

Two new species of the amphipod genus *Pseudoniphargus* (Crustacea) from Cabrera (Balearic Islands)

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Abstract

Two new, sympatric species of *Pseudoniphargus* are described from the island of Cabrera (Balearic Islands), thus rising to 7 the number of taxa known in the archipelago. They inhabit stenohaline fresh ground waters in the main island valley, being absent from anchihaline cave lakes of the littoral zone. They differ clearly in morphology: one species has second gnathopods strongly developed, while the other has second gnathopods with narrow hands. This is a pattern already described for other insular sympatric species. An origin via "regression evolution model", from an ancestor different for each species, before Tortonian times in the Mallorca-Cabrera paleo-island, is proposed.

Résumé

Deux nouvelles espèces sympatriques de *Pseudoniphargus* sont décrites de l'île Cabrera (Baléares), ce qui fait monter à 7 le nombre des taxa du genre actuellement connus de cet archipel. Les nouvelles espèces peuplent les eaux souterraines douces et stenohalines de la vallée principale de l'île, étant absentes des lacs des grottes anchihalines de la zone littorale. Elles diffèrent nettement par leur morphologie, une des espèces ayant les seconds gnathopodes fortement développés, tandis que ceux de la seconde espèce ont la paume étroite. Il s'agit ici d'un patron déjà décrit pour d'autres espèces insulaires sympatriques. On suppose que l'origine des nouvelles espèces – conformément au "regression evolution model" et à partir d'un ancêtre différent pour chaque espèce – doit être placée avant le Tortonien, dans la paléo-île Mallorca-Cabrera.

Introduction

In the last few years the knowledge of crustacean stygofauna of the Balearic islands has increased

enormously. Some genera of Amphipoda proved to be very diversified on the different islands, following a vicariant pattern of distribution (Platvoet, 1984; Pretus, 1988, 1989, 1990). Especially members of the genus *Pseudoniphargus* Chevreux, 1901 have diversified to a surprising degree in comparison to the reduced area of the islands (Gourbault & Lescher-Moutoué, 1979; Pretus, loc. cit.); typically for this genus, when a new population is described, it is usually attributed to a new species (Notenboom, 1986, 1987a, 1987b; Stock, 1988). This pattern has been attributed to a "non-adaptative" type of "radiation", with different morpho-species characterized mainly by different combinations of the same set of features, but not by a divergence in ecological roles or modes of life (Notenboom, 1988).

The evolutive pattern of the genus *Pseudoniphargus* evoked interest to the prospection of some previously unexplored stygohabitats of the small islands off the south coast of Mallorca. In the present paper two new species of *Pseudoniphargus* are described from fresh ground waters of Cabrera, thus rising to 7 the number of taxa known in the whole Balearic archipelago. Results concerning other groundwater Crustacea from Cabrera are published elsewhere (Jaume, in press). All the material examined is deposited in the crustacean collection of the Museu de la Naturalesa de les illes Balears (CR-MNCM).

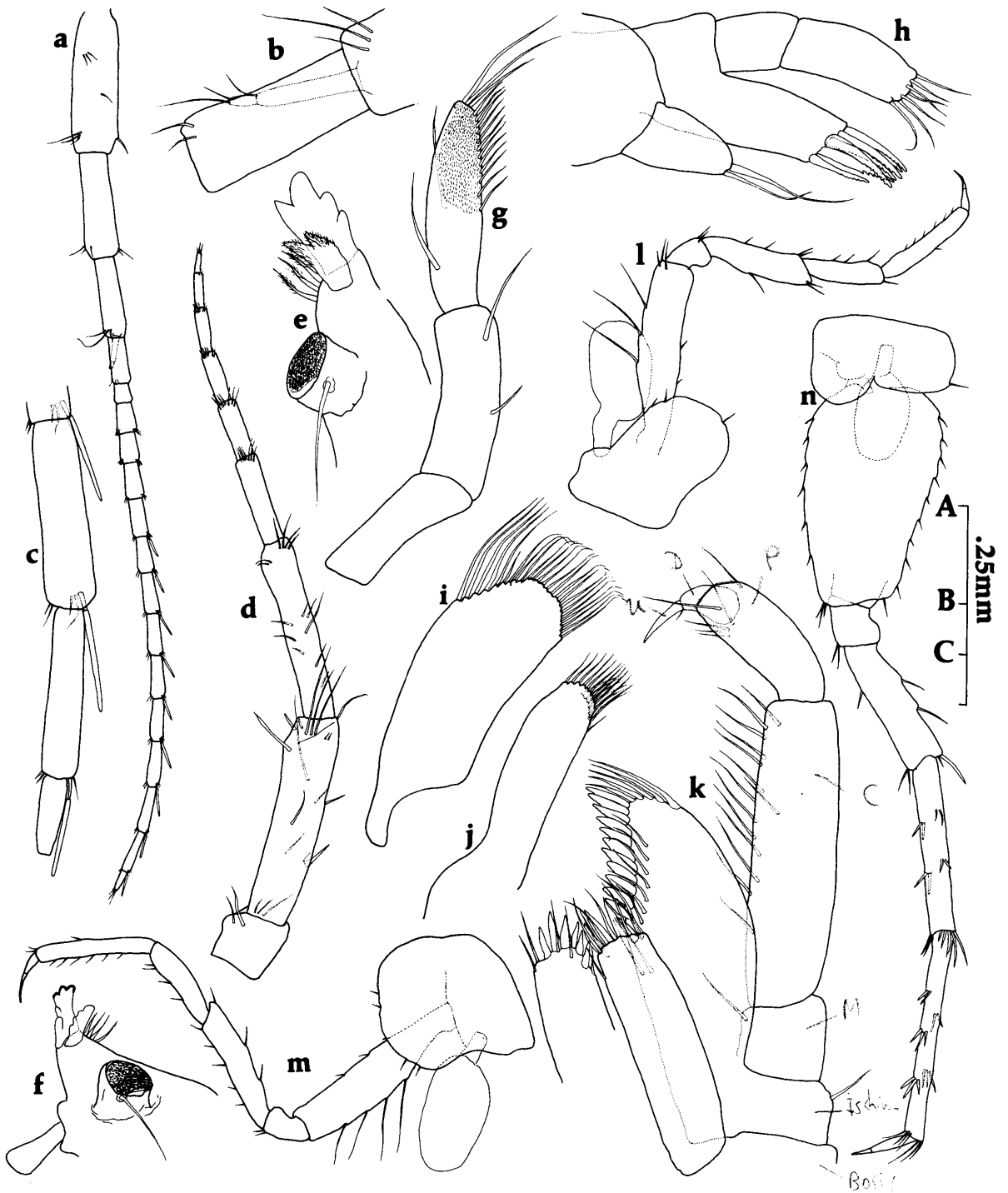


Fig. 1. *Pseudoniphargus triasi* n. sp. (a–n, ♂ holotype): a, antenna 1 (scale C); b, accessory flagellum of antenna 1 (A); c, tip of antenna 1 (A); d, antenna 2 (B); e, right mandible (B); f, left mandible (B); g, detail of antenna 1; h, detail of antenna 1; i, outer lobe of maxilla 2 (A); j, inner lobe of maxilla 2 (A); k, maxilliped (A); l, pereiopod 3 (C); m, pereiopod 4 (C); n, pereiopod 6 (C).

Descriptions

Pseudoniphargus triasi n. sp. (Figs. 1–3)

Material examined. – Hort de can Feliu (Cabrera, Balearic Islands). Phreatic pool at the end of a long (ca. 20m) man-made gallery, at 10m a.s.l., leg. D.J. & M. Trias. 14 June 1990. “Freshwater”. 6♂♂, 1♀, 1 juvenile. Holotype ♂ 9.5 mm (MNCM CR-101); allotype: ♀ 8.2 mm (MNCM CR-102). Paratypes: 5 ♂♂ (8.0, 7.8, 8.2, 7.7 and 8.2 mm (MNCM CR-103 to 107).

Description of ♂ holotype. – Antenna 1 (Figs. 1a, b, c): accessory flagellum shorter than first flagellum segment. Aesthetascs on 6th to 14th segments, their length less than that of segments except for distal aesthetasc, which surpasses apex of antenna. Antenna 2 (Fig. 1d) with 6-segmented flagellum, shorter than peduncle.

Upper and lower lip (Figs. 2a, b), and both mandibles (Figs. 1e, f) typical for the genus. Mandible palp segment 2 with only 2 setae along distoventral margin; segment 3 with 12 D-setae, 3 E-setae, 1 A-seta and 1 B-seta; distinctly longer proximal D-setae lacking (Fig. 1g). Maxilla 1 (Fig. 1h): distal segment of palp with 7 setae; outer lobe with 7 denticulated spines; inner lobe with 2 distal setae, one distinctly longer than the other. Maxilla 2 (Figs. 1i, j): outer lobe with 2 rows of setae without distinct discontinuity between them; inner lobe with one apical row of setae and one sub-apical row of 6 setae shorter than the former ones. Maxilliped (Fig. 1k): outer lobe with a medial row of 12 marginal spines and 5 terminal setae; a row of 10 submarginal setae placed parallel to the row of spines; 4 spines and 6 setae on left inner lobe and 6 spines and 5 setae on right inner lobe.

Coxal plates (Figs. 1l, m, n; 2c, f; 3d, e): ventral margin of plates 1 to 4 with 3-3-3-4 setae. Posterior margin of plate 4 shallowly excavate. Plate 5 with one seta on anterior lobe and 2 setae on posterior lobe. Plate 6 with only 1 seta, on posterior lobe. Plate 7 also with only one posterior seta.

Gnathopod 1 (Figs. 2c, d; 3b): not sexually dimorphic. Basis with 5 posterior, 2 postero-distal and 2 medial setae. Carpus elongate, twice as long as wide (the width considered is the same used be-

low to describe the propodus, e.g., the maximal distance between the anterior and posterior segment margin), with 6 rows of marginal, and 3 rows of medial setae. Propodus 1.7 times as long as wide, of same length as carpus; only one row of posterior setae.

Gnathopod 2 (Figs. 2e, f; 3c): carpus 1.7 times as long as wide, with 1 medial and 3 posterior rows of setae. Propodus elliptical and extended, 0.63 mm in length, and 1.8 times the carpus length, being also 1.8 times as long as wide; length of posterior margin 1.7 times that of total article, bearing 5 rows of long setae. 3 spines on palmar angle, one longer. Palm oblique, with row of 8 spines and 5 setae.

Pereiopods 3–4 (Figs. 1l, m) similar. Basis as long as merus and carpus together. Claws long, in P3 unguis longer than dactylus, in P4 slightly shorter. Coxal gills elliptic.

Pereiopods 5–7 (Figs. 1n; 3d, e, f) with short basis, that of P6 slightly more slender than the rest (ratio length: width 1.5-1.6-1.5, respectively). Posterior margin slightly convex. Posterodistal angle of basis obtuse, while posteroproximal lobe is well developed. Unguis clearly shorter than dactylus. Pereiopod 6 longer than P5.

Epimeral plates 1–3 (Fig. 2g) subquadrate. Ventral margin of plates 1 and 3 straight; that of plate 2 rounded. Number of setae on ventral margin 0-1-1. Posterior margin convex, with rounded angle, and 3-4-5 setae, respectively. Pleopod peduncles with 2 retinaculae. Exopodites 1-2-3 of 8-7-6 segments; endopodites of 6-6-5 segments.

Uropod 1 (Fig. 2h) with elongate peduncle and rami, roughly of same length; peduncle bearing basoventral spine plus 2 dorsal and 1 medial spine; rami without marginal spines. Uropod 2 (Fig. 2i): peduncle with 2 long distal spines; both peduncle and rami without marginal spines. Uropod 3 (Fig. 3g) not sexually dimorphic; peduncle not elongate (roughly twice as long as wide), without marginal armature. Exopodite 14.4 times as long as wide, 4.8 times as long as peduncle, tapering, not markedly upcurved; 6 groups of 1–3 short spines on both margins.

Telson (Fig. 2j) uncleft, wider than long; 3–4 spines on each corner, shorter than telson length; 3 (abnormal) lateral spines on left margin, which do

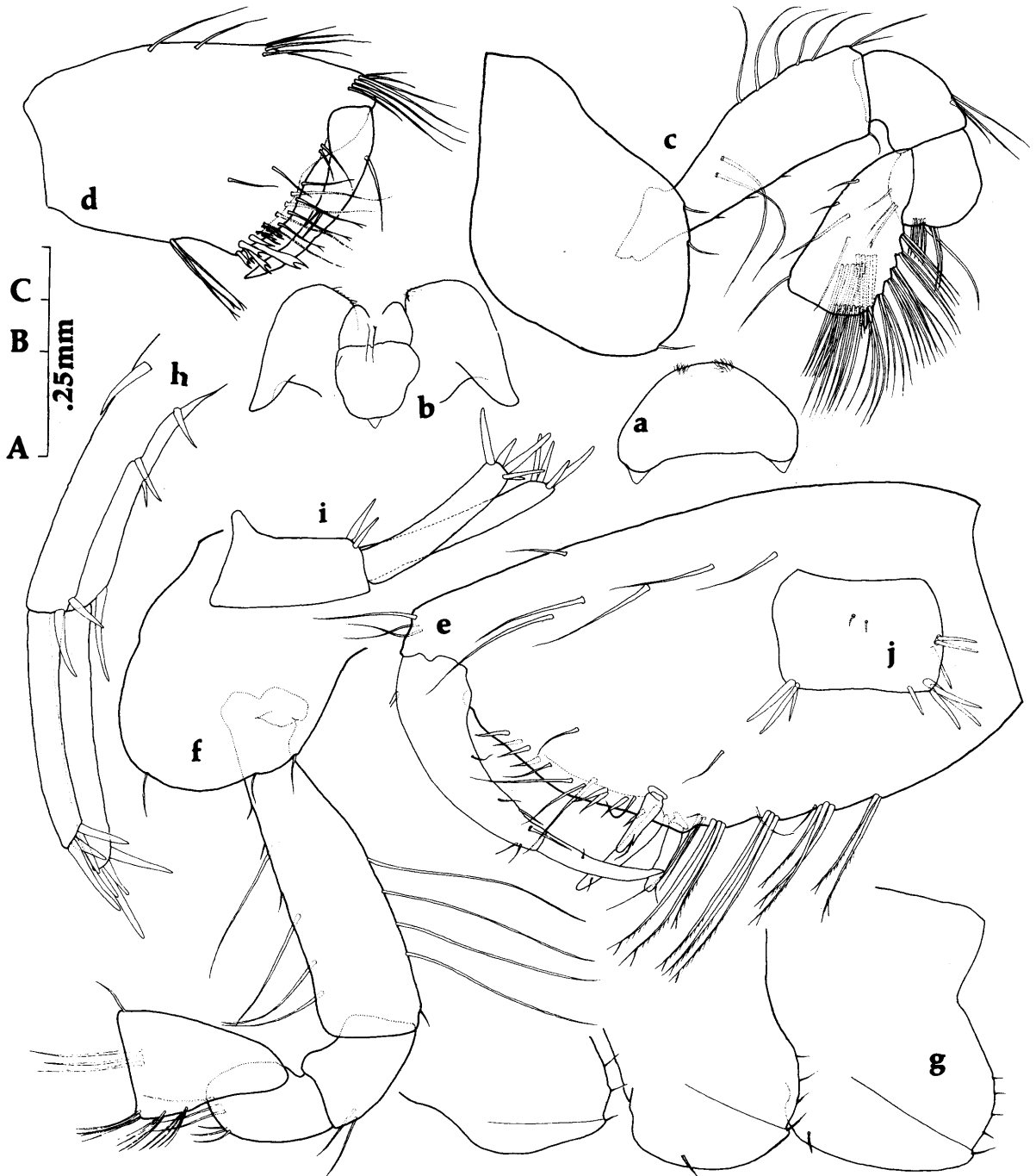


Fig. 2. *Pseudoniphargus triasi* n. sp. (a–j, ♂ holotype): a, upper lip (B); b, lower lip (B); c, coxa-carpus of gnathopod 1 (B); d, propodus-dactylus of gnathopod 1 (A); e, propodus-dactylus of gnathopod 2 (A); f, coxa-carpus of gnathopod 2 (B); g, epimeral plates 1-2-3 (C); h, first uropod (B); i, second uropod (B); j, telson (B).

not show up in other individuals examined; 2 mid-dorsal setules.

♀ allotype. – Accessory flagellum of right antenna

1 longer than first flagellum segment; that of left antenna shorter. Third segment of both mandibular palps without B-setae. Only 4 rows of marginal

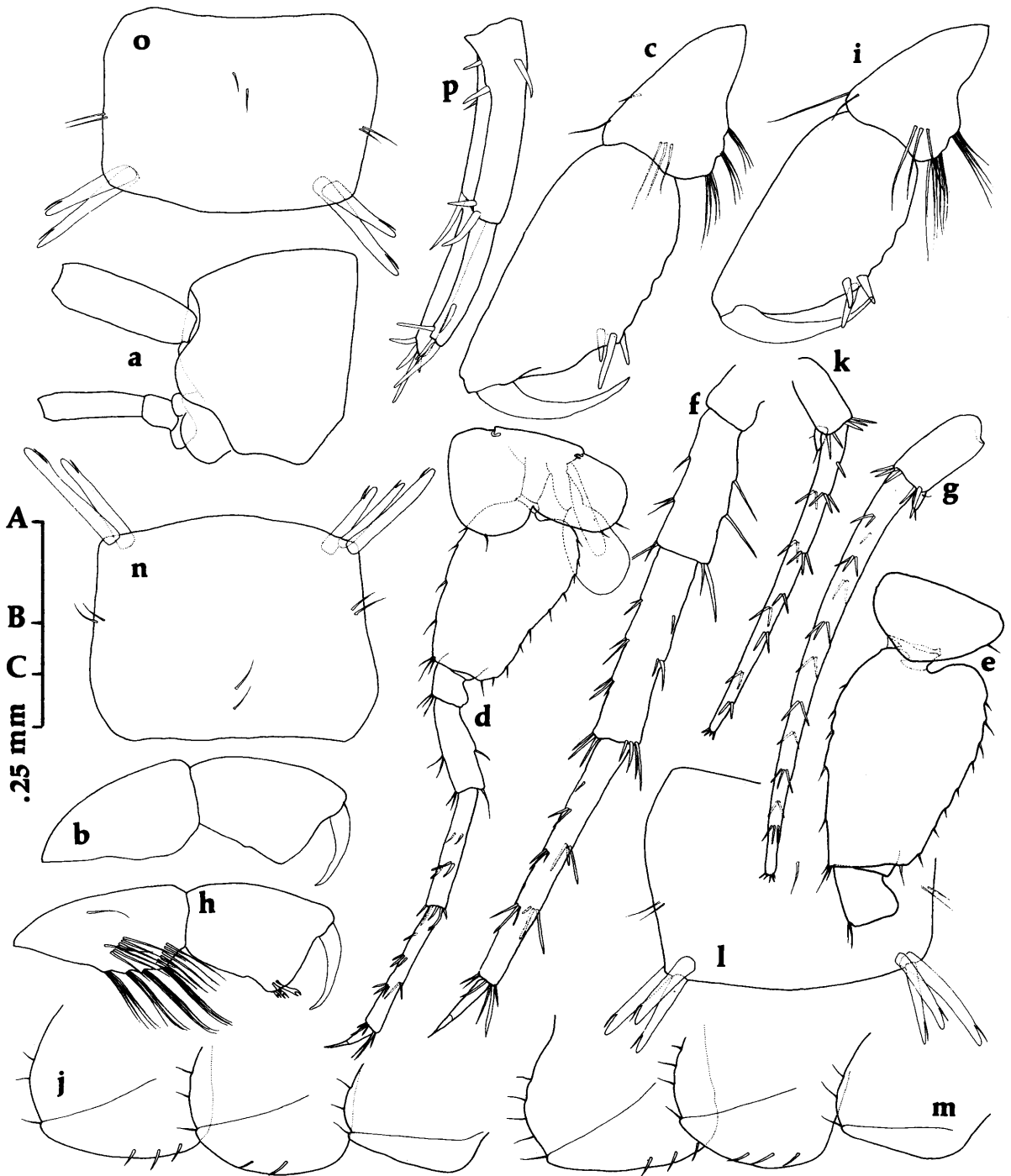


Fig. 3. *Pseudoniphargus triasi* n. sp. (a–g, ♂ holotype; h–k, ♀ allotype; l–m, ♂ paratype 7.8 mm; n, ♂ paratype 8.0 mm; o, ♂ paratype 7.70 mm; p, juvenile 6.0 mm): a, cephalon (C); b, profile of carpus-dactylus of gnathopod 1 (B); c, profile of carpus-dactylus of gnathopod 2 (B); d, paereiopod 5 (C); e, f, paereiopod 7 (C); g, uropod 3 (C); h, profile of carpus-dactylus of gnathopod 1 (B); i, profile of carpus-dactylus of gnathopod 2 (B); j, epimeral plates 1-2-3 (C); k, uropod 3 (C); l, telson (A); m, epimeral plates 1-2-3 (C); n, telson (A); o, telson (A); p, first uropod (B).

setae on carpus of gnathopod 1 (Fig. 3h). Only 2 on carpus of gnathopod 2 (Fig. 3i). Oostegites 2-3-4-5 slender, with 8-8-9-8 setae. Epimeral plates 1-2-3 (Fig. 3j) with 0-2-3 stout spines on ventral margin, and 3-3-3 setae on posterior margin. Uropod 3 (Fig. 3k): exopodite 14 times as long as wide, and 4.3 times as long as peduncle; peduncle 1.9 times as long as wide. Telson uncleft, with 2-3 terminal spines on each corner.

Variability. – One male examined (7.8 mm) bears 5 setae instead of 4 between pars molaris and lacinia on left mandible. Number of A- and B-setae on third segment of mandibular palp always is 1 in all individuals examined except for allotype, which lacks B-setae. Lateral rows of setae on carpus of gnathopod 1: (2)-3. Posterior rows of setae on carpus of gnathopod 2: (2)-3. Epimeral plates 1-2-3 have a uniform outline, but variable number of ventral spines and posterior setae (Figs. 2g; 3j, m); these numbers seem to decrease with individual size. One specimen examined had 3 dorsal spines on peduncle of uropod 1; allotype lacks medial spine on peduncle of this uropod. Uropod 2 of a juvenile (Fig. 3p) with a lateral spine on exopodite, possibly abnormal. Telson always uncleft, but with number of spines on both corners variable (Figs. 2j; 3l, n, o); nevertheless, the general pattern seems 3-3.

Diagnostic characters and affinities. – *P. triasi* is characterized by the following cluster of characters: mandibular palp lacking longer proximal D-setae, and bearing 1 A- and sometimes 1 B-setae on segment 3; a low number (2) of setae along lower margin of segment 2. Carpus of gnathopod 1 elongate, bearing 3 medial rows of setae. Propodus of gnathopod 2 not widened, with convex palmar margin; maximum width of propodus is attained halfway the posterior margin; if any, a slight sexual dimorphism is visible in the length of posterior margin of propodus in terms of palmar length, which is larger in males than in female; length and width of male carpus are also larger than in female. Nevertheless, more female material is needed to confirm these assertions. Posterodistal angle of basis of pereopods 5-7 obtuse, while posteroproximal lobe is well developed. Epimeral plates 1-2-3 with a pronouncedly convex posterior margin, infero-posterior corner rounded, and variable number of

ventral spines: (0)–(1 to 3)–(1 or 3), respectively. The number of ventral spines seems inversely related to body size; so, it is of dubious value to establish series of character transformations with phylogenetic significance, as pointed out by Notenboom (1988) based on this meristic character. First uropod elongated, without marginal spines on rami; peduncle bearing 1 basoventral, 2 dorsal and 1 medial spines. Uropod 2 with 2 long distal spines on peduncle and without lateral spinulation on both rami and peduncle. Uropod 3 exopodite elongate and hardly sexually dimorphic (“c” pattern of Notenboom, 1988, fig. 18). Telson uncleft, wider than long, with generally 3-3 spines on each corner. All the characters listed above clearly differentiate *P. triasi* from its sympatric congeneric *P. daviui* n. sp.

P. triasi differs from other representatives of the genus in the Balearic islands as follows: it differs from *P. adriaticus* Karaman, 1955, and *P. mercadali* Pretus, 1988 in the structure of peduncle and exopodite of uropod 3, not so elongate; the absence of a dentate spur in the mid-line of the posterodorsal margin of metasomite 2; the posterodistal corner of the basis of pereopods 5-7, without overhanging lobe, but forming an obtuse angle. It differs from *P. racovitzai* Pretus, 1990 by, among others, its larger body size, the lengthened exopodite of uropod 3, and the not emarginated telson with spines disposed distally; besides, maximum width of the propodus of gnathopod 2 is not attained at the palmar angle. Differences from *P. pitiusensis* Pretus, 1990 are the not emarginated telson, the obtuse posterodistal angle of the basis of pereopods 5-7, and the shape of propodus of the gnathopod 2, not attaining its maximum width at the palmar angle. *P. triasi* resembles the Formenteran *P. pedrerae* Pretus, 1990 by the shape of the propodus of gnathopod 2 and by the elongated carpus of gnathopod 1; nevertheless they differ, among other characters, in the number and disposition (subdistal in *pedrerae*) of the telson spines, in the posterodistal angle of the basis of pereopods 5-7 (obtuse in *triasi*, with developed lobe in *pedrerae*), and in the absence of setosity in dorsal parts of the body segments in *triasi*.

Identification of *P. triasi* with the key of Noten-

boom (1987b) leads to *P. gibraltarius* Notenboom, 1987 or *P. margalefi* Notenboom, 1987. The former was described from wells of Cádiz, southern Spain (Notenboom, 1987a), but differs from *P. triasi* in its incised telson and in the basis of P5 to P7, with wide posterodistal lobe, slightly overhanging. *P. margalefi* was described from Alicante, eastern Spain (Notenboom, 1987a); it differs from *P. triasi* in its lesser body size, the proportionally shorter uropod 3 exopodite, and in the presence of marginal spinulation in both endo- and exopodite of uropods 1 and 2.

Derivatio nominis. – The species is dedicated to Miquel Trias, one of the most experienced speleologists of the Balearic islands, and companion during our explorations.

Pseudoniphargus daviui n. sp. (Figs. 4–6)

Material examined. – Font de can Feliu (Cabrera, Balearic Islands), same locality and date as *P. triasi*, leg. D.J. & M. Trias. Holotype: ♂ 10.2 mm (MNCM CR-109); allotype: ♀ 9.9 mm (MNCM CR-110); paratypes: 5 ♂♂ (9.4, 7.9, 8.7, 7.3, and 8.3 mm; MNCM CR-110 to 114) and 5 ♀♀ (8.3, 9.5, 9.4, 8.2 and 8.6 mm; MNCM CR-115 to 119); 16 ♂♂, ♀♀ and juveniles in the author's personal collection.

Description of ♂ holotype. – Antenna 1 (Fig. 6a) with 12-segmented flagellum. Aesthetascs from 5th to 11th segment on left antenna, from 4th to 11th segment on right one, all shorter than the 12th segment. Accessory flagellum of left antenna longer than first segment of flagellum (Fig. 4a); that of right antenna abnormal, unisegmented, shorter than first segment of flagellum (Fig. 4b). Antenna 2 (Fig. 4c) with 6-segmented flagellum, shorter than peduncle.

Upper and lower lips (Figs. 5a, b), and left and right mandibles (Figs. 4d, e) typical for the genus. Mandibular palp (Fig. 5c): segment 2 with 6 setae along ventral margin; segment 3 with 2 A-setae, 2 B-setae, 13-D setae, the distalmost longer, and 3 E-setae; no proximal longer D-setae. Maxilla 1 (Fig. 5d): distal segment of palp with 6 setae; outer lobe with 7 denticulated spines; inner lobe with 2 distal setae. Maxilla 2 (Fig. 4f): outer lobe with 2 separate

groups of distal setae, outer one with fewer and longer setae than inner one. Inner lobe with distal setae roughly of same length as in inner row of outer lobe. Maxilliped (Fig. 4g): distal segments of palp slender; outer lobe with a medial row of 11 marginal spines and 8 terminal setae; row of 11 submarginal setae placed parallel to row of spines. Inner lobe with 2 spines and 6 setae in terminal part.

Coxal plates (Figs. 4h, i, j; 5e, g, i; 6c): ventral margin of plates 1 to 4 with 3-3-2-2 setae, respectively. Posterior margin of plate 4 nearly excavate. Plate 5 with one seta on each lobe. Plate 6 with 2 setae on each lobe. Plate 7 with only one seta.

Gnathopod 1 (Figs. 5e, f): not sexually dimorphic. Carpus elongate, 1.7 times longer than wide, with 5 marginal and 2 medial rows of setae. Propodus 1.2 times as long as carpus, and 1.7 times longer than wide, bearing 2 rows of marginal setae. Palmar angle with 5 teeth. Palm with 1 inner and 1 outer rows of long setae.

Gnathopod 2 (Figs. 5g, h; 6b) strong, sexually dimorphic. Carpus very short and wide, 1.2 times as long as wide, with 2 marginal and 1 medial rows of setae. Propodus 2.1 times as long as carpus, and 1.6 times longer than wide, attaining its maximal width at palmar angle. Five rows of posterior marginal setae. Palmar angle with 3 spines. Posterior half of palmar margin with bilobed protuberance. One row of bifid spines just on palmar margin; one row of submarginal spines and setae on inner side, and row of 5 long setae on outer side.

Pereiopods 3-4 (Figs. 4h, i) similar except coxae, described above. Basis as long as merus and carpus together. Unguis slightly longer than dactylus. Coxal gills subrectangular, but that of pereiopod 6 with circular profile.

Pereiopod 5 (Fig. 5i): anterior margin of basis convex, with 4 spines; posterior margin straight, with 8 setules. Posterodistal lobe of basis poorly developed or overhanging. Unguis shorter than dactylus. Pereiopod 6 (Figs. 6c, d): anterior margin of basis convex, with 6 spines; posterior margin straight, with 7 setae; posterodistal lobe present, but not overhanging. Unguis shorter than dactylus. Pereiopod 7 (Fig. 4j): both margins of basis convex, with 5–9 setae, respectively. Posterodistal lobe present but hardly overhanging. Unguis shorter

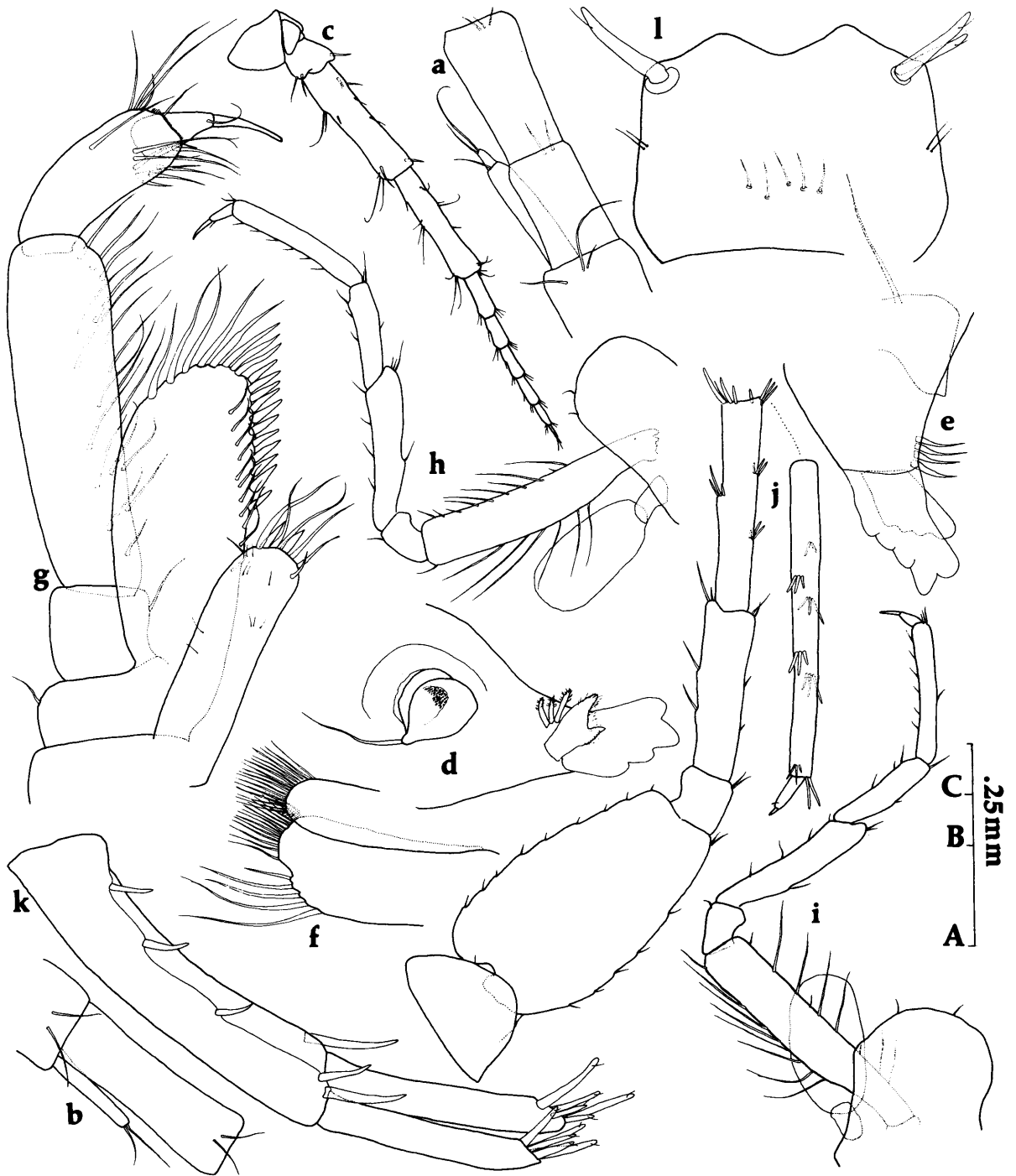


Fig. 4. *Pseudoniphargus daviui* n. sp. (a-1, ♂ holotype): a, accessory flagellum of left antenna 1 (A); b, accessory flagellum of right antenna 1 (A); c, antenna 2 (C); d, right mandible (A); e, left mandible (A); f, maxilla 2 (A); g, maxilliped (A); h, pereopod 3 (C); i, pereopod 4 (C); j, pereopod 7 (C); k, first uropod (B); 1, telson (A).

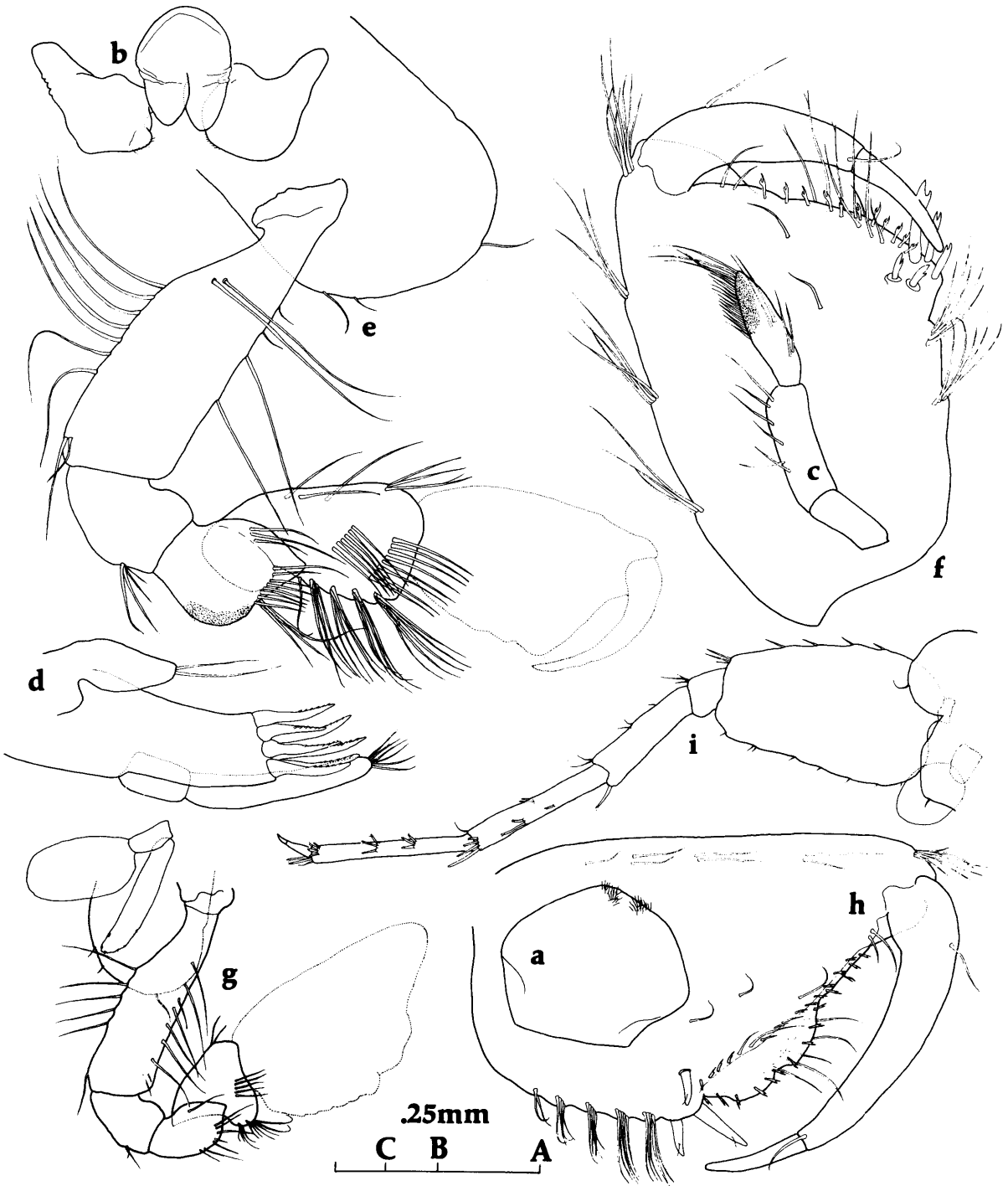


Fig. 5. Pseudoniphargus daviui n. sp. (a–i, ♂ holotype): a, upper lip (B); b, lower lip (B); c, mandibular palp (B); d, maxilla 1 (A); e, gnathopod 1 (B); f, propodus-dactylus of gnathopod 1 (A); g, gnathopod 2 (C); h, propodus-dactylus of gnathopod 2 (A); i, pereopod 5 (C).

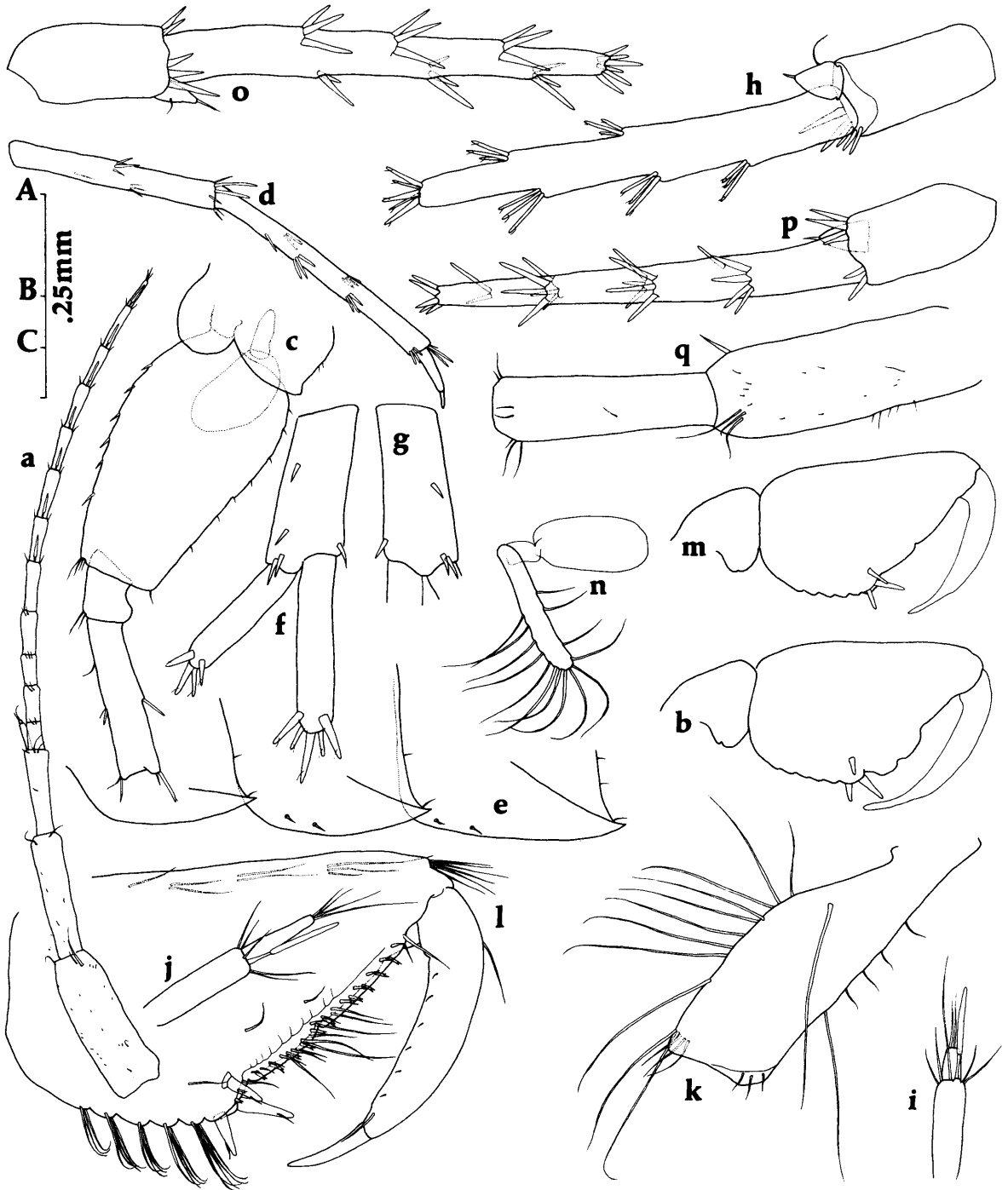


Fig. 6. *Pseudoniphargus daviui* n. sp. (a–h, ♂ holotype; i–o, ♀ allotype; p, ♀ paratype 9.5 mm; q, ♂ paratype 7.9 mm): a, antenna 1 (C); b, profile of carpus-dactylus of gnathopod 2 (C); c–d, pereiopod 6 (C); e, epimeral plates 1-2-3 (C); f, left uropod 2 (B); g, right peduncle of uropod 2 (B); h, uropod 3 (B); i, tip of left antenna 1 (A); j, tip of right antenna 1 (A); k, basis of gnathopod 1 (B); l, propodus and dactylus of gnathopod 2 (A); m, profile of carpus-dactylus of gnathopod 2 (C); n, oostegite (C); o, uropod 3 (B); p, uropod 3 (B); q, basal segments of antenna 1 (B).

than dactylus. Posteroproximal lobes of basis developed in the 3 pereopods.

Epimeral plates 1-2-3 (Fig. 6e): profile sub-square, straight posterior margins, with pointed angles, and 2-2-3 setae, respectively; 0-2-2 spines on ventral margin. Pleopod exopodites 1-2-3 of 10-8-7 segments; endopodites of 6-6-6 segments.

Uropod 1 (Fig. 4k): slender. Peduncle longer than rami, with 3 dorsal spines. Endo- and exopodite without marginal spinulation. Uropod 2 (Fig. 6f, g): rami without marginal spinulation; 2 dorsal spines on left peduncle, while only 1 on right one; 3 distal spines on both peduncles. Uropod 3 (Fig. 6h): exopodite hardly elongate, with sub-rectangular profile, neither tapering nor upcurved; 7.6 times as long as wide, and 3 times as long as peduncle; peduncle not elongate, 1.9 times as long as wide. Telson (Fig. 4l): Subrectangular, wider than long; clearly incised, with 1-2 spines, not on corners but sub-distally; 5 long setae implanted mid-ventrally, very conspicuous in lateral view.

♀ allotype. – Antenna 1 flagellum with unequal number of segments, 16 the left and 15 the right one; length of terminal segment of right flagellum relative to that of aesthetasc greater than 0.5 (Fig. 6j); that of left flagellum less than 0.5 (Fig. 6i). Accessory flagellum of both antennae 1 shorter than first flagellum segment. Left mandibular palp segment 2 with 5 setae along its lower margin; segment 3 with 2 A- and 2 B-setae. Right mandibular palp segment 2 with 6 setae along lower margin, and 1 A- and 2 B-setae on segment 3; a conspicuous longer distalmost D-seta on segment 3 of both mandibular palps. Basis of gnathopod 1 with only 1 medial seta, a row of 4 posterodistal setae on outer side (one longer), and a row of 3 short anterodistal setae on inner side (Fig. 6k). Gnathopod 2 (Figs. 6l, m) propodus sexually dimorphic, with posterior half of palmar margin not protruding. Oostegites (Fig. 6n) with up to 15 marginal setae. Basis of pereopods 5 to 7 with slightly developed posterodistal lobes, hardly overhanging, and posteroproximal lobes developed. Epimeral plates 1-2-3 bearing 0-2-2 spines and 2-3-3 posterior setae. Uropod 3 (Fig. 6o) without conspicuous sexual dimorphism. Peduncle 2 twice as long as wide; exopodite 8.7 times as long as wide and 2.8 times as long as peduncle.

Variability. – Segment 2 of mandibular palp with 5-6 setae; segment 3 with 1-2 A-, and/or 1-2 B-setae; one male examined carried 1 seta on palp segment 1. Basis of gnathopod 1 with 1-2 lateral setae. Sexual dimorphism in palmar margin of propodus of gnathopod 2 has been observed along the whole size range of examined males (7.3–10.2 mm). Nevertheless 2 males (8.3 and 8.7 mm) had the left gnathopod propodus protruded but not the right one. As the variability does not seem linked to body size, it is difficult to interpret it, and more material will be needed to solve the question. The armature of the epimeral plates 1-2-3 presents a uniform pattern of 0-2-2 ventral spines and 2-3-3 posterior setae. Uropod 2 may have 1–2 dorsal spines on its peduncle. No conspicuous sexual dimorphism on uropod 3 was observed (Figs. 6o, p, h): the peduncle was slightly more slender in females (1.8–2.0 times as long as wide) than in males (1.6–1.9), while the length of the exopodite relative to that of the peduncle was slightly higher in males (3.0) than in females (2.8–2.9).

Diagnostic characters and affinities. ¹– The diagnostic cluster of characters for *P. daviui* is as follows: mandibular palp lacking proximal longer D-setae on segment 3. Conspicuous sexual dimorphism in palm profile of gnathopod 2, with posterior half protruded in males, the latter a characteristic not yet described in *Pseudoniphargus* (see Notenboom, 1988). Maximal width of propodus attained at the palmar angle. Posterodistal lobe of basis of pereopods 5 and 7 developed and hardly overhanging; that of pereopod 6 not so developed; posteroproximal lobes of basis well developed, but not as strongly as in *P. triasi*. Epimeral plates 1-2-3 with pointed posterodistal corners, posterior margins straight and with 0-2-2 ventral spines. Uropod 1 slender and lacking marginal spines on rami; peduncle bearing 2-3 dorsal spines and lacking medial and baso-ventral spines. Uropod 2 without marginal spinulation on rami; peduncle bearing 1-2 dorsal and 3 distal spines. Uropod 3 not sexually dimorphic, with exopodite hardly elongated (type “b” of Notenboom, 1988, Fig. 18). Telson wider than long, incised, bearing 1-2 spines not distally, but subdistally. A row of 5 long setae implanted on ventral side, very conspicu-

ous. This cluster of characters clearly differentiates *P. daviui* from its sympatric congeneric *P. triasi*, described above.

P. daviui differs clearly from other Balearic species hitherto described. It differs from *P. adriaticus* Karaman, 1955 and *P. mercadali* Pretus, 1988 by the structure of the third uropod, with a non-elongate peduncle and not clearly elongate nor up-curved exopodite; the non-overhanging postero-distal lobe of basis of pereopods 5-7, and the absence of dentate spur in the midline of the postero-dorsal margin of metasomite 2 are also diagnostic. Differences from *P. racovitzai* Pretus, 1990 are, among others, its larger body size, the elongate peduncle and endopodite of uropod 1, the absence of a basoventral spine on the peduncle of uropod 1, and the longer exopodite of uropod 3. *P. daviui* differs from *P. pedrerae* Pretus, 1990 mainly in the outline of the propodus of gnathopod 2, attaining its maximal width at the palmar angle, the absence of a basoventral spine on the peduncle of uropod 1, the incised telson, and the absence of setosity on the dorsal part of the body segments. *P. daviui* resembles the Formenteran *P. pityusensis* Pretus, 1990 in its large body size, strongly developed propodus of the second gnathopod, and distinct lobes at posterodistal corner of the basis of pereopods 5-7. But conspicuous diagnostic characters for *daviui* concern the sexually dimorphic propodus of gnathopod 2, the absence of a basoventral spine on the peduncle of uropod 1, the pointed angles of epimeral plates 1 to 3, the less elongate exopodite of uropod 3, and the subdistal position of the telson spines.

Derivatio nominis. – The species is dedicated to Guiem Daviu, boat commander and cook during my visit to the island.

Discussion

The presence of two sympatric *Pseudoniphargus* species in fresh ground waters of Cabrera is certain because of the divergent morphology of some characters considered diagnostic elsewhere (Notenboom, 1988), when individuals of the same body size are compared. The tentative pattern for coex-

isting morphotypes of *Pseudoniphargus* presented elsewhere (Stock et al., 1986; Pretus, 1990) and consisting of, on the one hand, a species with strongly developed second gnathopods (viz. *P. daviui*) and, on the other hand, a species with elongated first and second gnathopods, with narrow hands (viz. *P. triasii*), is repeated here.

Cases of sympatry in *Pseudoniphargus* are rare (Stock et al., 1986; Notenboom, 1987; Pretus, 1990), and sometimes they are associated with small islands (e.g.: Bermuda, Formentera). Moreover, the general pattern seems to be that of one species with a wider distributional range than the other. In the Balearic islands, some new species described recently as endemic to only one island turned out to be present in neighbouring islands. This is the case in *P. mercadali* Pretus, 1988, initially considered as endemic to Menorca, but later recorded also from wells in the NE region of Mallorca (Pretus, 1989). In the Pitiusic islands, *P. pityusensis* and *P. pedrerae* Pretus, 1990, two sympatric species described from Formentera, are also present in the neighbouring island of Eivissa (Pretus, 1990). The question is whether the two taxa from Cabrera originated in situ or, on the contrary, Cabrera is only a part of a wider range which could embrace the S and SE of Mallorca. Palaeogeographic models based on the distribution of fossil coral reef front facies postulate the existence of a continuum between Mallorca and Cabrera in Tortonian times (Pomar, 1979). Besides, the plesiomorphism of the Cabrera taxa suggests an ancient origin. On the other hand, due to the small area of Cabrera (ca. 20 km²) an (allopatric) speciation event seems unlikely, and the morphological differences between the two species involved make unlikely the idea of a common direct ancestor. Our own prospections in the S and SE zone of Mallorca hitherto have not revealed any freshwater *Pseudoniphargus*. Probably they are actually not present in the zone due to overexploitation of aquifers for agricultural practices, which has led to generalized marine intrusions. So, we suppose the Cabrera taxa are relicts originating, at least at the end of the Tertiary, if not earlier, from the Mallorca-Cabrera paleo-island. As usual for the genus, a "regression model" evolution type (Stock, 1980) can be used to explain the origin of

both taxa. Undescribed material from the Mallorcan central plains (Pretus, in prep.) perhaps will elucidate the question.

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