mandibular palp, structure of pluritoothed distal spine of outer lobe of maxilla I, shorter antenna and smaller gnathopods (if compared with body size: see habitus in fig. 1c), epimeral plates with right angle, lateral setation of urosomites 1-2, dorsal armature of telson and armature of inner ramus of uropod 3.

The armature and length of the distal plumed seta of inner ramus of uropod 3, very short in males, may be useful to distinguish *Niphargus lessiniensis* from juveniles of *Niphargus costozzae* (which have broader basis of pereopods 5-7 as well). However, adult males are needed for a correct identification.

DISTRIBUTION AND HABITAT - The range of *Niphargus lessiniensis* n. sp. in Lessinian Mountains is restricted to the western sources and caves, where it was found in small pools and rivulets of percolating water.

Niphargus cf. *lessiniensis* mihi

Synonymy:

Niphargus stygius stygius (partim): Ruffo, 1937: 160.

Nyphargus stygius (partim): Caoduro et al., 1994: 41.

MATERIAL EXAMINED - Grotta dei Damati (9 V/VR), Case Damati (Lessinian Mountains), Tregnago, prov. Verona: 29/08/1933 leg. Ruffo S., 2 spec.; 27/08/1964 leg. Palminteri R., 5 spec.; 09/06/1968 leg. Amici della Natura, 1 spec.; 30/03/1969 leg. G.A.M., 13 spec.; 31/08/1969 leg. Palminteri R., 5 spec.; 10/03/1978 leg. Vigna Taglianti A., 5 spec.; 04/10/1979 leg. Caoduro G., 2 spec.; 23/01/1983 leg. Piva E., Ferrari I., 1 spec.; 03/08/1986 leg. Baldan A., Comotti G., 1 juv.; 20/07/1993 leg. Caoduro G., Gasparo F., Stoch F., 19 spec.

REMARKS AND AFFINITIES - The males from the cave named "Grotta dei Damati" (body size of adult specimens mm 12-14) differ from *Niphargus lessiniensis* n. sp. by the narrow basis of peraeopods 5-7, very slender, and the outer ramus of uropod 1 being longer than inner ramus. The taxonomic value of these differences cannot be appreciated on the basis of a single locality.

Niphargus tridentinus n. sp.

Synonymy:

Niphargus stygius s. lato: Ruffo, 1953: 116.

MATERIAL EXAMINED - Venetia: Grotta del Subiolo (135 V/VI), Ponte Subiolo (Altopiano dei Sette Comuni), Valstagna, prov. Vicenza: 16/06/1938 leg. (?), 1 spec.; 04/03/1990 leg. Peretto G., 1 spec.; 24/05/1997 leg. Piva E., Stoch F., 1 ♀. Grotta dell'Elefante Bianco (1657 V/VI), Ponte Subiolo (Altopiano dei Sette Comuni), Valstagna, prov. Vicenza: 02/02/1992 leg. (?), 1 ♀. Trentino: Grotta del Calgeron (244 VT/TN) (or Grotta G.B. Trener), Selva di Grigno (Valsugana), Grigno, prov. Trento: 22/08/1952 leg. Conci C., 1 spec.; 24/02/1990 leg. Piva E., Ferrari I., 1 ♂; 24/03/1990 leg. Peretto G., 2 spec. Grotta della Bigonda (243 VT/TN), Grigno (Valsugana), prov. Trento: 20/03/1952 leg. Tomasi L., Galvagni A., Perini T. (1200 m from the entrance), 10 spec.; 21/03/1952 leg. Tomasi L., Perini T. (600-1000 m from the entrance), 10 spec.; 24/03/1952 leg. Perini T. ("Galleria del Drago"), many spec.; 01/08/1952 leg. Tamanini L., 8 spec.; 01/08/1952 leg. Galvagni A. ("Ramo del Grillo"), 2 spec.; 01/08/1952 leg. (?), 9 spec.; 20/08/1952 leg. Conci C. ("Piazza Selva"), 1 spec.; 22/03/1953 leg. Perini T. ("Galleria del Drago"), many spec.; 10/03/1996 leg. Peretto G., 1 spec.

TYPE LOCALITY - Cave named "Grotta della Bigonda" (cadastre number 243 VT/TN), Grigno, Valsugana, province of Trento.

TYPE MATERIAL - Holotype, 1 ♂ mm 18; paratypes, 5 ♂♂, 9 ♀♀, 3 juv., 24/03/1952 leg. Perini T. ("Galleria del Drago").

ETYMOLOGY - The specific name is derived from the latin name of Trentino.

DESCRIPTION - Male, body length 18-19 mm; habitus as in fig. 1b. Dorsal surface of somites sparsely covered with very short setules. Metasomites 1-3 with up to 12 short dorsoposterior setae (fig. 16g); urosomite 1 with 3 setae on each side; urosomite 2 with lateral groups of 3 spines and 2 setae (fig. 16g).

Antenna 1 (fig. 13a) slightly longer than 50% length of body (56% in the holotype), with peduncle articles 1-3 progressively shorter; peduncle article 3 with distal sensorial setae close to the insertion of accessory flagellum. Primary flagellum with 27 articles, usually bearing 1 aesthetasc (penultimate article bearing 2 aesthetascs); distal article with 1 short blunt aesthetasc, a lateral plumose seta and 5 distal naked setae. Accessory flagellum (fig. 13a) 2-articulate, only slightly longer than article 1 of primary flagellum; article 2 only slightly shorter than half of article 1, with 3 distal setae and 1 short blunt aesthetasc.

Antenna 2 (fig. 13b) with peduncle articles 4 and 5 subequal in length; peduncle article 4 bearing a proximal row of short sensorial setae on ventral margin; peduncle article 5 with 5 transversal rows of setae. Flagellum slightly longer than peduncle article 5, consisting of 12 articles bearing short setae.

Labrum as in *Niphargus costozzae*; labium as in fig. 13c.

Right mandible (fig. 13d) with incisor process consisting of 4 stout teeth; other details as in fig. 13d. Spine row consisting of 10 serrate spines accompanied by 6 sensorial setae. Molar process accompanied by 2 basal setae and 1 group of short sensorial structures. Left mandible with basal seta shorter than in right mandible (fig. 13e). Mandibular palp 3-articulate (fig. 13f); article 1 without setae; article 2 densely setose. Article 3 with 1 group of up to 8 A setae, not reaching the distal margin of the article, 3 groups of 3-4 B setae, up to 17 D setae and 6 E setae.

Maxilla 1 (fig. 13h): inner lobe bearing 2-3 distal setae; outer lobe with 7 distal spines (6 spines with 1, occasionally 2 lateral teeth, innermost spine with 3 teeth, the proximal one pointed, the others blunt). Palp 2-articulate, longer than outer lobe; distal article of palp bearing 10 setae.

Maxilla 2 (fig. 13g) with lobes sparsely covered by hairs; distal setae as in fig. 13g.

Maxilliped as in fig. 14f; inner lobe bearing a row of 3 bladespines accompanied by 6 setae (fig. 14e); palp 4-articulate, armed as in fig. 14f.

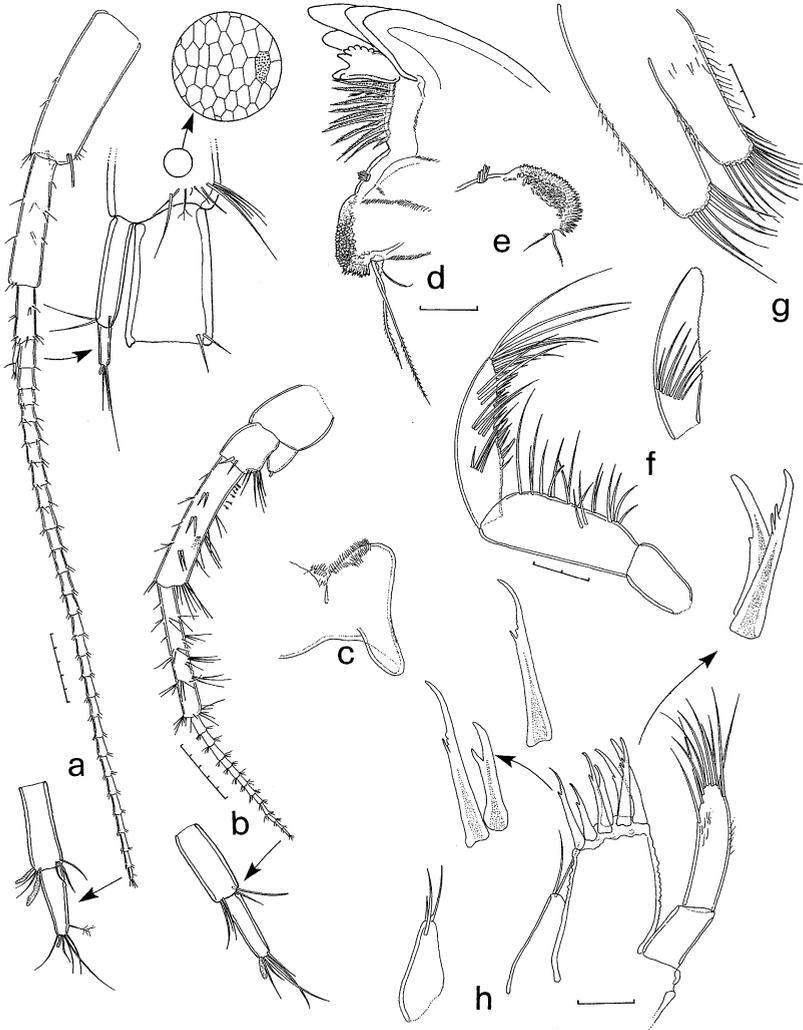


Fig. 13 - *Niphargus tridentinus* n. sp. (holotype ♂ mm 18): a) antenna 1 with details of distal articles of primary flagellum, accessory flagellum and cuticular sculpture; b) antenna 2 and distal articles of flagellum; c) labium; d) right mandible; e) molar process of left mandible; f) mandibular palp; g) maxilla 2; h) maxilla 1 with spines of outer lobe and inner lobe of the other side. Scale bars = 10 μ m

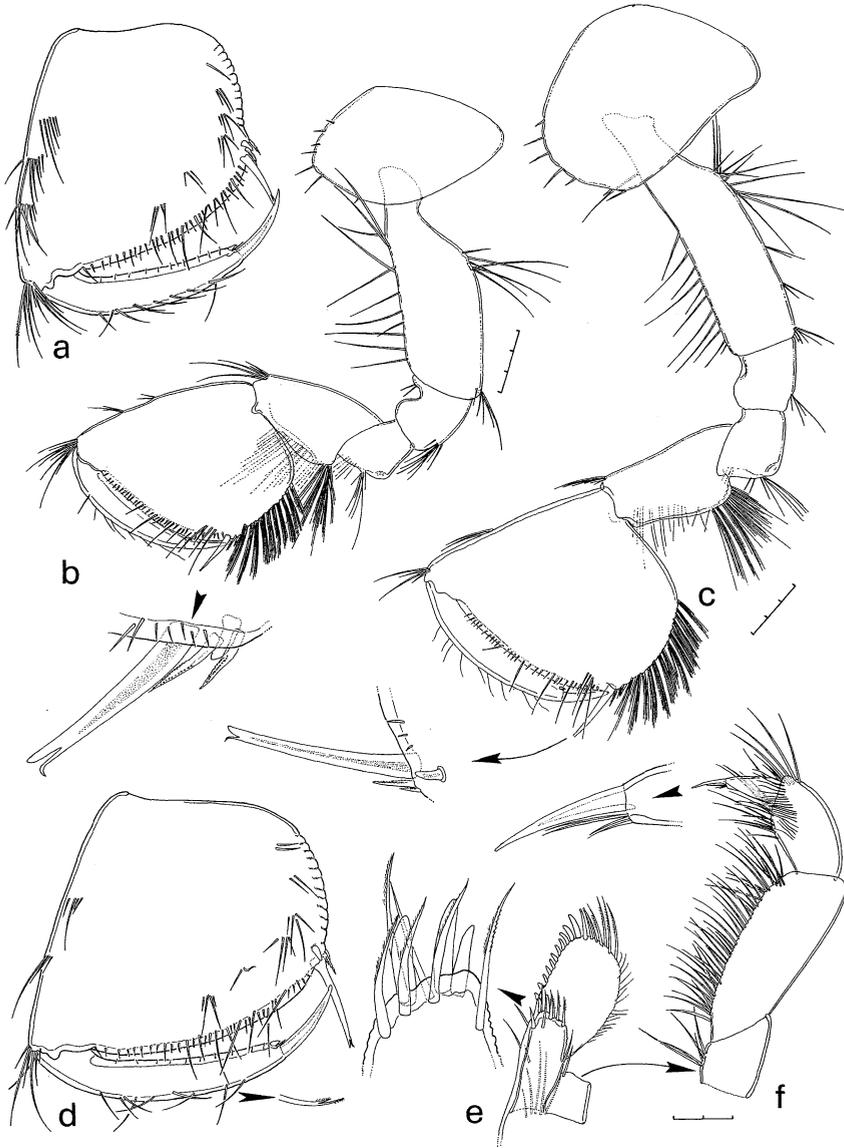


Fig. 14 - *Nipbargus tridentinus* n. sp. (holotype ♂ mm 18): a) propodus of gnathopod 1; b) gnathopod 1 and spines of palmar corner; c) gnathopod 2 and spines of palmar corner; d) propodus of gnathopod 2; e, f) maxilliped. Scale bars = 10 μ m

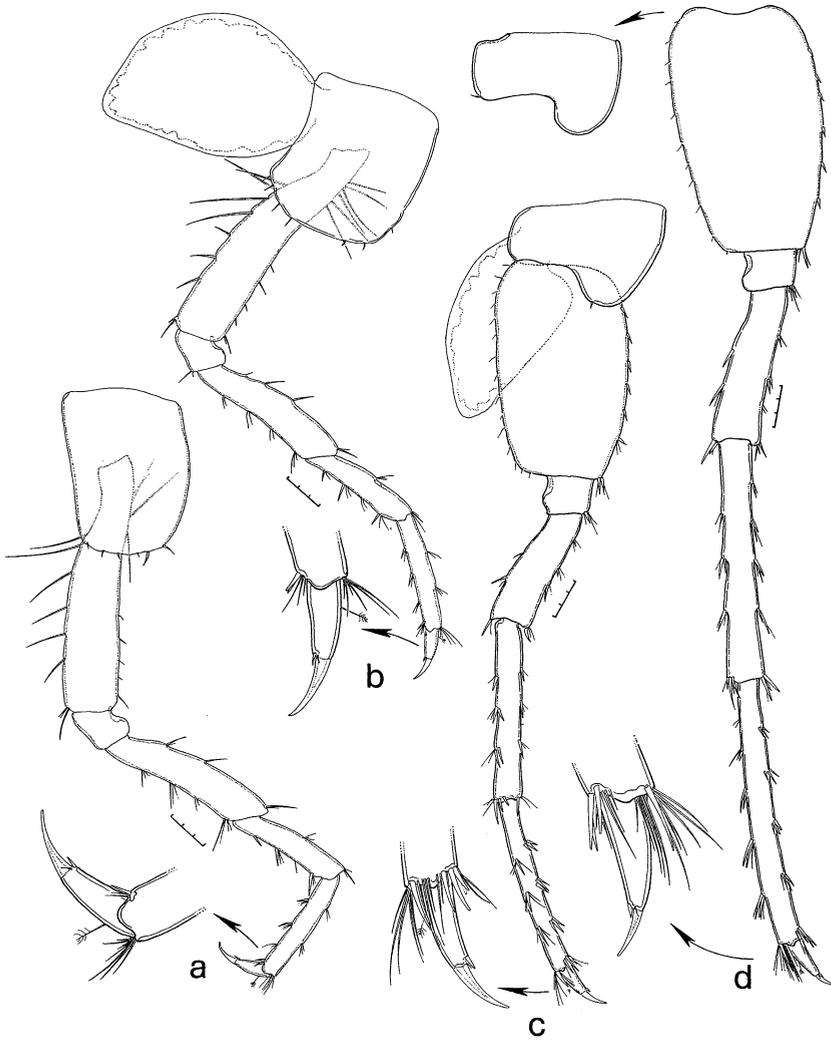


Fig. 15 - *Nipbargus tridentinus* n. sp. (holotype ♂ mm 18): a) pereopod 3 and dactylus (coxal gill omitted); b) pereopod 4 and dactylus; c) pereopod 5 and dactylus; d) pereopod 6 and dactylus (coxal gill omitted). Scale bars = 10 μ m

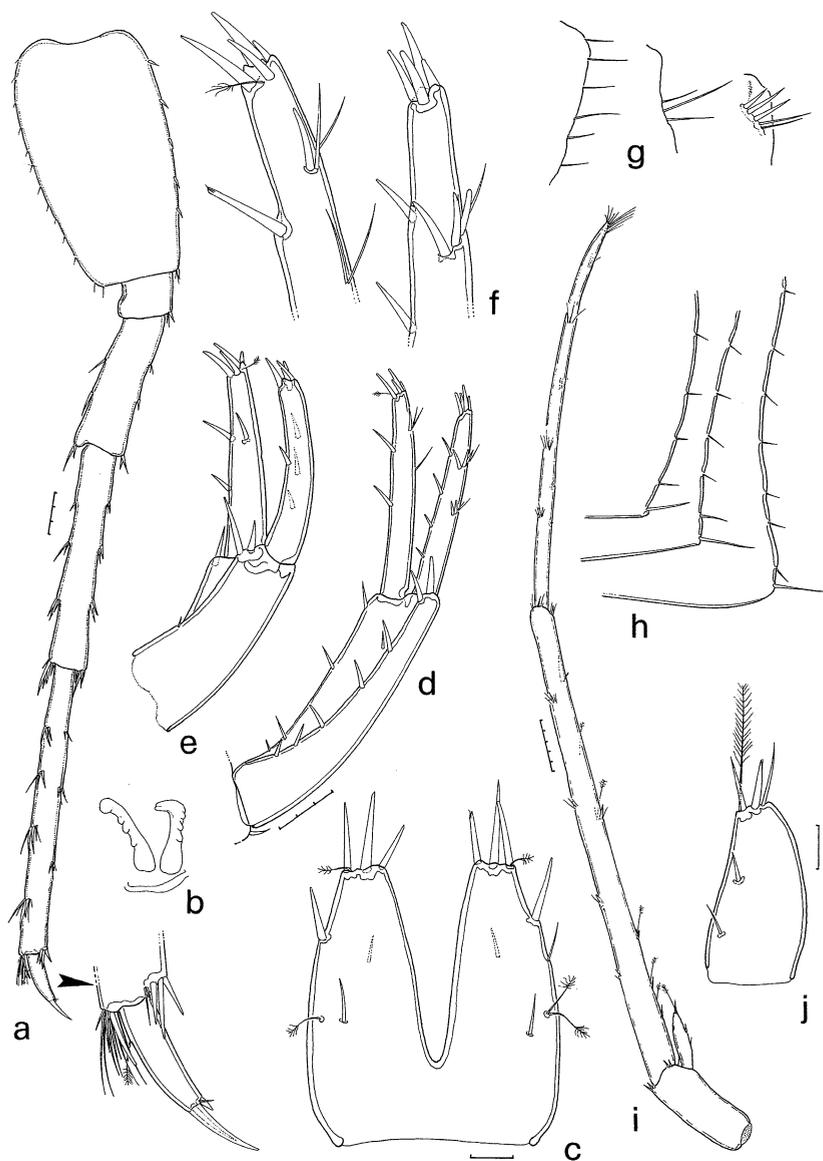


Fig. 16 - *Nipbargus tridentinus* n. sp. (holotype ♂ mm 18): a) pereopod 7 and dactylus; b) retinacula of pleopod 3; c) telson (dorsal view); d) uropod 1; e) uropod 2; f) distal part of rami of uropod 1; g) setae and spines of metasomite 3 and urosomites 1-2; h) epimeral plates; i) uropod 3; j) inner ramus of uropod 3. Scale bars = 10 μ m

Gnathopod 1 (fig. 14b): coxal plate approximately as long as wide; distal margin setose, with setae longer than in *Niphargus costozzae*; propodus (fig. 14a) slightly longer than wide, with 4 anterior rows of setae; palm remarkably inclined as in fig. 14a, bearing 1 long and slender spine near the posterodistal corner accompanied by 4 facial setae and 2 shorter serrate spines on outer surface (fig. 14b) and a short blunt spine on inner surface; dactyl with an anterior row of 9 single setae.

Gnathopod 2 (fig. 14c): coxal plate longer than wide, distal margin setose; coxal gill narrow and longer than coxal plate; propodus (fig. 14d) wider than long, with 3 rows of setae on anterior margin; palm inclined as in fig. 14d, with 4 facial setae; posterodistal corner armed with a long slender spine accompanied by 2 serrate spines on outer surface (fig. 14c) and a short blunt spine on inner surface; dactyl with an anterior row of 9 single setae.

Pereopods 3 and 4 as in figs. 15 a-b. Coxal plates longer than wide, with distal margin setose. Basis of both pereopods bearing few long setae on posterior margins; other details as in figs. 15 a-b.

Pereopods 5-7 slender, as in figs. 15 c-d, 16a; pereopod 5 (fig. 15c) remarkably shorter than pereopod 6 (fig. 15 d); pereopod 7 (excluding coxal plate) approximately 60% length of body. Coxal plates and gills as in figs. 15 c-d; basis narrower than in the other species described above, posterior lobe absent; dactyls short (figs. 15 c-d, 16a), bearing 1 plumose seta on posterior margin and 1 subungual spine accompanied by 2 short setae; no other spines are present on anterior margin; unguis slender and shorter than dactyl.

Epimeral plates 1-3 with pointed angles (fig. 16h), posterior margins with short setae; corner seta long.

Pleopods 1-3 with 2 retinacula each (fig. 16b).

Urosomite 1 with 1 short spine near peduncle of uropod 1 (fig. 16d).

Uropod 1 (fig. 16d) with peduncle bearing 2 rows of dorsal spines, not sexually dimorphic; rami subequal in length (fig. 16f), bearing 2 ventral rows of spines and setae; setae of distal row of inner ramus not reaching the tip of distal spines.

Uropod 2 (fig. 16e) shorter and stouter than uropod 1; rami subequal in length.

Uropod 3 (fig. 16i) with inner ramus (fig. 16j) short, subrounded; inner margin armed with a short proximal seta and a short medial seta; distal margin bearing 2 spines, 1 naked seta and 1 long plu-

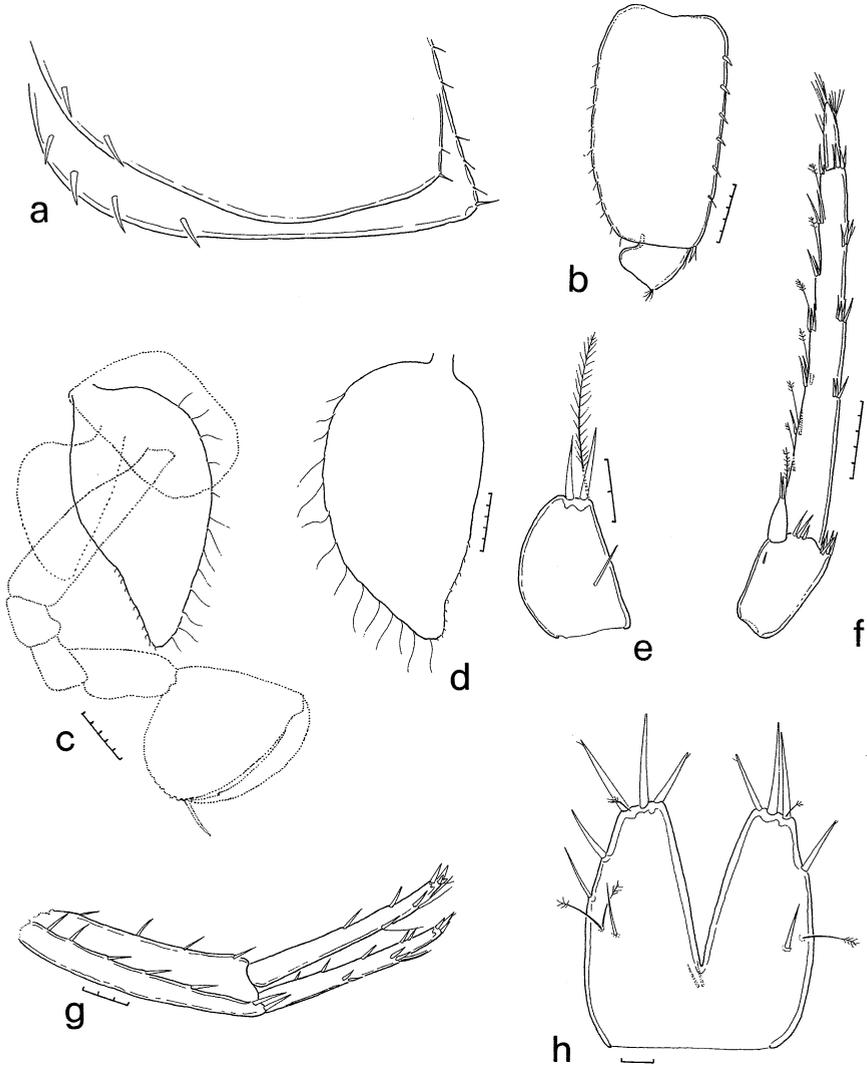


Fig. 17 - *Nipbargus tridentinus* n. sp. (paratype ♀ mm 15): a) epimeral plates 2-3; b) basis of pereopod 7; c) gnathopod 2 with oostegite; d) oostegite of pereopod 3; e) inner ramus of uropod 3; f) uropod 3; g) uropod 1; h) telson (dorsal view). Scale bars = 10 μ m

mose seta, longer than twice the distal spines. Outer ramus very long and slender, 2-articulate; article 2 slightly shorter than article 1 in older males; setation as in fig. 16i.

Telson (fig. 16c) longer than wide, incised more than $3/4$ of its length; lobes slightly divergent; each lobe with 3 distal spines accompanied by 1 plumose seta, 1-2 lateral outer spines, 1 dorsal spine, 1 ventral spine and 1-2 lateral plumose setae. The dorsal spines are thin (fig. 16c).

Female smaller than male (body length 16-20 mm), with epimeral plates (fig. 17a) bearing shorter corner setae. Oostegites like in fig. 17c-d; antennae, mouthparts and gnathopods like in male; basis of pereopods (fig. 17b) slightly broader than in male. Uropod 1 (fig. 17g) like in male, with rami subequal in length. Uropod 3 (fig. 17f) short; inner ramus (fig. 17e) subrounded, shorter than in male, with 2 distal spines and 1 long plumose seta; article 2 of outer ramus 20% length of article 1. Telson (fig. 17h) with slender spines, longer than in male.

VARIABILITY - The variability of some morphological characters with age is the same as illustrated for *Niphargus costozzae*, except for epimeral plates which are pointed also in older males. A noteworthy variability was observed in the number of molar setae of left mandible; some specimens (as in fig. 13d) have 2 or 3 setae instead of 1. This variability, observed in *Niphargus stygius* as well, can be due to regeneration processes. The other morphological characters show no remarkable variability in the specimens examined.

REMARKS AND AFFINITIES - *Niphargus tridentinus* n. sp. can be easily distinguished from the other species described herein by the following characters of males: habitus (fig. 1b), long antenna 1, elongated distal article of accessory flagellum of antenna 1, long corner spine and inclined palma of propodus of gnathopods 1-2, long and slender articles of pereopods 3-7, slightly pointed epimeral plates with longer corner setae, different armature of telson, uropod 1 with subequal rami in older males, different armature of inner ramus of uropod 3, outer ramus of uropod 3 long and slender in older males. The species is rather similar to *Niphargus brixianus* Ruffo, 1937, which differs by the shape of propodus of gnathopods 1-2 (very large and pyriform in older males), the armature of telson, the shape of uropod 3 and several smaller details which will be discussed dealing with the redescription of this species in another paper.

DISTRIBUTION AND HABITAT - The species was found in hypogean brooks and streams drained by Brenta river. Most of the caves were covered by glaciers during the last ice-age; the species may have recolonized the caves during the Olocene from nearby areas, or survived under the ice cover in deep phreatic waters.

Niphargus montellianus n. sp.

Synonymy:

Niphargus (Stygoniphargus) costozzae: Karaman S., 1954: 166

Nyphargus stygius (partim): Karaman G., 1993: 263.

MATERIAL EXAMINED - Venetia, massif of Montello, province of Treviso: Tavarano Grande (69 V/TV), Santa Croce, Nervesa della Battaglia: 14/04/1952 leg. Busulini E., 1 spec.; 28/04/1990 leg. Gasparo F., Stoch F., 19 spec.; 07/03/1992 leg. Peretto G., Piva E., 2 spec. Tavarano Lungo (77 V/TV), Strada 7, com. Nervesa della Battaglia: 10/11/1966 leg. Paoletti M., 1 spec.; 18/07/1971 leg. Paoletti M., 3 spec.; 25/07/1971 leg. Paoletti M., 6 spec.; 08/08/1971 leg. Paoletti M., 2 spec.; 31/10/1971 leg. Paoletti M., 1 juv.; 30/04/1972 leg. Paoletti M., 1 spec. Aqueduct of Nervesa della Battaglia, leg. Benedetti G.B., 08/1941, 6 juv. Bus de le Fate Superiore o di Val Pomera (76 V/TV), Latteria, Nervesa della Battaglia: 08/1970 leg. Bini A., 1 juv.; 12/11/1948 leg. Burlini M., 5 spec.; 08/09/1982 leg. Piva E., Ferrari I., 2 spec.; 09/10/1982 leg. Piva E., Ferrari I., 1 spec.; 22/02/1992 leg. Peretto G., Piva E., 4 spec. Bus de le Fratte (1277 V/TV), Strada 3, Nervesa della Battaglia: leg. Rallo ("Cunicolo del Serpente"), 1 spec. Busa di Castel Sotterra (68 V/TV), Presa 10, Volpago del Montello: 30/03/1952 leg. Busulini E. ("Sala delle Frane"), many spec.; 17/04/1959 leg. Zecchini ("Sala delle Frane"), 2 spec. Grotta della Presa 7 (?): 07/1941 leg. Benedetti G.B., 13 spec. Grotta Grande di Val Boera (1143 V/TV), Nervesa della Battaglia: 14/03/1992 leg. Peretto G., Piva E., 2 spec. Venetia, massif of Grappa, province of Treviso: La Bislonga (1001 V/TV), Pederobba: 05/03/1949 leg. Boldori L., many spec.

TYPE LOCALITY - Cave named "Tavarano Grande" (cadastre number 69 V/TV), Santa Croce (Montello), Nervesa della Battaglia, province of Treviso.

TYPE MATERIAL - Holotype, 1 ♂ mm 24; paratypes, 9 ♂♂, 8 ♀♀, 2 juv., 28/04/1990 leg. Gasparo F., Stoch F.

ETYMOLOGY - The name is derived from the karstic massif of Montello, where the new species was discovered.

DESCRIPTION - Male (holotype), body length 20-24 mm; habitus as in fig. 18c. Dorsal surface of somites sparsely covered with very short setules. Metasomites 1-3 with 5-6 short dorsoposterior setae; urosomite 1 with 3 setae on each side, urosomite 2 with lateral groups of 3 spines (fig. 21d).

Antenna 1 (fig. 18a) approximately 50% of body length, with peduncle articles 1-3 progressively shorter; peduncle article 1 bearing a row of short proximal sensorial setae on dorsal margin. Primary flagellum with up to 25 articles, usually bearing 1 aesthetasc; distal article with a short blunt aesthetasc, a lateral plumose seta and 6 distal naked setae. Accessory flagellum (fig. 18a) 2-articulate, as long as the two distal articles of primary flagellum; article 2 elongated, with 3 distal setae and 1 short blunt aesthetasc.

Antenna 2 (fig. 18b) with peduncle articles 4 and 5 subequal in length; peduncle article 4 bearing a proximal row of short sensorial setae on ventral margin; peduncle article 5 with 4 transversal rows of setae. Flagellum slightly longer than peduncle article 5, consisting of 13 articles bearing short setae.

Labrum, labium and maxilla 2 as in *Niphargus tridentinus*.

Right mandible with incisor process consisting of 4 stout teeth; spine row consisting of 10 serrate spines accompanied by sensorial setae. Molar process accompanied by 1 basal seta and 1 group of short sensorial structures. Left mandible with basal seta shorter than in right mandible. Mandibular palp 3-articulate (fig. 18d); article 1 without setae; article 2 densely setose. Article 3 (fig. 18d) with 1 group of up to 9 A setae, not reaching the distal margin of the article, 4 groups of 3-5 B setae, more than 30 D setae and 7 E setae.

Maxilla 1 (fig. 18f): inner lobe bearing 6 distal setae; outer lobe with 7 distal spines (6 spines with 1 lateral tooth, innermost spine with 2 blunt teeth). Palp 2-articulate, longer than outer lobe; distal article of palp bearing 8 setae.

Maxilliped typical of the genus; inner lobe (fig. 18e) bearing a row of 5 bladespines accompanied by 8 setae; palp 4-articulate.

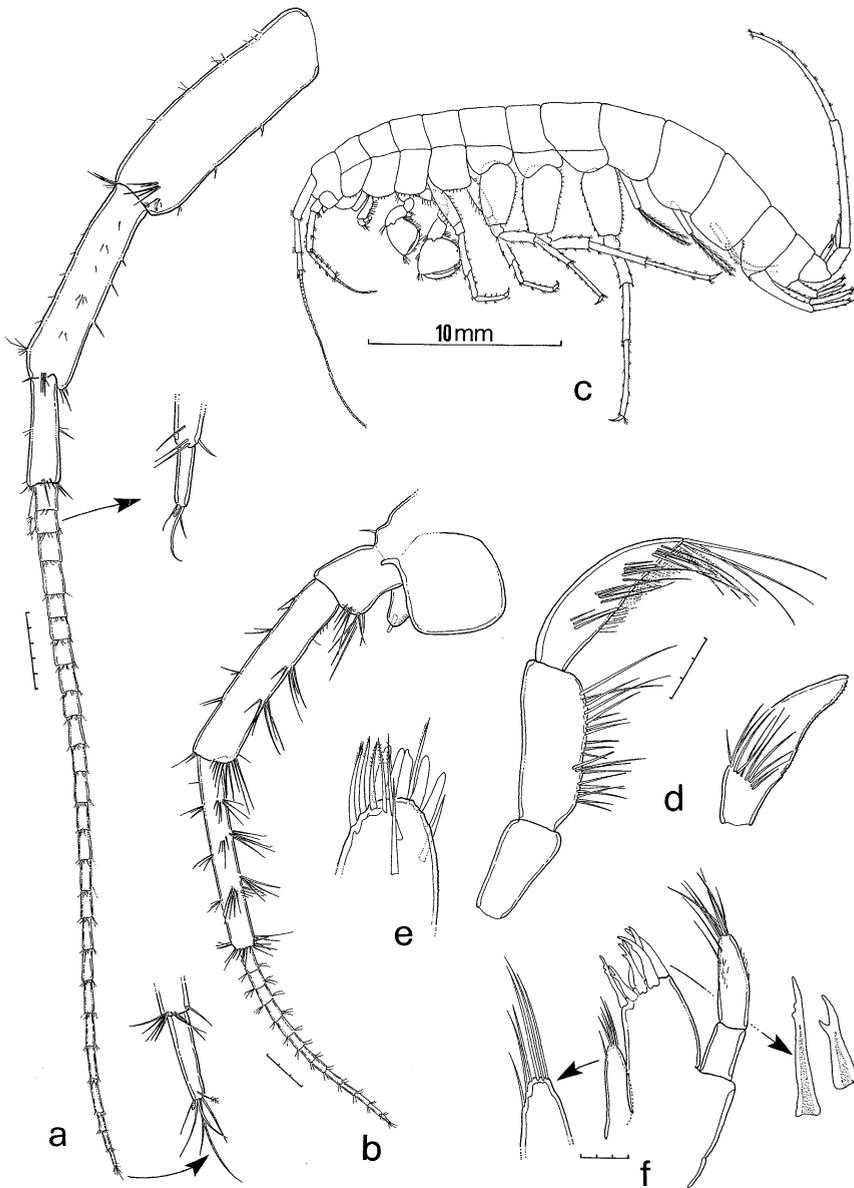


Fig. 18 - *Nipbargus montellianus* n. sp. (holotype ♂ mm 24): a) antenna 1 and distal articles of primary and accessory flagellum; b) antenna 2; c) habitus; d) mandibular palp; e) inner plate of maxilliped; f) maxilla 1 with details of inner plate and spines of outer plate. Scale bars = 10 μ m

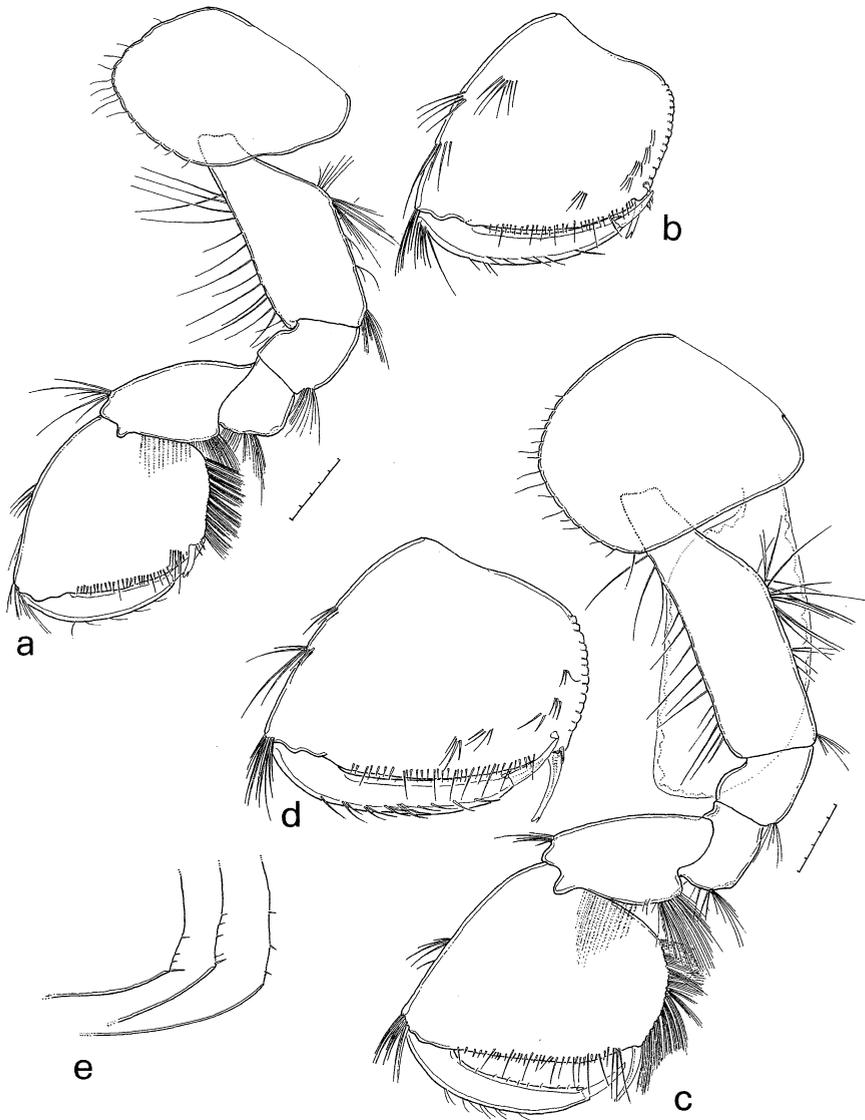


Fig. 19 - *Niphargus montellianus* n. sp. (holotype ♂ mm 24): a) gnathopod 1; b) propodus of gnathopod 1; c) gnathopod 2; d) propodus of gnathopod 2; e) epimeral plates. Scale bars = 10 μ m

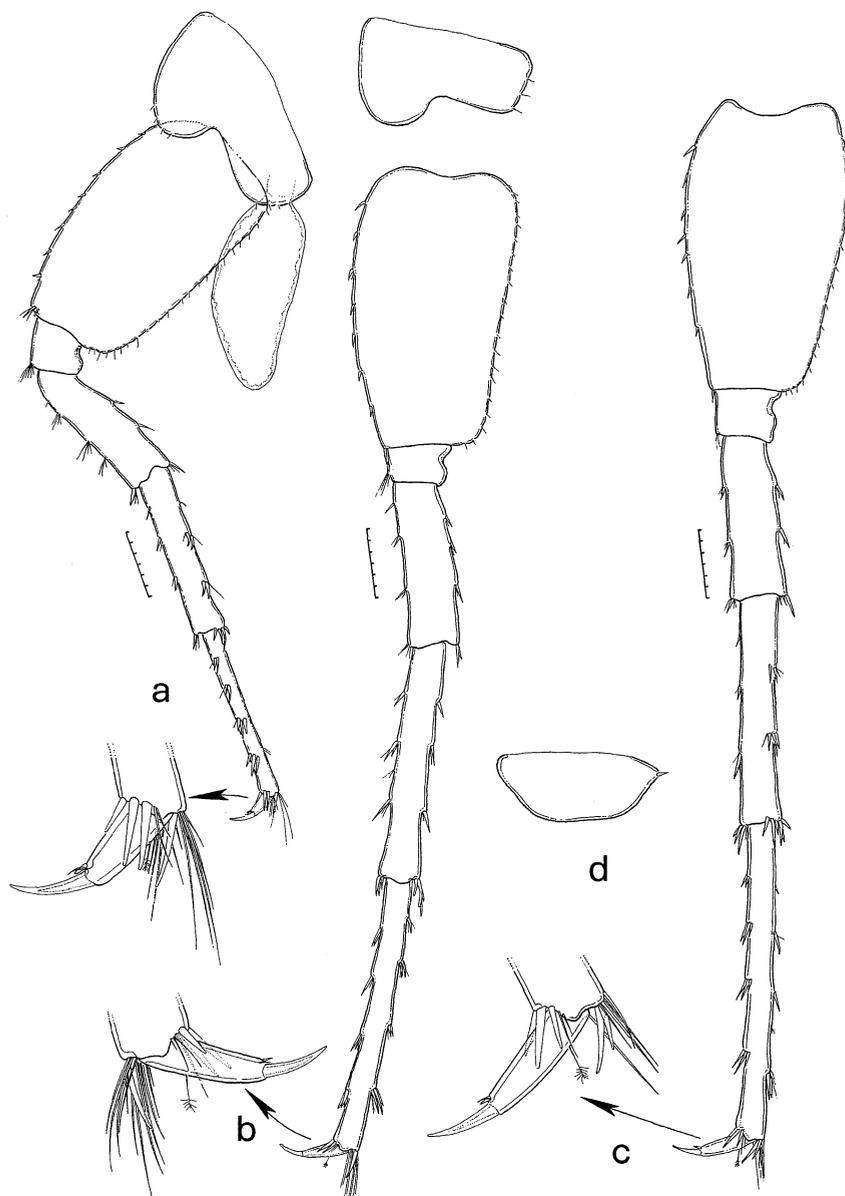


Fig. 20 - *Nipbargus montellianus* n. sp. (holotype ♂ mm 24): a) pereopod 5 and dactylus; b) pereopod 6 and dactylus; c) pereopod 7 and dactylus; d) coxal plate of pereopod 7. Scale bars = 10 μ m

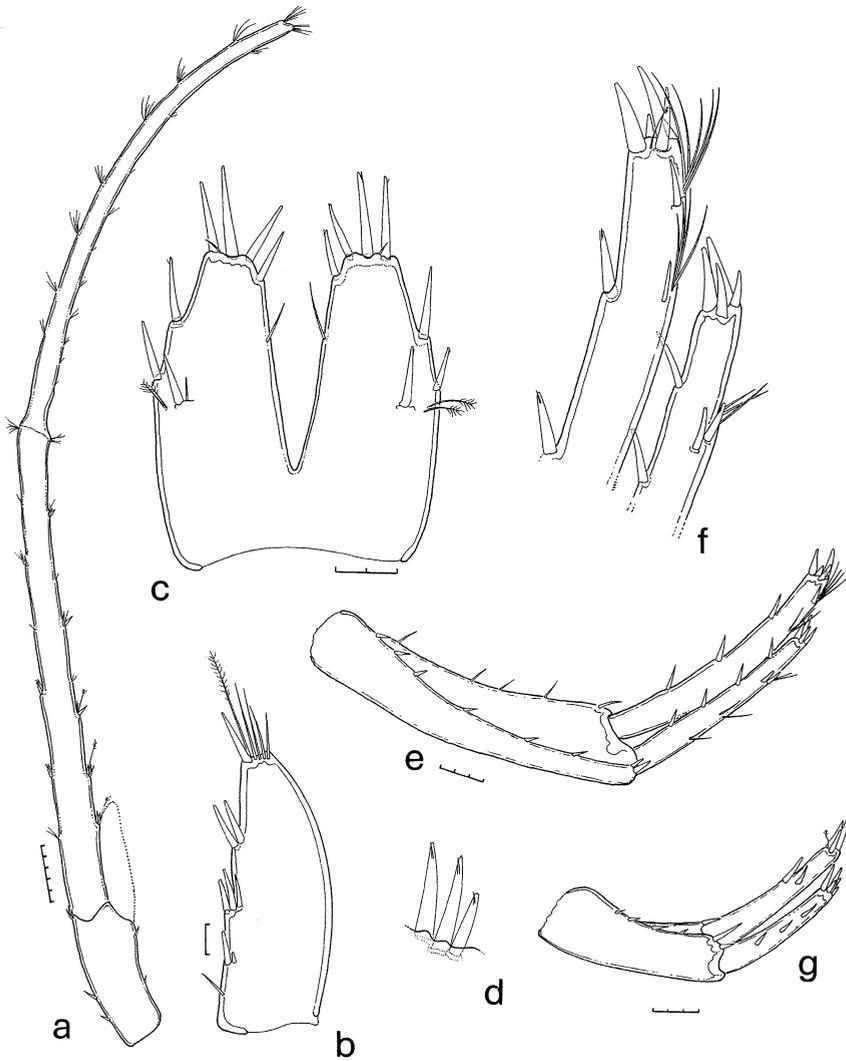


Fig. 21 - *Niphargus montellianus* n. sp. (holotype ♂ mm 24): a) uropod 3; b) inner ramus of uropod 3; c) telson (dorsal view); d) lateral spines of urosomite 3; e) uropod 1; f) distal part of rami of uropod 1; g) uropod 2. Scale bars = 10 μ m

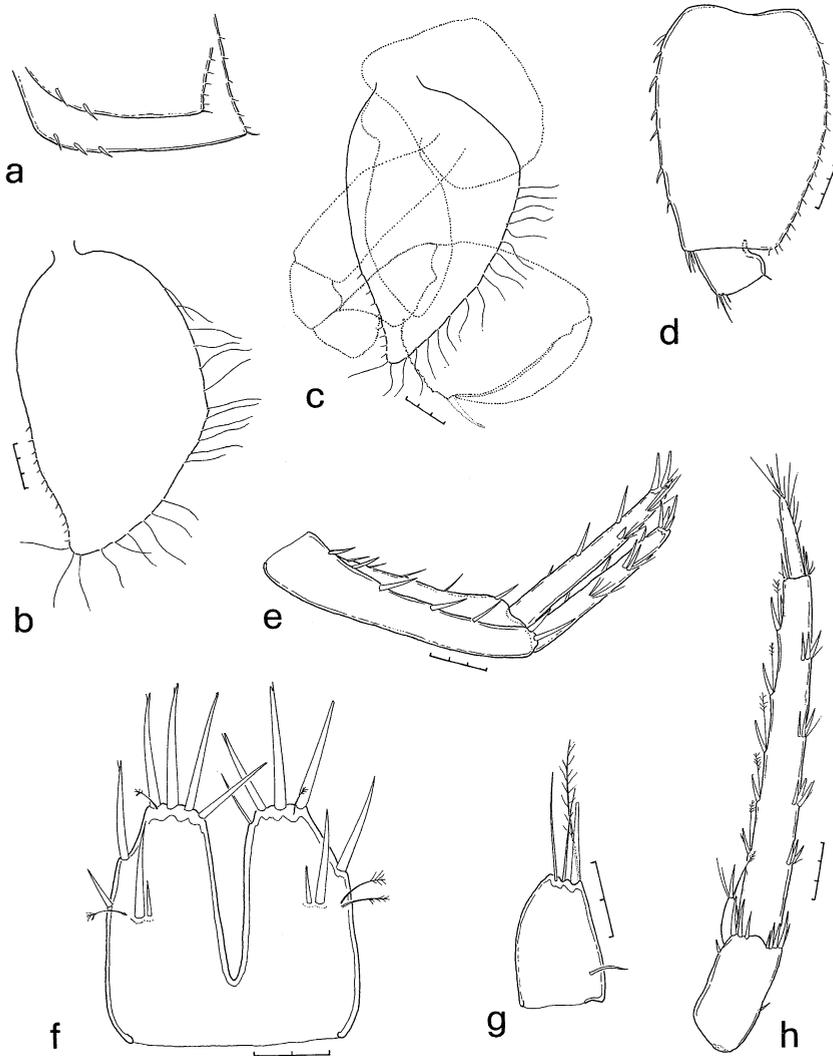


Fig. 22 - *Nipbargus montellianus* n. sp. (paratype ♀ mm 22): a) epimeral plates 2-3; b) oostegite of pereopod 3; c) gnathopod 2 with oostegite; d) basis of pereopod 7; e) uropod 1; f) telson (dorsal view); g) inner ramus of uropod 3; h) uropod 3. Scale bars = 10 µm

Gnathopod 1 (fig. 19a): coxal plate wider than long, distal margin setose; propodus (fig. 19b) longer than wide, with 4 anterior rows of setae; palm slightly inclined as in fig. 19b, bearing 1 long spine near the posterodistal corner accompanied by 5 facial setae and 2 serrate spines on outer surface and a short blunt spine on inner surface; dactyl with an anterior row of single setae.

Gnathopod 2 (fig. 19c): coxal plate approximately twice longer than wide, distal margin setose; coxal gill narrow and longer than coxal plate; propodus (fig. 19d) wider than long, with 3 rows of setae on anterior margin; palm slightly inclined as in fig. 19d, with 3 facial setae; posterodistal corner armed with a long curved spine accompanied by 2 serrate spines on outer surface and a short blunt spine on inner surface; dactyl with an anterior row of 9 groups of 1-2 setae.

Pereopods 3 and 4 as in *Niphargus tridentinus*; coxal plates longer than wide, with distal margin setose. Basis of both pereopods bearing long setae on posterior margins.

Pereopods 5-7 slender, as in figs. 20 a-c; pereopod 5 (fig. 20a) remarkably shorter than pereopod 6 (fig. 20b); pereopod 7 (excluding coxal plate) slightly shorter than 50% length of body. Coxal plates and gills as in figs. 20 a-d; basis ovoid and broad, posterior lobe absent; dactyls slightly longer than in the other species described above (figs. 20 a-c), bearing 1 plumose seta on posterior margin and 1 subungual spine accompanied by 2 short setae; no other spines are present on anterior margin; unguis as long as half of dactyl.

Epimeral plates 1-3 as in fig. 19e, slightly rounded in older males; posterior margins with short setae.

Pleopods 1-3 with 2 retinacula each, their shape as in the other species of the group.

Urosomite 1 with 1 short spine near peduncle of uropod 1.

Uropod 1 (fig. 21e) with peduncle bearing 2 rows of dorsal spines; outer ramus remarkably shorter than inner ramus (fig. 21f), sexually dimorphic, bearing 3 ventral rows of setae; setae of distal row of inner ramus reaching the tip of distal spines (fig. 21f).

Uropod 2 (fig. 21g) shorter and stouter than uropod 1; outer ramus only slightly shorter than inner one.

Uropod 3 (fig. 21a) with inner ramus (fig. 21b) elongated, inner margin armed with a short proximal seta and 3 groups of spines; distal margin bearing 1 spine, 4 naked setae and a long plumose seta, its length less than twice that of distal spines. Outer ramus

long and slender, 2-articulate; distal article approximately as long as article 1 in older males; setation as in fig. 21a.

Telson (fig. 21c) longer than wide, incised $3/4$ of its length; lobes slightly divergent; each lobe with 4 distal spines accompanied by a plumose seta, 1 subdistal inner seta, 2 lateral outer spines, 1-2 dorsal spines and 2 lateral plumose setae. All the spines are slender (fig. 21c).

Female smaller than male (body length 18-19 mm), with epimeral plates (fig. 22a) pointed. Oostegites like in fig. 22 b-c; antennae, mouthparts and gnathopods like in male; basis of pereopods (fig. 22d) broader than in male. Uropod 1 (fig. 22e) with rami subequal in length, or outer ramus only slightly shorter than inner one. Uropod 3 (fig. 22h) short; inner ramus (fig. 22g) subrounded, shorter than in male, with 1 distal spine accompanied by 2 naked setae and 1 plumose seta; article 2 of outer ramus up to 25% length of article 1. Telson (fig. 22f) shorter than in male, with long slender spines.

VARIABILITY - The variability of some morphological characters with age is the same as illustrated for *Niphargus costozzae*.

REMARKS AND AFFINITIES - The species is very closely related to *Niphargus tridentinus*, from which it can be distinguished by the following characters of males: higher number of distal setae on inner lobe of maxilla 1, shorter corner spine on propodus of gnathopods 1-2, subrounded epimeral plates with shorter posterior spines, armature of telson, sexually dimorphic uropod 1 with outer ramus remarkably shorter than inner one in adult males, inner ramus of uropod 3 elongated and with a more complex armature. The elongation of pereopods 5-7, the shape and armature of inner ramus of uropod 3 and the sexually dimorphic uropod 1 allow an easy separation of this species from the other members of the *Niphargus stygius* - group in Venetia.

DISTRIBUTION AND HABITAT - The species was discovered in hypogean brooks and streams in the isolated karstic massif of Montello and in a cave in the massif of Grappa.

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