A new species of *Pseudoniphargus* (Crustacea, Amphipoda, Melitidae) from an anchialine cave on the French Mediterranean coast

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Bréhier F. & Jaume D. 2009. — A new species of *Pseudoniphargus* (Crustacea, Amphipoda, Melitidae) from an anchialine cave on the French Mediterranean coast. *Zoosystema* 31 (1): 17-32.

ABSTRACT
A new species of the stygobiont melitid amphipod genus *Pseudoniphargus* Chevreux, 1901 is described from an anchialine cave located on the inner shore of the Salses-Leucate coastal lagoon, on the French Mediterranean coast. The new species is distinguished from other members of the genus by the combined display of: 1) gnathopod II not sexually dimorphic, with short carpus; 2) outline of basis of pereopods V-VII sexually dimorphic, with both margins convex and with overhanging posterodistal lobe in male, whereas margins subparallel and posterodistal lobe present but not overhanging in female; 3) uropod I protopod lacking basofacial robust seta; 4) protopod of uropod III sexually dimorphic, proportionaly more elongated in male; 5) exopod of male uropod III not strongly elongated (less than 12 times as long as wide), slightly upcurved and tapering; female exopod similar but shorter (about 8.8 times as long as wide); and 6) telson wider than long, with distal margin shallowly excavated and with two distal robust setae at each side. The relationships of this species are briefly discussed.

KEY WORDS
Crustacea,
Amphipoda,
Gammaridea,
Melitidae,
stygofauna,
France,
mixohaline waters,
new species.

RÉSUMÉ
Une nouvelle espèce de Pseudoniphargus *(Crustacea, Amphipoda, Melitidae) d'une grotte anchialine de la côte méditerranéenne française.*
Un nouvel amphipode stygobionte du genre *Pseudoniphargus* Chevreux, 1901 (Amphipoda, Melitidae) est décrit d'une cavité anchialine située en bordure de l'étang de Salses-Leucate, sur la côte méditerranéenne française (Leucate, Aude, France). Cette nouvelle espèce se distingue de ses congénères par l'ensemble des caractères suivants : 1) gnathopode II sans dimorphisme sexuel, à carpus court ; 2) basis des péreopodes V à VII à dimorphisme sexuel, avec les marges convexes et le lobe postero-distal bien marqué chez le mâle, alors que les marges sont subparallèles et le lobe postero-distal présent mais peu marqué chez la femelle ; 3) absence de soie robuste basofaciale sur le protopode de l'uropode I ; 4) protopode de l'uropode III à dimorphisme sexuel, proportionnellement plus allongé chez le mâle ; 5) exopode de l'uropode III du mâle ne présentant pas de forte élongation (moins de 12 fois plus long que large), légèrement incurvé et effilé ; exopode de la femelle similaire mais plus court (8,8 fois plus long que large) ; et 6) telson plus large que long, à marge distale peu profondément creusée, possédant deux soies robustes distales de part et d'autre. Les parentés de cette espèce sont brièvement discutées.

MOTS CLÉS
Crustacea,
Amphipoda,
Gammaridea,
Melitidae,
stygofaune,
France,
eaux mixohalines,
espèce nouvelle.

INTRODUCTION

The inland groundwaters of the French Mediterranean arc are home to a diverse assemblage of thalassoid crustaceans, including cirolanid and microparasellid isopods, gammarid, salentinellid and ingolfiellid amphipods, thermosbaenaceans, decapods, and cyclopoid copepods (Table 1; see Botosaneanu 1986, and references therein; Wagner 1994; Jaume & Bréhier 2005). With regard to melitid amphipods, one of the most characteristic thalassoid lineages in inland groundwaters elsewhere, no records were known thus far from the region, although *Pseudoniphargus adriaticus* S. Karaman, 1955, a widely distributed stygobiont Mediterranean marine/euryhaline species, has been collected repeatedly at marine interstitial stations from Banyuls (Pyrénées-Orientales) to Le Brusc (Var) (Stock 1980).

Here we report the discovery of a new species of *Pseudoniphargus* Chevreux, 1901 from an anchialine cave located on the inner margin of the coastal lagoon of Salses-Leucate (Aude). The cave, Grotte des Fées de Leucate, is a classical stygofaunal site representing the type locality of the cyclopoid copepod *Halicyclops troglodytes* Kiefer, 1954, and harbours also one of the two known populations of the recently described atyid shrimp *Typhlatya arfeae* Jaume & Bréhier, 2005 (Kiefer 1954; Jaume & Bréhier 2005). In addition, the cave is inhabited by the stygobiont amphipods *Niphargus angelieri* Ruffo, 1954 and *N. delamarei* Ruffo, 1954, plus several epigean species from the nearby Salses-Leucate coastal lagoon (*viz.* the calanoid copepod *Calanipeda aquaedulcis* Kritschagin, 1873, the cyclopoid copepod *Diacyclops bicuspidatus odessanus* (Schmankevitch, 1875), and the eel *Anguilla anguilla* (Linnaeus, 1758)).

Together with Font Estramar (Salses-le-Château), Aven Station (Fleury), Font Caude (Gruissan), and few other anchialine caves from Aude and Pyrénées-Orientales not yet sampled, Grotte des Fées de Leucate represents an original habitat which has proved to harbour a peculiar fauna not present anywhere else. Even though the cave was sampled repeatedly between April 2003 and June 2005, *Pseudoniphargus leucatensis* n. sp. appeared there only once, and only five specimens were found. Furthermore, searches of other anchialine (*viz.* Font Estramar, Aven Station,

TABLE 1. — Checklist of stygobiont thalassoid crustaceans from southern France.

Order, family	Species
Amphipoda	
Gammaridae Latreille, 1802	*Rhipidogammarus rhipidiophorus* (Catta, 1878)
Salentinellidae Bousfield, 1977	*Parasalentinella rouchi* Bou, 1971
	Salentinella delamarei delamarei Coineau, 1962
	S. delamarei macrocheles Coineau, 1967
	S. gineti Balazuc, 1957
	S. petiti Coineau, 1968
Ingolfiellidae Hansen, 1903	*Ingolfiella catalanensis* Coineau, 1963
	I. thibaudi Coineau, 1968
Isopoda	
Cirolanidae Dana, 1852	*Faucheria faucheri* (Dollfus & Viré, 1900)
	Sphaeromides raymondi Dollfus, 1897
Microparasellidae S. Karaman, 1933	*Angeliera phreaticola* Chappuis & Delamare, 1952
	Microcharon angelieri Coineau, 1963
	M. doueti Coineau, 1968
	M. juberthiei ramosus Coineau, 1968
Thermosbaenacea	*Limnosbaena* sp.
Decapoda	*Troglocaris inermis* Fage, 1937
	Typhlatya arfeae Jaume & Bréhier, 2005
Copepoda	*Halicyclops troglodytes* Kiefer, 1954

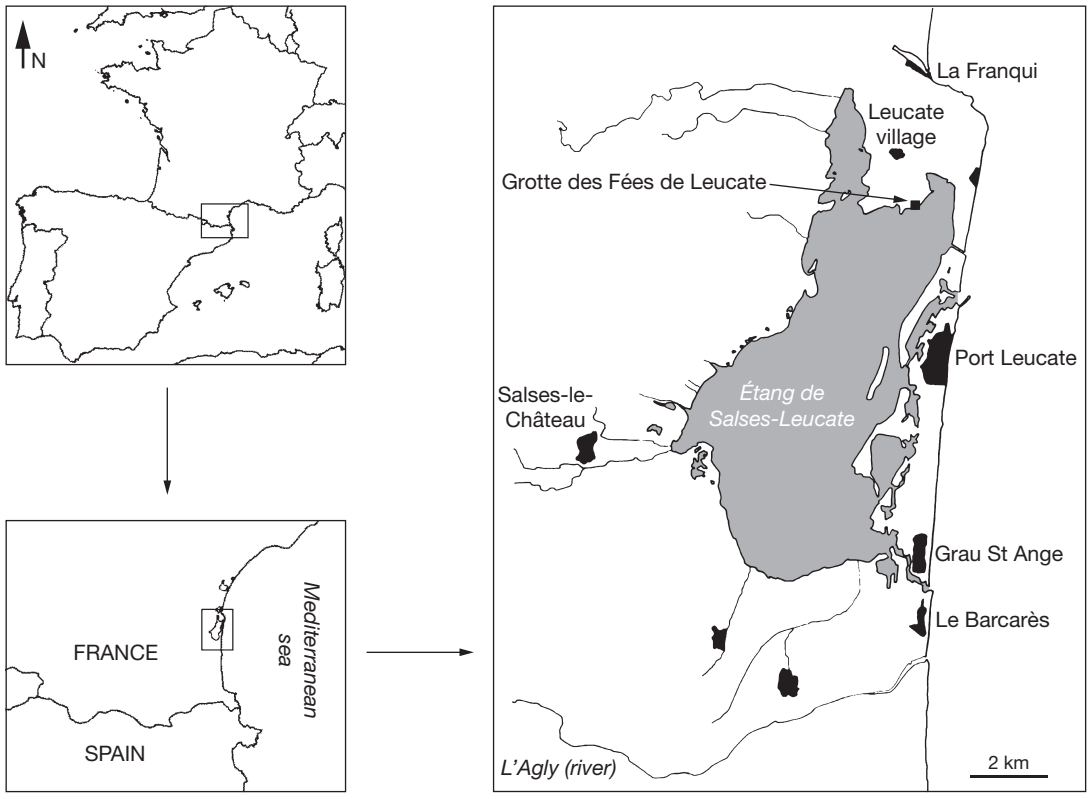

FIG. 1. — Location of Grotte des Fées de Leucate (Leucate, Aude, France).

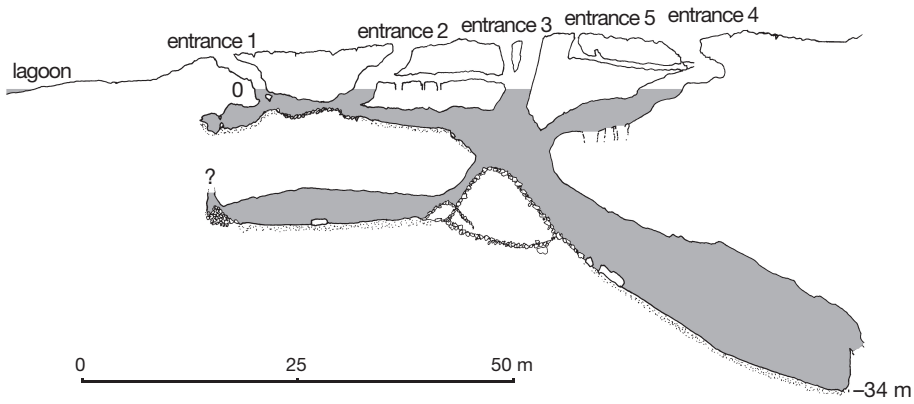

FIG. 2. — Profile of Grotte des Fées de Leucate (Leucate, Aude, France). Survey: F. Bréhier, D. Gramont and G. Tixier.

Font Caude) and freshwater caves in the same area have not rendered additional specimens.

The new species described herein, together with *Pseudoniphargus adriaticus*, are the only members of the genus reported to occur in metropolitan France. Nevertheless, Notenboom (1988: 165) mentions the presence of the genus in the Pyrénées-Atlantiques (SW France), but without giving the species.

MATERIAL AND METHODS

The specimens were collected with baited traps set in the deepest submerged passages of the cave for 48 h using specialised cave diving techniques. Salinity and temperature profiles of the water column were produced with a SEABIRD SBE19 CTD oceanographic profiler programmed to take readings every 0.5 s. The descent of the profiler was controlled to a rate of *c.* 10 cm/s with the profiler kept in front of the diver to avoid disturbing the water column. Specimens were fixed in the field in 70% ethanol and treated in the laboratory with lactic acid to remove internal tissues to facilitate observation. Drawings were prepared using a camera lucida on Olympus BH2 and Leica DM 2500 microscopes equipped with Nomarski differential interference contrast. Material preserved on slides was mounted in lactophenol and the coverslips sealed with nail varnish. Body measurements were derived from the sum of the maximum dorsal dimensions of head, pereonites, pleosomites and urosomites, and exclude telson length. Material is deposited in the Crustacea collection of the Muséum national d'Histoire naturelle, Paris (MNHN).

Following Boxshall (2004), a distinction is made in antennules and antennae between articles (corresponding to subdivisions of true segments by the formation of annuli, each lacking intrinsic musculature) and proper segments (displaying intrinsic musculature). The so-called (medial and lateral) lobes and palp displayed by the amphipod maxillule are identified as coxal and basal endites, and as endopod, respectively, on the basis of comparison with the basic pattern exhibited in malacostracan crustaceans, where this limb is biramous and comprises protopod with coxa and basis, each with single endite, an up to 3-segmented endopod, and an unsegmented exopod (see Boxshall 1997). With regard to the segmentation of the maxilliped, it is homologised with that of the pereopods, with the so-called palp corresponding to the merus-dactylus portion, whereas the inner and outer lobes are identified as basal and ischial endites, respectively. The term "spine" in descriptions is restricted for rigid armature elements with a hollow central core that do not articulate basally to the body integument.

THE CAVE

Grotte des Fées de Leucate is situated at the NE part of the Corbières mountains and opens only

30 m from the northern shore of the coastal lagoon of Salses-Leucate (Fig. 1). It has five entrances interconnected by underwater passages (Fig. 2). The main entrance leads to a submerged room followed by a passage that reaches a depth of –34 m at its furthest point. The total length of the cave exceeds 235 m. It is excavated in Early Cretaceous limestone of Barremo-Aptian age (112 to 130 Ma) (see Aunay *et al*. 2002), and is currently disconnected from any karstic system (Ladouche *et al*. 2000).

The salinity and temperature profile of the water column was produced on 7 December 2003 after several days of strong rainfall. Aside from a surface layer (3 m) of mixed water, three additional pycnoclines were discernible at depths of 5-12, 18-20, and 32-34 m (Fig. 3). At the cave bottom (–37 m depth), salinity reached 22‰, which was the same as in the neighbouring lagoon at that time. Water temperature in the cave remained comparatively warm and stable between 15.5-16.5°C throughout the entire column.

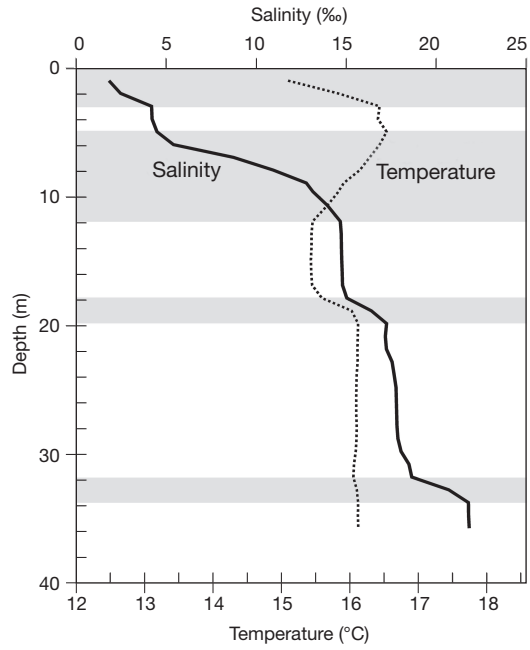

FIG. 3. — Temperature and salinity profile of the water column at Grotte des Fées de Leucate (Leucate, Aude, France) on December 7, 2003. Layers in gray correspond to pycnoclines.

SYSTEMATICS

Suborder GAMMARIDEA Latreille, 1802
Family MELITIDAE Bousfield, 1977
Genus *Pseudoniphargus* Chevreux, 1901

Pseudoniphargus leucatensis n. sp.
(Figs 4-9)

HOLOTYPE. — **France.** Aude, Leucate, Grotte des Fées, UTM coordinates (use 31): 050289E/4749421N, altitude: 5 m, 8.XII.2003, F. Bréhier coll., preparatory ♀ (oostegites non-setose) 3.91 mm, completely dissected and mounted on single slide (MNHN-Am 7541).

PARATYPES. — Same data as holotype, ♂ 4.41 mm with first and second gnathopods, pereopods 5 to 7, and third uropod mounted on single slide (MNHN-Am 7542); 3 brooding ♀♀ (oostegites setose) 5.19, 4.37 and 4.32 mm in ethanol vial except first and second gnathopods, and sixth and seventh pereopods of 5.19 mm specimen, which are mounted on single slide (MNHN-Am 7543).

ETYMOLOGY. — Species named after Leucate, the town where the cave harbouring the new species is located.

DIAGNOSIS. — Gnathopod II not sexually dimorphic, with short carpus. Outline of basis of pereopods V-VII sexually dimorphic, with both margins convex and with overhanging posterodistal lobe in male, whereas margins subparallel and posterodistal lobe present but not overhanging in female. Protopod of uropod I lacking basofacial robust seta. Protopod of uropod III sexually dimorphic, proportionaly more elongated in male. Exopod of male uropod III not strongly elongated (less than 12 times as long as wide), slightly upcurved and tapering; female exopod similar but shorter (about 8.8 times as long as wide). Telson wider than long, with distal margin shallowly excavated and with two distal robust setae at each side.

DESCRIPTION OF FEMALE HOLOTYPE

Body unpigmented, eyeless (Fig. 4A). Head lacking rostrum, with broadly rounded lateral lobes (Fig. 4B). Antennule (Fig. 4B) about one-third of body length. Peduncle segments progressively shorter, relative lengths 1 : 0.74 : 0.45. Main flagellum composed of 10-12 articles; aesthetascs present on articles 4 to 12, each shorter than corresponding

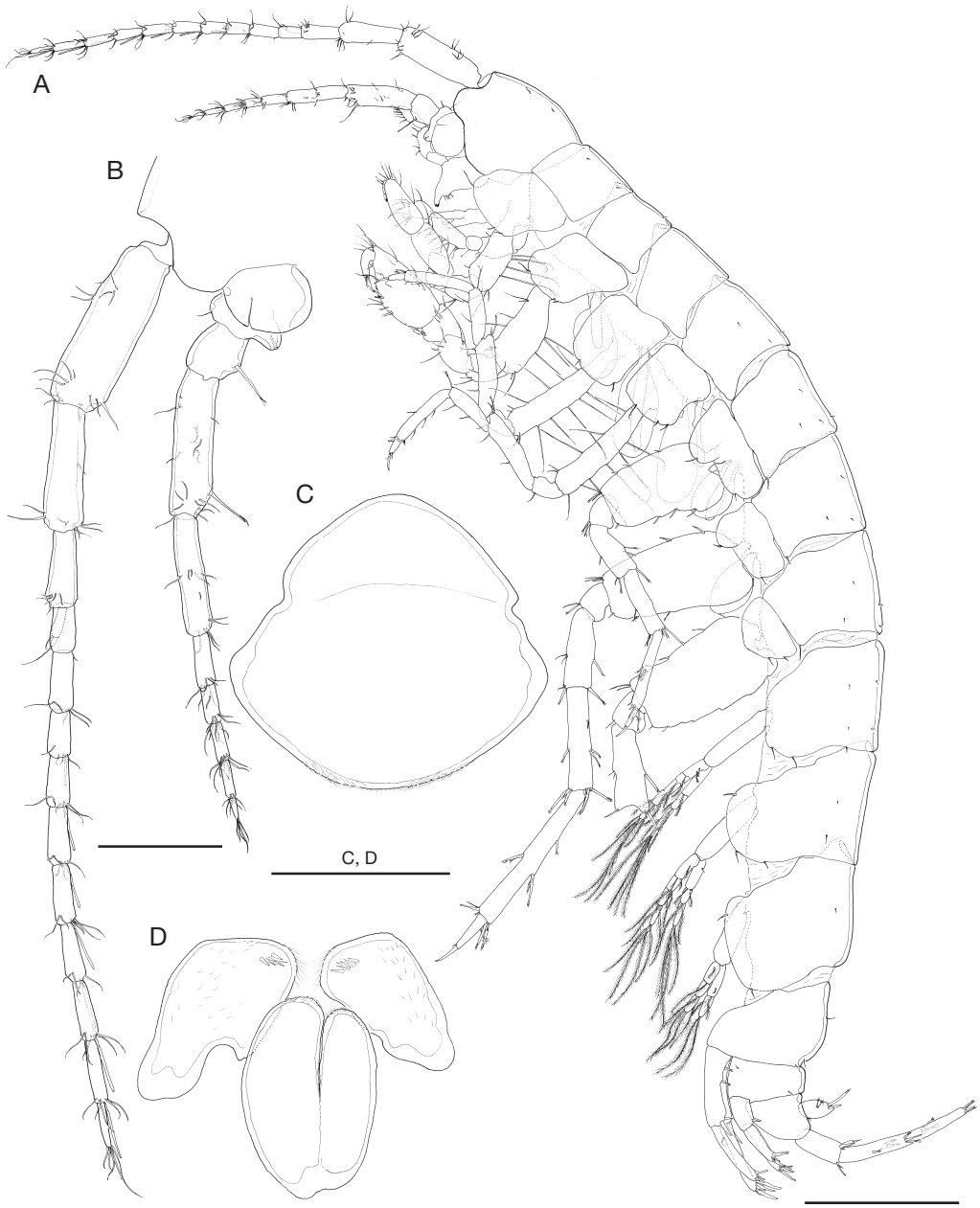

FIG. 4. — *Pseudoniphargus leucatensis* n. sp., ♀ holotype: **A**, general aspect, lateral view; **B**, inset of head with left antennule and antenna attached, lateral view; **C**, labrum, anterior view; **D**, paragnaths. Scale bars: A, 0.5 mm; B, 0.2 mm; C, D, 0.1 mm.

article except distal. Accessory flagellum shorter than first article of main flagellum, 2-articulate. Antenna (Fig. 4B) about two-thirds length of antennule. Peduncle segments 3 to 5 relative length 0.36 : 1 : 0.81. Flagellum 5- or 6-articulate, about half length of peduncle.

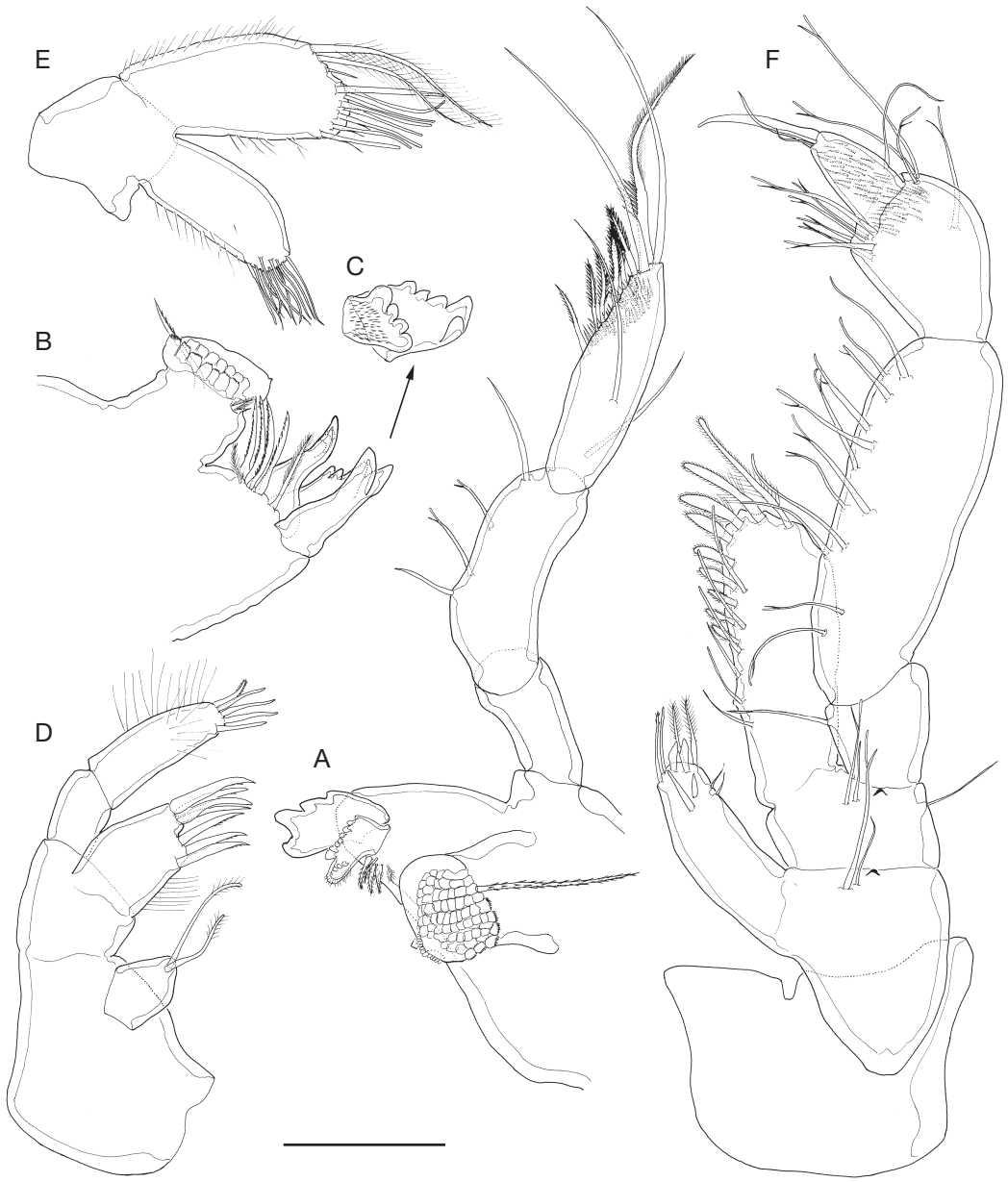

FIG. 5. — *Pseudoniphargus leucatensis* n. sp., ♀ holotype: **A**, right mandible, medial view; **B**, detail of distal portion of left mandible, ventral view; **C**, detail of incisor and lacinia of latter; **D**, maxillule; **E**, maxilla; **F**, right maxilliped with unnaturally bent basal endite, posterior view. Scale bar: 0.1 mm.

Labrum (Fig. 4C) globose, hardly setulose distally. Paragnaths (Fig. 4D) with well-developed inner lobes; patch of lamellar spinules placed close to distomedial angle of outer lobes. Right mandible (Fig. 5A) incisor 4-denticulate; lacinia articulated basally, bifid, one branch with eight rounded denticles,

Fig. 6. — *Pseudoniphargus leucatensis* n. sp., ♀ holotype: **A**, left gnathopod I, medial view; **B**, right gnathopod II, medial view. Scale bar: 0.1 mm.

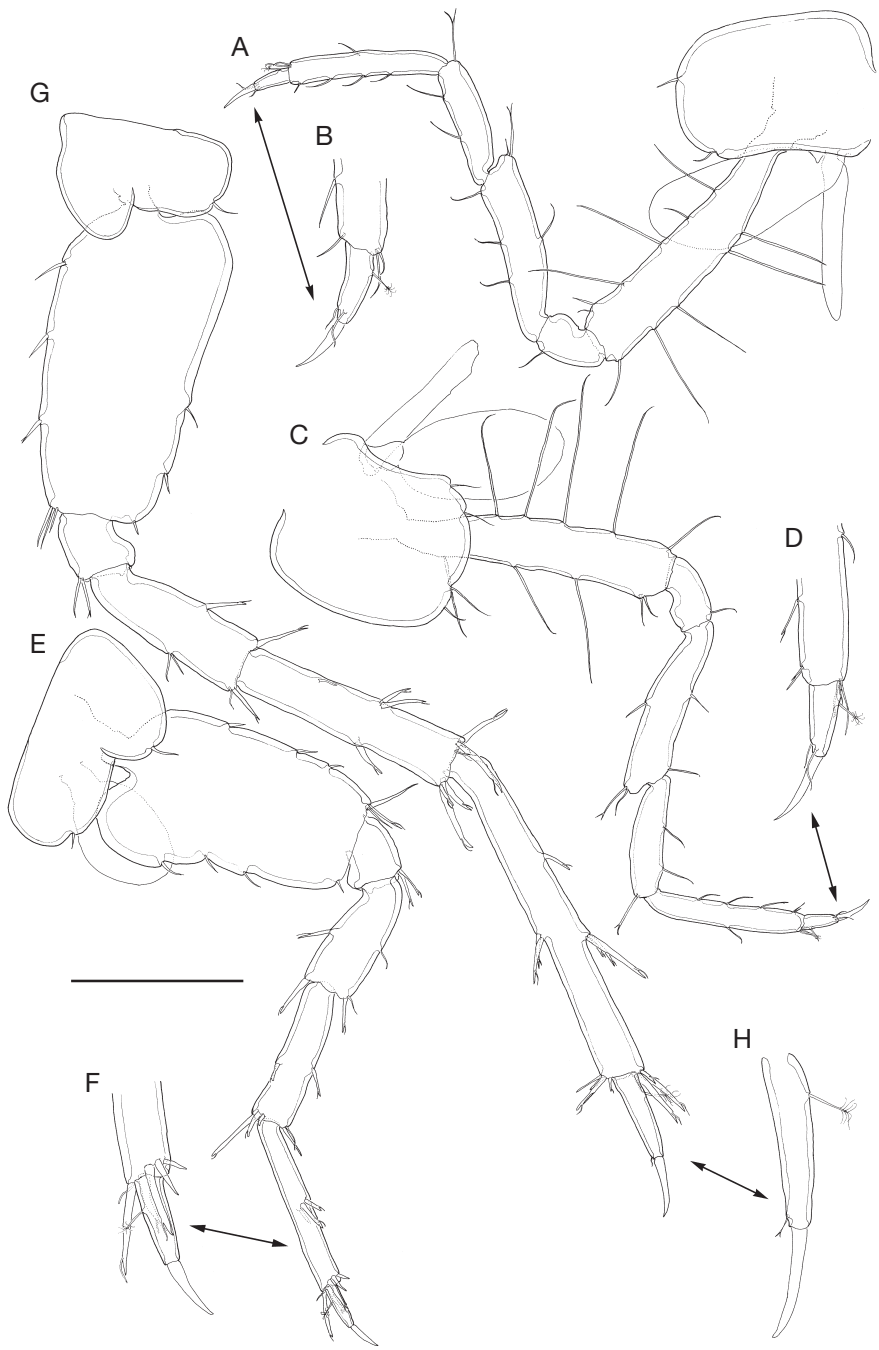

FIG. 7. — *Pseudoniphargus leucatensis* n. sp., ♀ holotype: **A**, left pereopod III, lateral view; **B**, same showing detail of nail, medial view; **C**, left pereopod IV, lateral view; **D**, same showing detail of nail, medial view; **E**, right pereopod V, lateral view; **F**, same showing detail of nail, lateral view; **G**, left pereopod VI, lateral view; **H**, same showing detail of nail, lateral view. Scale bar: A, C, E, G, 0.25 mm; B, D, F, H, 0.125 mm.

other branch 4-denticulate with setulose distal surface; spine row with three pappose (= circumplumose) elements; two reduced setae implanted adjacent and dorsal to spine row. Molar process columnar, with sclerotised grinding surface; stout pappose molar seta on proximal surface of process, plus short plumose setae on anterior surface (as in Fig. 5B). Palp 3-segmented, relative length of segments 0.61 : 0.78 : 1; segment 2 with four setae on medial margin; segment 3 with distal patch of short spinules and with six equally long D-setae, three E-setae, one A-seta and one B-seta (cf. Stock 1974); one of E-setae with distinct proximal row of long setules on one side; ornamentation of rest of setae as figured. Left mandible as right counterpart except for longer elements of spine row, which are denticulated instead of pappose (Fig. 5B), 5-denticulate incisor and 4-denticulate lacinia mobilis (Fig. 5C); latter similar in appearance and orientation to incisor, with proximodistal portion developed as articular condyle (see Fig. 5B).

Maxillule (Fig. 5D) coxal endite (= inner lobe) subtriangular with two distal setae bearing two distal rows of long thin setules. Basal endite (= outer lobe) with seven stout denticulated robust setae distally. Endopod (= palp) 2-segmented, distal segment setulose with five stout robust setae distally.

Maxilla (Fig. 5E) inner lobe with setulose medial margin and with apical cluster of short and slender setae separated in two sets by reduced seta. Outer lobe with both margins setulose and with cluster of unequal setae distally, one of them reduced.

Maxillipeds (Fig. 5F) with fused coxae unarmed. Basis with two setae on posterior surface; basal endite (= inner lobe) with four short robust setae and six unequal setae distally. Ischium with two setae on posterior surface and one lateral seta; ischial endite (= outer lobe) not reaching midway along carpus (= second palp segment), with eight setulose robust setae along distomedial and distal margins, setae progressively longer towards distal; stiff setulose seta with blunt tip on distolateral angle; submarginal row of six short and smooth setae along medial margin. Merus with seta on medial margin. Carpus 2.8 times as long as wide, with six pairs of setae along medial margin. Propodus expanded distally, with about six setae on distomedial angle and 3 or 4 setae on distolateral angle; cluster of spinules covering anterodistal (= dorsodistal) surface of segment. Dactylus with seta proximally on lateral margin and two unequal setae on distomedial angle; patch of spinules covering anterior surface of segment. Unguis slender, slightly longer than dactylus.

Coxal gills on gnathopod II and pereopods III-VI (Fig. 4A), each with well-defined stalk (Figs 6B; 7A, C, E). Oostegites on gnathopod II and pereopods III-V (Figs 4A; 6B; 7A, C).

Gnathopod I (Figs 4A; 6A) coxa with three setae on ventral margin. Merus posteromedial surface densely setulose. Carpus slightly shorter than propodus, with three clusters of setae on posterior margin, and another two on medial surface. Propodus 1.5 times longer than wide, with maximum width attained at palm angle, placed at 61% maximum (= anterior margin) length of segment. Armature on palm angle and palm margin not fully developed or teratological (compare with condition displayed by brooding females, described under Variability below): palm angle with long, bifid, flagellate robust seta on lateral side, plus 2 + 1 shorter bifid flagellate robust setae on medial side; posterior half of palm margin convex, anterior half straight; margin microtuberculate on medial side as figured. Nail 3.1 times longer than broad; dactylus: unguis length ratio 2.3. Dactylus with three blunt smooth setae plus triangular process on medial margin.

Gnathopod II (Figs 4A; 6B) coxa with three setae on ventral margin. Carpus about 68% length of propodus, with well-developed posterior lobe. Propodus slender, subrectangular, 1.6 times longer than wide, palm angle placed about 60% of maximum length of segment, with three unequal flagellate robust setae on medial side; palm margin slightly convex, with microtuberculate integument, armed as figured. Two clusters of setae on posterior margin of segment. Nail 5.5 times longer than broad; dactylus: unguis length ratio 1.9. Dactylus with two unequal setae subdistally.

Pereopods III-IV (Fig. 7A-D) of about same length. Coxal plate of pereopod III (Fig. 7A) 1.3 times longer than wide with straight anterior and slightly concave posterior margins, distal margin convex with two short setae. Nail (Fig. 7B) 4.5

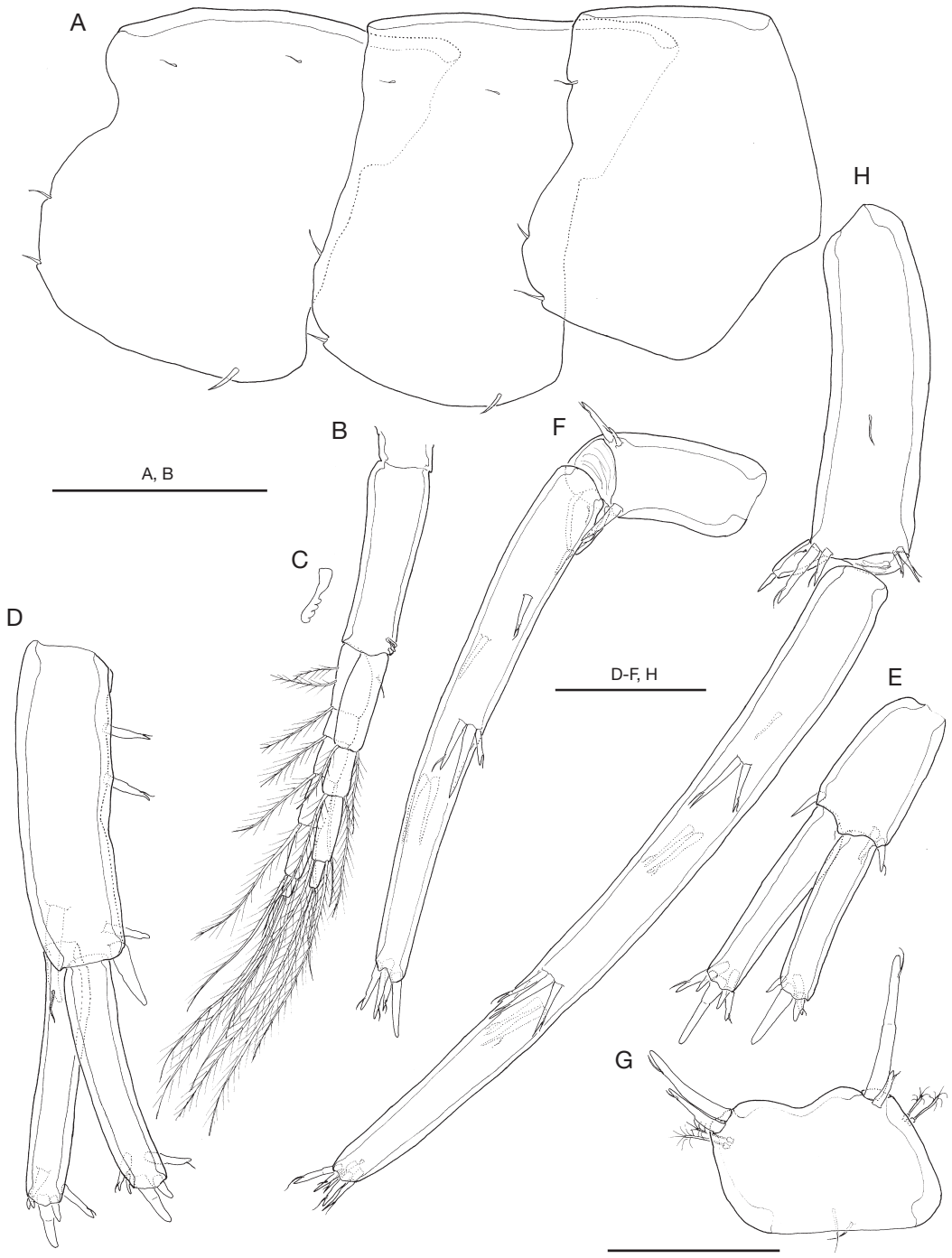

FIG. 8. — *Pseudoniphargus leucatensis* n. sp.: **A**-**G**, ♀ holotype; **A**, right epimeral plates, lateral view; **B**, right pleopod I, anterior view; **C**, same showing detail of retinacle; **D**, left uropod I, anterior view; **E**, left uropod II, anterior view; **F**, left uropod III, lateral view; **G**, telson, dorsal view; **H**, right uropod III of ♂ paratype 4.41 mm, lateral view. Scale bars: A, B, 0.25 mm; D-F, H, 0.125 mm; G, 0.1 mm.

times longer than wide, dactylus: unguis length ratio 1.3. Coxal plate of pereopod IV (Fig. 7C) roughly subquadrate, with convex anterior and concave posterior margins; posterior emargination ratio (*sensu* Notenboom 1988: 178; i.e. maximum plate width minus minimum plate width divided by length of coxal plate) 0.06; distal margin of plate convex with 3 or 4 short setae. Nail (Fig. 7D) 4.5 times as long as wide, dactylus: unguis length ratio 1.0.

Pereopods V-VII progressively longer towards posterior, each with basis anterior and posterior margins subparallel, hardly serrated, with broad, evenly rounded posteroproximal angle; posterodistal lobe developed but hardly overhanging. Pereopod V (Fig. 7E) coxa with one marginal seta on well-developed, broad anteroventral lobe, and another on hardly developed posteroventral lobe. Basis about 1.6 times as long as wide. Nail (Fig. 7F) 5.2 times as long as wide, dactylus: unguis length ratio 1.4. Pereopod VI (Fig. 7G) coxa with well-developed, broad anteroventral lobe bearing 0-1 seta on margin; posteroventral lobe hardly developed, with marginal seta. Basis 1.9 times as long as wide. Nail (Fig. 7H) 6.6 times longer than broad, dactylus: unguis length ratio 1.5. Pereopod VII (as Fig. 9A, which corresponds to female paratype) coxa with two setae on posterior margin. Basis about twice as long as wide. Nail (Fig. 7J) 5.8 times longer than wide, dactylus: unguis length ratio 1.6.

Epimeral plates (Fig. 8A) each with 1 or 2 setae on convex, evenly rounded posterior margin; plate I ventral margin straight; plates II-III with convex ventral margin, each with slender spine on anterior portion of margin.

Pleopods I-III (Fig. 8B) progressively shorter towards posterior (Fig. 4A). Protopods each with two retinacles (Fig. 8C). Exopods 6-, 5-, and 3-articulate, respectively; endopods 4-, 4-, and 2-articulate, respectively.

Uropod I (Fig. 8D) not overreaching tip of rami of uropod II; protopod about 3.4 times longer than wide, lacking basofacial robust seta, with two stout robust setae on distolateral angle and two more slender robust setae along posterolateral margin; stout subterminal robust seta present on distomedial angle. Rami shorter than protopod, about equal in length, each with five unequal robust setae distally; reduced slender seta proximally on anterior surface of endopod.

Uropod II (Fig. 8E) protopod about 1.6 times longer than wide, with two robust setae on distolateral angle and single robust seta on distomedial angle. Rami longer than protopod; exopod shorter than endopod, with four terminal robust setae; endopod 1.5 times longer than protopod, with five terminal robust setae.

Uropod III (Fig. 8F) longest, slightly upcurved and tapering; protopod 1.9 times as long as wide, with 1 or 2 robust setae on distolateral angle and two robust setae on distomedial angle. Exopod about 3.2 times longer than protopod and 8.8 times as long as wide, with two sets of 1-3 robust setae along both lateral and medial margins, plus 4 or 5 terminal spines. Endopod reduced, subtriangular, with single robust seta on tip and with reduced seta on lateral margin.

Telson (Fig. 8G) subrectangular, wider than long, with distal emargination shallow and wide, with two unequal apical robust setae on each side, medial clearly longer than lateral, plus two penicillate setae (= with distinct articulated pedestal and bearing two distal rows of long thin setules) subterminally on each lateral margin; two smooth slender setae placed proximally on posterior surface.

Variability

The specimen selected as holotype is the only one retaining all limbs, the rest of females, even though displaying setose oostegites, lack some of the pereopods and the third uropods. Unfortunately, the armature of the palm angle and palm margin of the first gnathopod of the holotype looks abnormal or not fully developed compared with the armature displayed in homologous position by the rest of the specimens. The armature of the latter comprises two bifid robust setae on medial side of palm angle and four bifid robust setae on lateral side of angle (Fig. 9F); in addition, there is a row of up to six reduced bifid robust setae running between the four bifid robust setae on the lateral side of angle and the angle itself (see Fig. 9G). Other variability noticed involves 11 or 12 articles on the flagellum of the antennule; 5 or 6 articles on the flagellum of the antenna; 1 or 2 marginal robust setae on

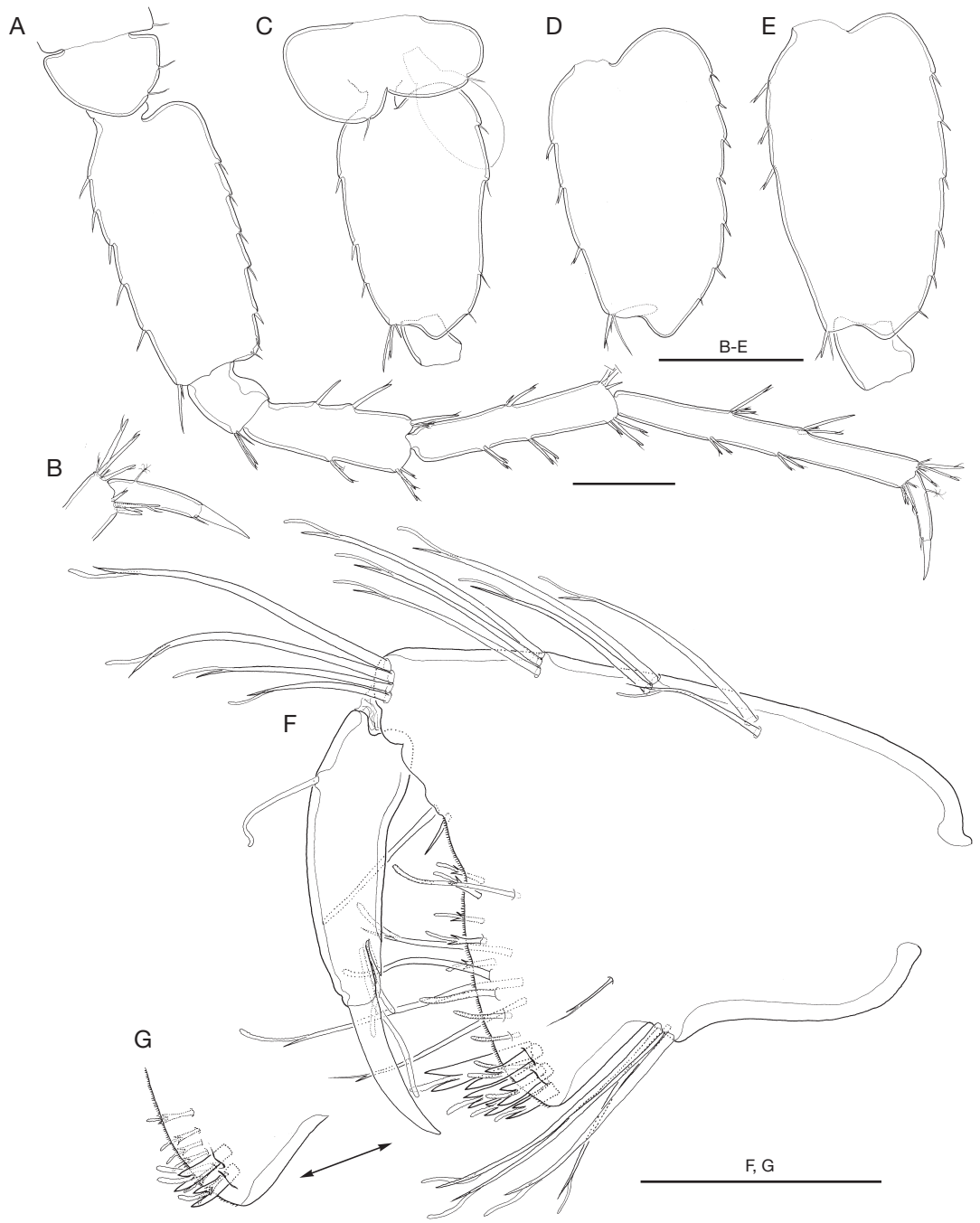

FIG. 9. — *Pseudoniphargus leucatensis* n. sp.: **A**, left pereopod VII of brooding ♀ paratype 5.19 mm, lateral view; **B**, same showing detail of nail; **C**-**E**, proximal portion of left pereopods V to VII of ♂ paratype, lateral view; **F**, propodus and nail of right gnathopod I of brooding ♀ paratype 5.19 mm, medial view; **G**, same showing detail of palm angle, with bifid robust setae on lateral side not represented to unveil row of six short and more slender bifid robust setae not shown in F, medial view. Scale bars: A-E, 0.25 mm; F, G, 0.1 mm.

the epimeral plates II-III; 4-6 setae on the second segment of the mandibular palp; 6-13 D-setae on the third segment of the mandibular palp; 2-4 robust setae on the posterolateral margin of the protopod of the first uropod; and 0 or 1 robust seta on the posterolateral margin of the protopod of the uropod II.

Description of male paratype

As female except for the comparatively longer third uropod (Fig. 8H), with protopod about 3.5 times longer than wide compared to only 1.9 times in female, and exopod 11.4 times longer than wide (vs. 8.8 times in female). In addition, the basis of pereopods V-VII has convex anterior and posterior margins (margins subparallel in female) and a well-developed, overhanging posterodistal lobe (Fig. 9C-E). Sexual dimorphism in the second gnathopod is not apparent: the carpus attains about 67% length of propodus (68% in female), whereas the propodus is 1.6 times longer than wide, as in the female, and has the palm angle placed at 66% of maximum length of segment (at 60% in female).

Remarks

The genus *Pseudoniphargus* currently comprises 65 species distinguished by their different combinations of a standard set of features rather than by outstanding autapomorphic traits or by different modes of life (Stock 1980, 1988; Notenboom 1986, 1987a, b, 1988; Stock *et al.* 1986; Pretus 1988, 1990; Boutin & Coineau 1988; Karaman & Ruffo 1989; Sánchez 1989, 1990, 1991; Jaume 1991; Stock & Abreu 1992; Coineau & Boutin 1996; Fakher el Abiari *et al.* 1999). Excluding the three species known only from females (*viz. P. unispinosus* Stock, 1988, *P. littoralis* Stock & Abreu, 1992, and *P. africanus italicus* Karaman & Ruffo, 1989), only 10 species share with the new species the display of a sexually dimorphic basis of pereopods V-VII with the posterodistal angle strongly overhanging in the male but hardly developed or wanting in the female. Most of these (*viz. P. salinus* Stock, 1988, *P. gomerae* Stock, 1988, *P. cupicola* Stock, 1988, *P. candelariae* Sánchez, 1990, *P. macrurus* Stock & Abreu, 1992, *P. porticola* Stock, 1988 and *P. longicauda* Stock, 1988) inhabit the Macaronesian archipelagoes, although *P. mateusorum* Stock, 1980 is known from the coast of Portugal. Only *P. adriaticus* S. Karaman, 1955 and *P. mercadali* Pretus, 1988 share with the new taxon a western Mediterranean distribution. All these species differ from *P. leucatensis* n. sp. in showing a basofacial robust seta on the protopod of the uropod I. In addition, *P. porticola*, *P. adriaticus*, *P. mercadali*, *P. longicauda* and *P. macrurus* differ in the extraordinary elongation of the exopod of the male uropod III, which is more than 15 times as long as wide, strongly upcurved and not tapering. *Pseudoniphargus gomerae* is easily distinguished from the new taxon by its non-sexually dimorphic uropod III, which is hardly elongated (exopod less than 8 times longer than wide). The remaining four species (viz. *P. salinus*, *P. cupicola*, *P. candelariae* and *P. mateusorum*) have an exopod on the uropod III that is similar to the new species, being moderately elongated (11 to 14 times as long as wide), slightly upcurved and tapering in the male. Nevertheless, none has a sexually dimorphic protopod on this uropod as in the new species.

As previously mentioned, two species of *Pseudoniphargus* are known only from the female (*P. unispinosus* and *P. africanus italicus*), or the single male specimen known does not retain the pereopods (*P. littoralis*). It is therefore impossible to check whether the basis of pereopods V-VII is sexually dimorphic in these species. Nevertheless, all of them are easily distinguishable from the new species based on the presence of a basofacial robust seta on the protopod of the uropod I. In addition, *P. unispinosus* has a peculiar telson, with a non-excavated distal margin and provided with a single terminal robust seta on each side (telson slightly excavated and with two distal robust setae each side in the new species), and the exopod of the uropod III is shorter (7 times as long as wide vs. 8.8 in the female of the new species). Likewise, *P. littoralis* can be separated by the morphology of the uropod III, with the protopod not sexually dimorphic whereas the exopod of the male is comparatively shorter (less than 10 times as long as wide vs. 11.4 in the new species), and it is neither slightly upcurved nor tapering. *Pseudoniphargus africanus italicus* differs in the longer-than-wide telson, and in the proportionally shorter exopod of the uropod III (7.6 times as long as wide vs. 8.8 times in the new species).

As regards the origin and relationships of the new species, its ties to coastal brackish waters located adjacent to the shoreline and its apparent absence from inland groundwaters suggests a very recent marine derivation. It shows the closest phenetic affinity to three anchialine taxa from the Canaries (viz. *P. salinus*, *P. cupicola*, *P. candelariae*) and one from the coast of Portugal (*P. mateusorum*), especially to the latter, rather than to *P. adriaticus*, the species broadly distributed around the shores of the western Mediterranean and Adriatic Sea that could be considered as its natural direct ancestor in a peripatric speciation scenario, like that envisaged by Notenboom (1988) for the evolution of the genus. If the phenetic resemblance between these species reflects their actual phyletic relatedness, they are presumably derived from a common thalassostygobiont ancestor distributed along the shores of the western Mediterranean and neighbouring Atlantic coasts, that has yet to be discovered or that has recently become extinct.

Acknowledgements
This is a contribution to Spanish MEC projects CGL2005-02217/BOS and CGL2006-01365/BOS. We are grateful to the Salses-le-Château and Leucate communes for giving us access to the cave.

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Submitted on 9 July 2007;
accepted on 18 February 2008.