

THE ALPHEID SHRIMP GENUS *LEPTALPHEUS* WILLIAMS, 1965, IN THE TROPICAL WESTERN PACIFIC, WITH DESCRIPTIONS OF TWO NEW SPECIES (CRUSTACEA: DECAPODA: CARIDEA)

Arthur Anker

Dickinson Hall, Florida Museum of Natural History, University of Florida, Gainesville, FL 32611-7800 USA

Email: aanker@fmnh.ufl.edu

Ivan N. Marin

Laboratory of Ecology and Morphology of Marine Invertebrates, A.N. Severtzov Institute of Ecology and Evolution,

R. A. S., Leninsky prospect, 33, 119071, Moscow, Russia

Email: coralliodecapoda@mail.ru

ABSTRACT. – Two new species of the alpheid shrimp genus *Leptalpheus* Williams, 1965, are described from the tropical western Pacific. *Leptalpheus denticulatus*, new species, is described on the basis of several specimens collected in Nhatrang Bay, Vietnam (type locality); Panglao, off Bohol, the Philippines; and Yaqara Bay, Viti Levu, Fiji. *Leptalpheus dworschaki*, new species, is described on the basis of two specimens collected in Panglao. All specimens were collected from burrows of callianassid ghost shrimps, including *Glypturus* cf. *armatus* (A. Milne-Edwards, 1870) and *Neocallichirus calmani* (Nobili, 1904). Both *L. denticulatus*, new species, and *L. dworschaki*, new species, are closely related to *L. pacificus* Banner & Banner, 1974, from Hawaii, differing from the latter species in subtle morphological details.

KEY WORDS. – Alpheidae, *Leptalpheus*, Indo-West Pacific, infauna, commensal, new species, Callianassidae.

INTRODUCTION

The alpheid shrimp genus *Leptalpheus* Williams, 1965, is characterised by the strongly asymmetrical chelipeds, carried folded, with subcylindrical, peculiarly shaped major and minor chelae; the presence of an articulated plate at the posteroventral angle of the sixth pleonite; the absence of orbital teeth and rostrum (although a subtriangular rostral projection may be present in some species); the third maxilliped with a produced, often acute lateral plate on the coxa; and the uropodal diaeresis bearing a conspicuous subacute tooth near the mesial margin of the exopod (Williams, 1965; Ríos & Carvacho, 1983; Dworschak & Coelho, 1999; Anker et al., 2006). All these features are also present in *Fenneralpheus* Felder & Manning, 1986, which differs from *Leptalpheus* mainly by the major cheliped being stouter and bearing unique lamellar teeth on the fingers (Felder and Manning, 1986). All species of *Leptalpheus* live as “commensals” in burrows of thalassinideans, mainly mudshrimps (Upogebiidae) and ghostshrimps (Callianassidae); the hosts of *Fenneralpheus* presently remain unknown (Anker et al., 2006).

Leptalpheus is particularly well represented in the western Atlantic, with at least seven species (Anker et al., 2006); however, only four of them are described: *L. forceps* Williams, 1965 (type species), *L. axianassae* Dworschak & Coelho, 1999, *L. felderi* Anker, Vera Caripe & Lira, 2006, and *L. pierrenoeli* Anker, 2008 (Anker et al., 2006; Anker, 2008). In the eastern Pacific, at least four species are known, but again only one of them is described: *L. mexicanus* Ríos & Carvacho, 1983 (Anker et al., 2006). Only one species, *L. pacificus* Banner & Banner, 1974, has been described from the vast Indo-West Pacific region, with only two records: Hawaii (type locality) and southwestern Madagascar (Banner & Banner, 1974, 1983). However, Anker et al. (2006) pointed out that Banner & Banner’s (1983) record of *L. pacificus* from Madagascar, based on untraced material, requires confirmation.

Recently, thalassinidean burrows were sampled with the aid of a bait suction pump at three distant localities in the tropical Indo-West Pacific: (1) Yaqara Bay on the northern coast of Viti Levu, Fiji (AA, in 2005); (2) Nhatrang Bay, south-central Vietnam (IM, in 2004); and Panglao Island, southwest off Bohol, the Philippines (P. C. Dworschak, in 2004). These efforts enabled to obtain several specimens of

Leptalpheus, all preliminarily identified as *L. cf. pacificus*. However, a closer inspection of this material revealed the presence of two species in Panglao, *Leptalpheus* sp. A and *Leptalpheus* sp. B, each represented by two specimens, differing from each other by the dentition on the fingers of the major chela. The finger armature of *Leptalpheus* sp. A was very similar to that of the Hawaiian type specimen of *L. pacificus* (Banner & Banner, 1974), and also to the armature observed in Vietnamese and Fijian specimens. However, subtle differences in some other features, e.g., on the uropod, were detected between *Leptalpheus* sp. A and *L. pacificus*. On the other hand, the finger armature of *Leptalpheus* sp. B was clearly different from both *Leptalpheus* sp. A and *L. pacificus*.

At our request, R. Robles and D. L. Felder (University of Louisiana, Lafayette, USA) performed DNA sequencing of the Nhatrang, Panglao and Fiji specimens, and then compared the obtained sequences to the already available sequences from the Hawaiian specimens. They confirmed the presence of two genetically distinct forms – one in Panglao and another in Fiji, Nhatrang and Panglao – both sufficiently different from the Hawaiian form to be considered as separate species. Thus the above-mentioned morphological differences between *Leptalpheus* sp. A, *Leptalpheus* sp. B and *L. pacificus* are supported by genetic data, which will be published elsewhere (Robles & Felder, in prep.). Therefore, *Leptalpheus* sp. A and *Leptalpheus* sp. B are described as new species in this study.

MATERIALS AND METHODS

All specimens were collected with the aid of a steel bait suction pump (“yabby pump”). Some were photographed alive prior to preservation in 70% ethanol. Drawings were made under the dissection microscope equipped with a camera lucida. The material is deposited in the following institutions: FLMNH, Florida Museum of Natural History, Gainesville, USA; LACM, Natural History Museum of Los Angeles County, Los Angeles, USA; MNHN, Muséum national d’Histoire naturelle, Paris, France; NMCR, National Museum, Manila, the Philippines; OUMNH, Oxford University Museum of Natural History, Oxford, UK; USNM, National Museum of Natural History, Washington DC, USA; ZRC, Zoological Reference Collection, Raffles Museum of Biodiversity Research, NUS, Singapore. Abbreviations used in the text: P, pereopod; Mxp, maxilliped; fcn, field collection number.

SYSTEMATICS

Leptalpheus Williams, 1965

Leptalpheus denticulatus, new species

(Figs. 1–6, 7a, b, 8)

Leptalpheus cf. pacificus B – Anker et al, 2006: Table 1.
Leptalpheus cf. pacificus C – Anker et al, 2006: Table 1.

Type material. – **Vietnam:** Holotype: male, CL 6.4, TL 19.1 (MNHN-Na 17064), Nhatrang Bay, Dam Bay, intertidal sand flat, fringe mangrove, bait suction pump, from burrow of *Glypturus cf. armatus*, coll. I. Marin, 17 Jun.2004. Paratypes: 1 female, CL 7.6, TL 23.8 (FLMNH UF Arthropoda 15018), same collection data as for holotype; 1 female, CL 10.0, TL not measured (USNM 1110002), same collection data as for holotype [specimen dissected]; 1 breeding female, CL 14.5, TL 44.7 (MNHN-Na 17065), same collection data as for holotype [specimen photographed].

Additional (non-type) material. – **Fiji:** 1 female, CL 6.0, TL 18.8 (LACM CR 2005-006.1), Viti Levu, Yaqara Bay, ca. 2 km north of Yaqara Pastoral Community, sand beach fringed with mangrove, bait suction pump, from burrow, depth: 1.0–1.5 m, coll. A. Anker & T. Faught, 10 Jan.2005 [fcn 845; specimen photographed]; 1 male, CL 6.7, TL not measured (LACM CR 2005-007.1), Viti Levu, Yaqara Bay, ca. 2 km north of Yaqara Pastoral Community, Nasilau Point, sand beach, bait suction pump, from burrow, depth 0.5–1.0 m, coll. A. Anker & A. Bunouf, 27 Jan.2005 [fcn 594; specimen photographed, dissected]; 1 male, CL 7.4, TL 19.5 (MNHN-Na 15776), same collection data as for previous specimen [fcn 562; specimen photographed]; 1 female, CL 5.3, TL 16.7 (OUMNH-ZC 2005-07-16), same collection data as for previous specimen [fcn 574]. **Philippines:** 1 male, CL 6.2, TL 16.8 (ZRC 2005.0086), Panglao Island, Alona Beach, Sta. M1, 9°32.9’N 123°46.6’E, intertidal and shallow subtidal, depth 0–1 m, bait suction pump, from burrow of *Neocallichirus calmani*, coll. P. C. Dworschak, 3 Jun.2004 [fcn PD-1; specimen photographed]; 1 female, CL 6.5, TL 17.65 (ZRC 2005.0087), same collection data as for previous specimen [fcn PD-1].

Comparative material. – *Leptalpheus pacificus*. **Hawaii:** 1 breeding female, CL 8.1, TL not measured (FLMNH UF Arthropoda 12473), Maui, Hekili Point, 20°8108’N 156°6214’E, back reef 0–1 m, hand collected, C. Pittman, 28 Sep.2007; 1 breeding female, CL and TL not measured (USNM 205907), Oahu, Honolulu, Waikiki Beach, coll. R. Heard, 7 Jan.1988.

Description. – (based on Nhatrang specimens) – Body moderately slender, rather stout in large individuals, carapace and abdomen very slightly compressed laterally, glabrous except for minute pits (Fig. 1a). Carapace with inconspicuous suture proximal to base of antenna (Fig. 1b). Frontal margin protruding and broadly rounded, without rostral projection or orbital teeth, without orbital crests (Fig. 1a). Pterygostomial angle rounded (Fig. 1b, c); branchiostegial region with pronounced “lip” anteriorly (Figs. 1b, c); cardiac notch deep (Fig. 1d). Eyes not visible in dorsal view, anterior portion visible in lateral view (Fig. 1a–c); anteromesial process well marked; cornea small, lateral, pigmented (Fig. 1c, e). Ocellar beak not conspicuous.

Antennular peduncle relatively stout (Fig. 1a), flattened dorsoventrally; second segment about twice as long as broad, about as long as dorsally visible portion of first segment; stylocerite not reaching distal margin of first segment, subacute distally (Fig. 1a, b); ventromesial carina of first segment with strong tooth (Fig. 1f); lateral flagellum biramous, with shorter ramus well developed, situated at third segment (Fig. 1g). Antenna with basicerite bearing strong ventrolateral tooth (Fig. 1b); scaphocerite broadly ovate, anterior margin of blade slightly convex, but not protruding beyond distolateral tooth (Fig. 1a); carpocerite long, stout, reaching far beyond scaphocerite (Fig. 1b).

Mouthparts and third maxilliped typical for genus (Fig. 2a–f). Mandible with incisor process bearing six teeth, median two largest (Fig. 2a). Maxillule with bilobed palp, both lobes with one stiff seta (Fig. 2c). First maxilliped with expanded caridean lobe on exopod (Fig. 2e). Second maxilliped with elongate epipod (Fig. 2f). Third maxilliped relatively slender, elongate; lateral plate acutely produced (Fig. 2g); ultimate segment with rows of long, distally thickened setae, tip unarmed; arthrobranch very large (Fig. 2g).

Chelipeds strongly asymmetrical in shape, unequal in size (Fig. 3), carried folded when not in use (Fig. 8a). Major cheliped (on either left or right side) enlarged, elongate (Fig. 3a, b); ischium short, ventromesial margin without subtriangular tooth (Fig. 3b); merus long, slender, with smooth margins, distally not widening, ventrally depressed, distal margin ending bluntly; carpus short, cup-shaped, with blunt distolateral process; chela subcylindrical, palm smooth, ventromesially excavated, about three times as long as high; adhesive discs well developed (Fig. 3a, c); fingers about 1/3 length of palm; dactylus moderately curved distally, with subacute tip, cutting edge with one feebly protruding, distally rounded, median tooth, about 1/3 as high as long and small, subtriangular, proximal tooth; pollex as long as dactylus, abruptly ending, tip truncate, with two subacute teeth, cutting edge with one much larger subtriangular proximal tooth and one smaller truncate distal tooth (Fig. 3c, d). Minor cheliped weaker than major cheliped, slender (Fig. 3e), ischium short, unarmed; merus slender, ventrally depressed (Fig. 3e); carpus short, cup-shaped; chela smooth, subcylindrical, with fingers about as long as palm, tips crossing when chela closed; cutting edges of dactylus and pollex with small curved teeth proximally and two larger opposing teeth at about 2/3 of finger length (Fig. 3f).

Second pereopod relatively slender (Fig. 2h); ischium about 3/4 length of merus; carpus five-segmented, segments with ratio approximately equal to 3.5/1/1.5/1/2.5; chela simple, slightly shorter than first carpal segment; fingers as long as palm. Third pereopod moderately slender (Fig. 3i), ischium unarmed; merus flattened mesially, about 2.5 times as long as ischium, about four times as long as wide, with convex dorsal and ventral margins (Fig. 2i); carpus less than 1/2 length of merus, with distoventral spiniform seta; propodus longer than carpus, with two ventral spiniform setae and one distoventral spiniform seta proximal to dactylus; dactylus simple, conical, about 2/5 length of propodus, curved (Fig. 2j). Fourth pereopod generally similar to third. Fifth pereopod much more slender than third and fourth pereopods (Fig. 2k); ischium and merus not flattened mesially, unarmed; carpus without distal spiniform seta; propodus as long as merus, without spiniform setae, distally with at least six rows of setae; dactylus similar to that of third and fourth pereopods.

First to fifth pleomeres with minute pits on surface; posteroventral angles rounded; sixth pleonite with large articulated plate posteroventrally, dividing suture appearing somewhat incomplete (Fig. 11). Male second pleopod (Fig. 2l) with appendix interna and appendix masculina, latter about

1.5 times as long as former and bearing several slender, spiniform, apical and subapical setae (Fig. 2m).

Uropod with lateral lobe of protopod bearing two small subacute teeth distally (Fig. 1h); endopod somewhat longer than exopod, without specific features; exopod with truncate posterior margin and with feebly protruding, blunt distolateral tooth adjacent to robust distolateral spiniform seta; lateral half of diaeresis mostly straight except for central-most portion curved into small tooth (Fig. 1i); mesial portion deeply incised forming stout subtriangular tooth proximal to mesial margin (Fig. 1i).

Telson moderately slender, slightly tapering distally, about 2.5 times as long as wide proximally (Fig. 1j); dorsal surface pitted (Fig. 1k), with two pairs of strong spiniform setae inserted at short distance from lateral margin, at about 1/3 and 3/5 length of telson, respectively (Fig. 1j); posterior margin broadly rounded, each posterolateral angle with two spiniform setae, mesial at least five times longer than lateral (Fig. 1k); anal tubercles small, feebly sclerotised.

Gill/exopod formula typical for genus: 5 pleurobranchs (above P1–5); 1 arthrobranch (above Mxp3); 0 podobranch; 2 lobe-shaped epipods (Mxp1–2); 5 mastigobranchs or strap-like epipods (Mxp3, P1–4); 5 sets of setobranchs (P1–5); 3 exopods (Mxp1–3).

Colour pattern. – Semitransparent with more or less pronounced pinkish tinge; carapace dorsally with reddish chromatophores; each pleonite with diffuse transverse band of reddish chromatophores along posterior margin; antennular and antennal peduncles, telson and uropod more intense pink due to higher concentration of reddish chromatophores; walking legs and antennular and antennal flagella semitransparent; major chela hyaline-whitish with scattered reddish chromatophores (Fig. 8).

Size. – The smallest examined specimen is a female from Fiji with 5.3 mm CL and 16.7 mm TL; the largest is an ovigerous paratype female from Nhatrang with 14.5 mm CL and 44.7 mm TL. The diameter of embryos (measured in the largest female from Nhatrang) is approximately 0.6 × 0.5 mm.

Etymology. – The specific name (*denticulatus* – Latin for “bearing a denticle or small tooth”) refers to the presence of a small tooth on the central portion of the uropodal diaeresis, a key feature to distinguish the new species from the closely related *L. pacificus* (see under Remarks below).

Type locality. – Nhatrang Bay, Vietnam.

Distribution. – Western tropical Pacific; presently known from three distant localities: Nhatrang Bay in Vietnam (type locality); Viti Levu in Fiji; and Panglao Island, southwest of Bohol, in the Philippine Archipelago.

Ecology. – All specimens were collected from burrows of large callianassid ghostshrimps on intertidal or shallow

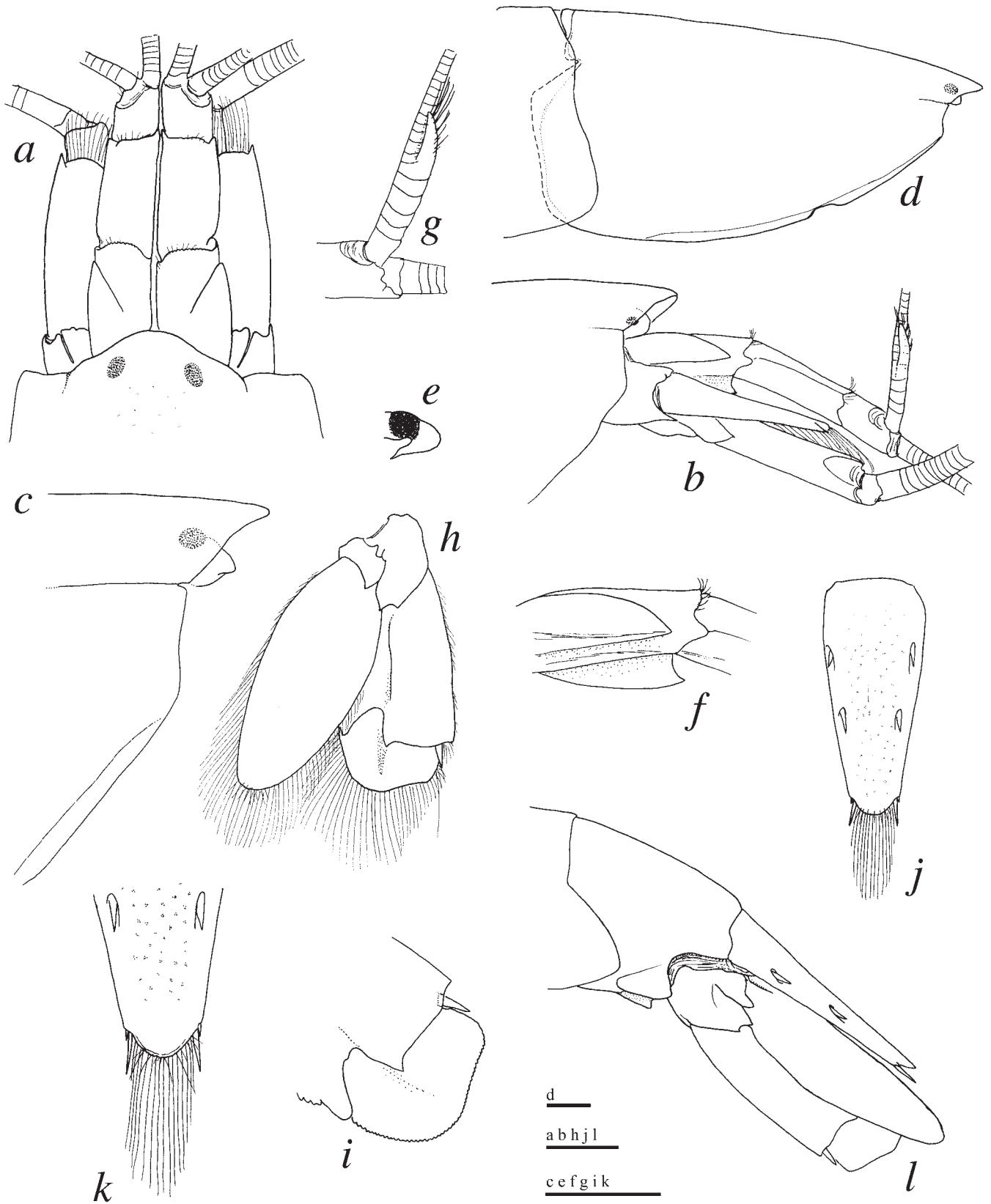


Fig. 1. *Leptalpheus denticulatus*, new species, female paratype from Nhatrang Bay, Vietnam (USNM 1110002): a, frontal region, dorsal view; b, same, lateral view; c, frontal margin of carapace, lateral view; d, carapace, lateral view; e, right eye, ventrolateral view; f, first segment of right antennular peduncle, lateral view; g, lateral flagellum of right antennule, lateral view; h, right uropod, dorsal view; i, same, detail of exopod, setae omitted; j, telson, dorsal view; k, same, detail of posterior half; l, sixth pleonite and tail fan, setae omitted, lateral view. Scale bars = 1 mm.

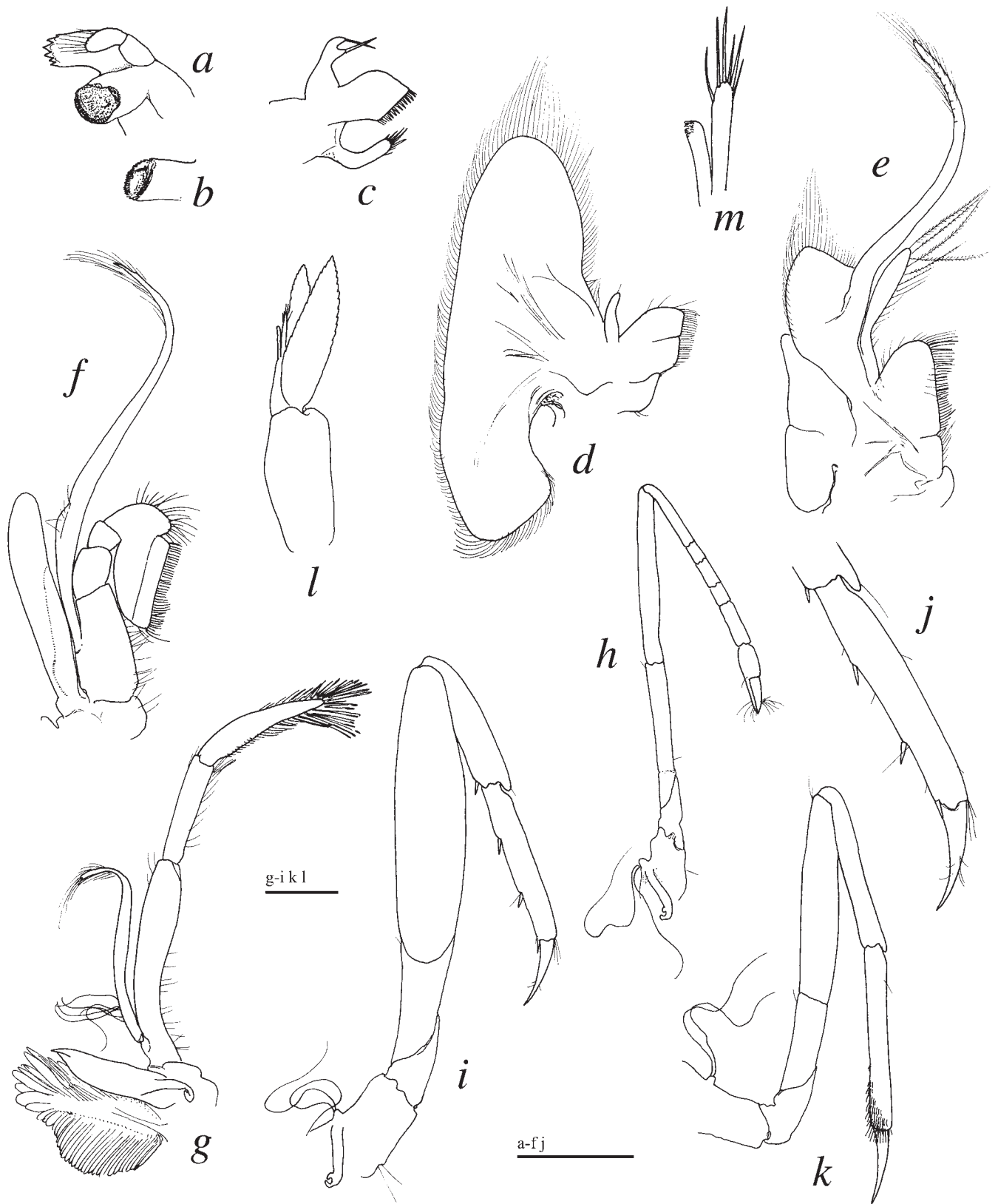


Fig. 2. *Leptalpheus denticulatus*, new species, a-k: female paratype from Nhatrang Bay, Vietnam (USNM 1110002); l, m: male holotype from Nhatrang Bay (MNHN-Na 17064): a, mandible, mesial view; b, same, molar process; c, maxillule, lateral view; d, maxilla, lateral view; e, first maxilliped, lateral view; f, second maxilliped, lateral view; g, third maxilliped, lateral view; h, second pereiopod, lateral view; i, third pereiopod, lateral view; j, same, distal carpus, propodus and dactylus; k, fifth pereiopod, lateral view; l, second pleopod, lateral view; m, same, detail of appendix masculina and appendix interna. Scale bars = 1 mm; m drawn without scale.

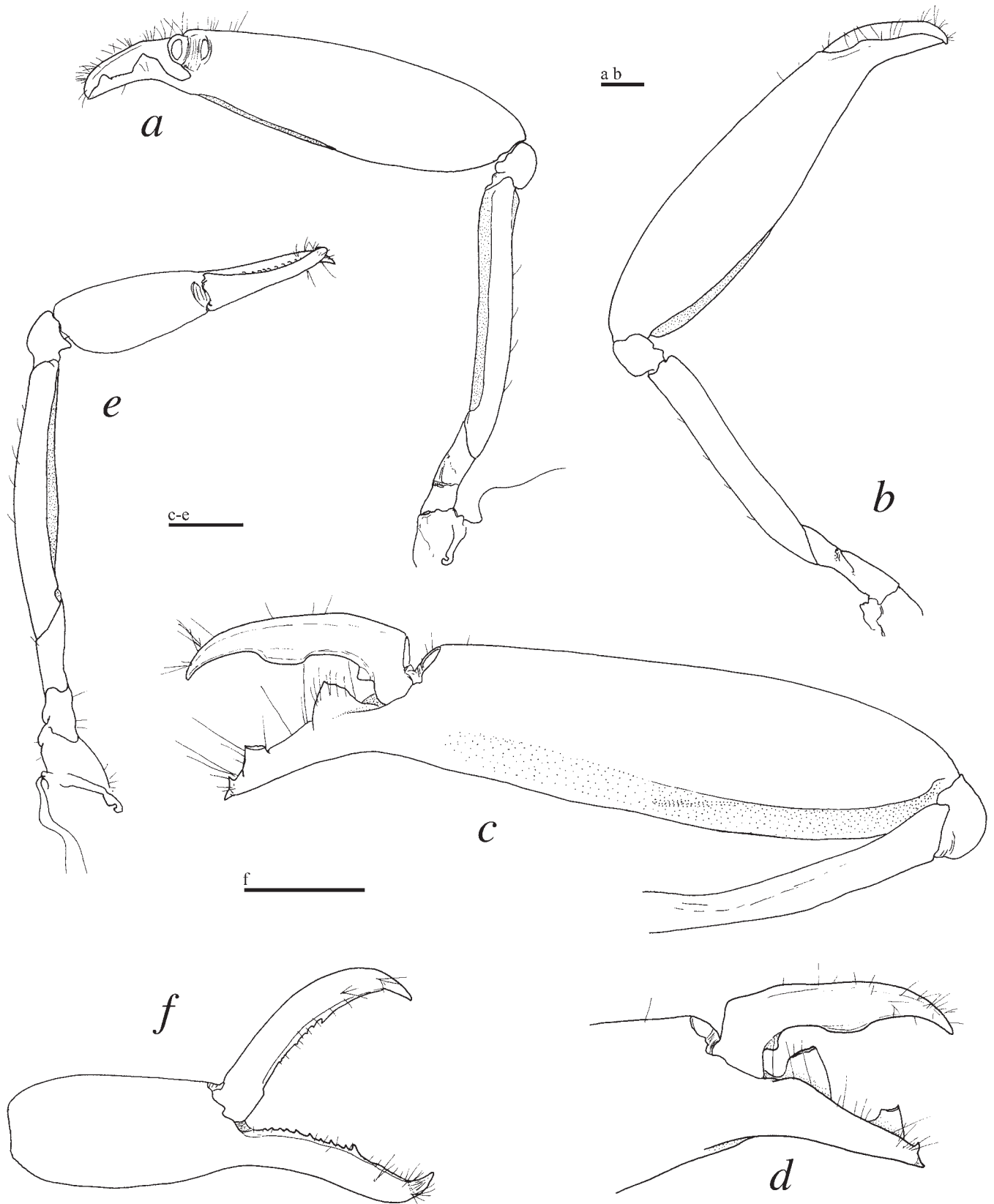


Fig. 3. *Leptalpheus denticulatus*, new species, female paratype from Nhatrang Bay, Vietnam (USNM 1110002): a, major (left) cheliped, lateral view; b, same, mesial view; c, same, chela, carpus and distal merus, ventrolateral view; d, same, distal portion of chela, mesial view; e, minor (right) cheliped, lateral view; f, same, chela, ventrolateral view. Scale bars = 1 mm.

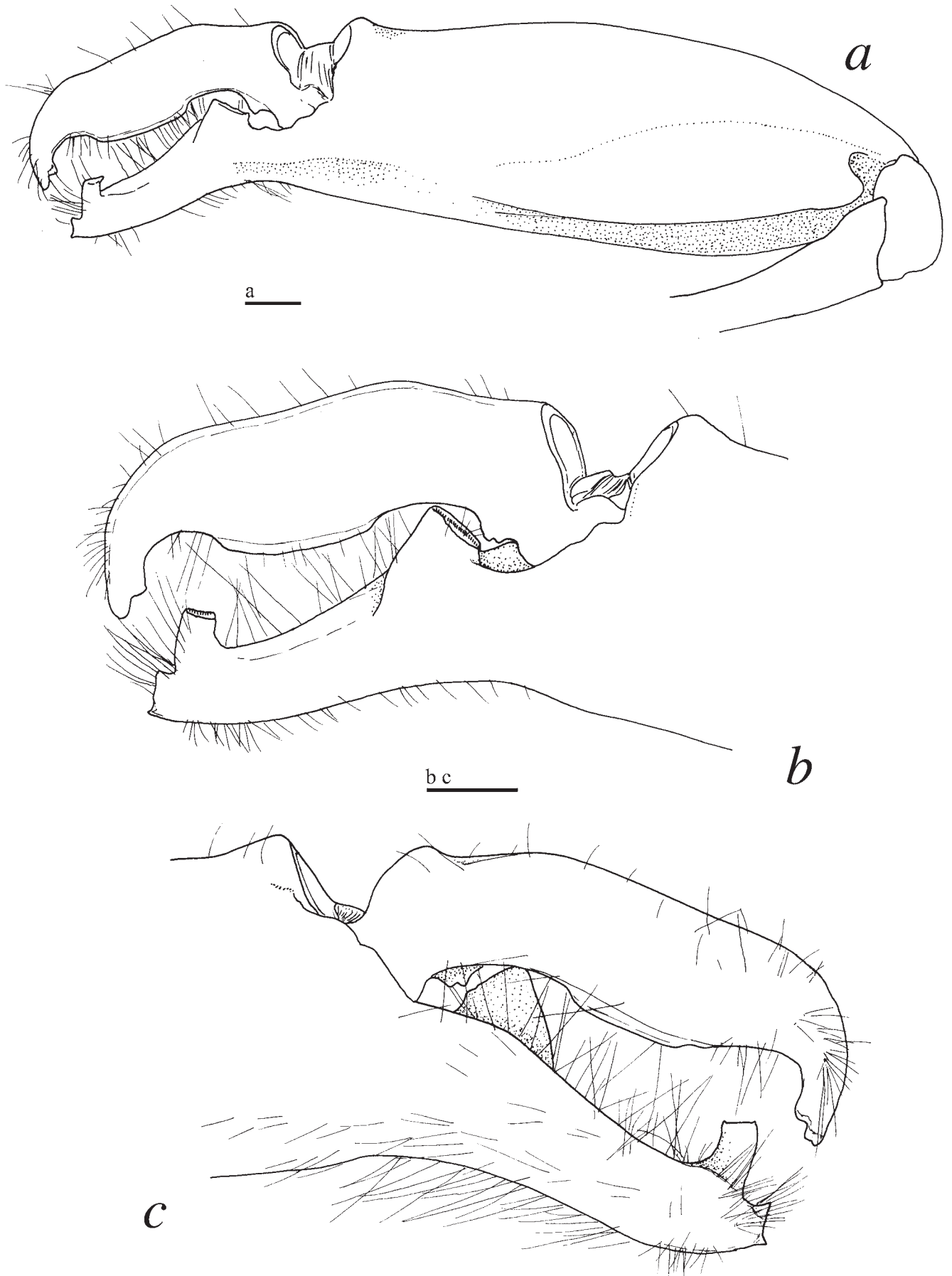


Fig. 4. *Leptalpheus denticulatus*, new species, largest female paratype from Nhatrang Bay, Vietnam (MNHN-Na 17065): a, major (left) cheliped, distal merus, carpus and chela, ventrolateral view; b, same, detail of fingers; c, same, ventromesial view. Scale bars = 1 mm.

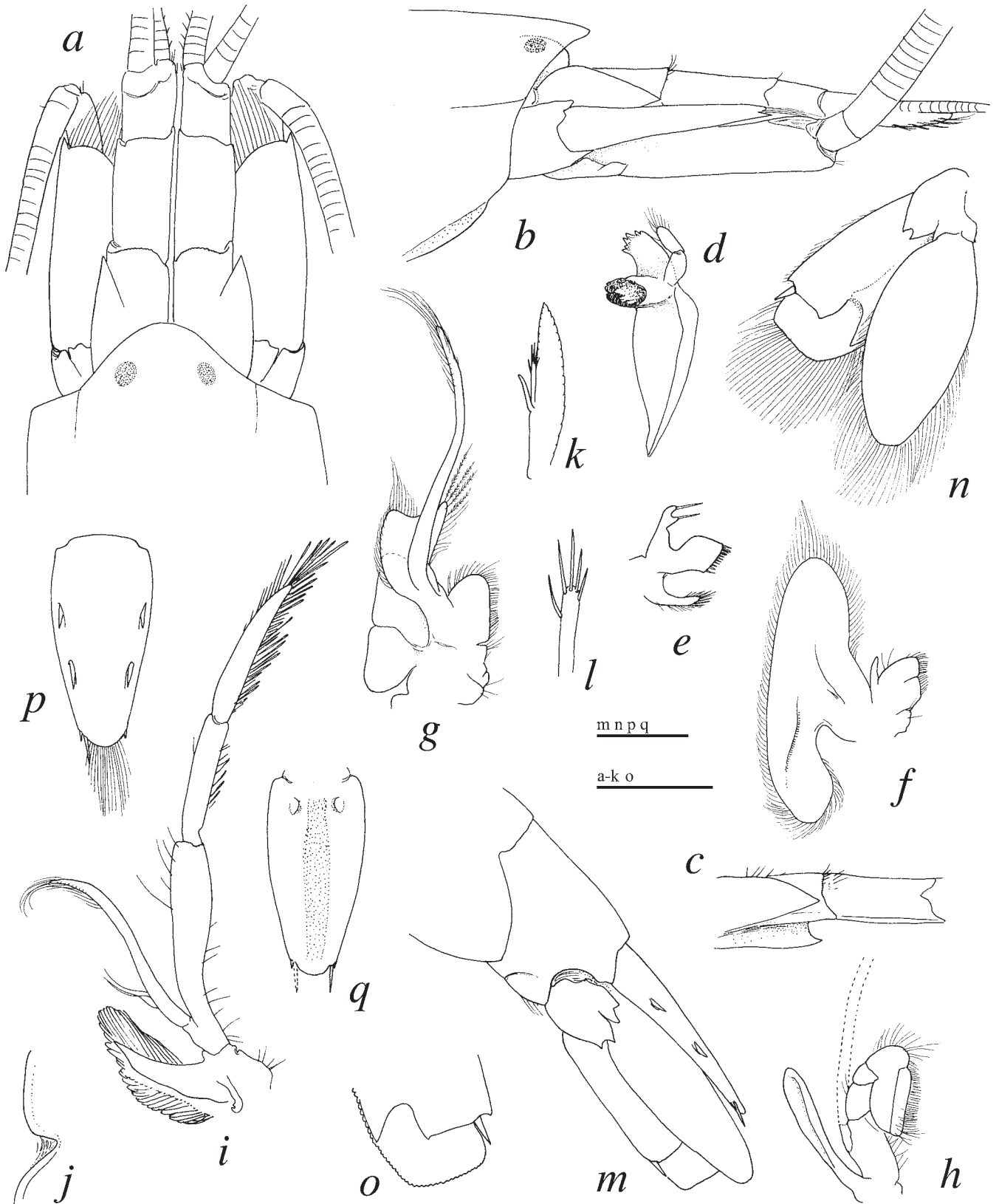


Fig. 5. *Leptalpheus denticulatus*, new species, male from Yaqara Bay, Viti Levu, Fiji (LACM CR 2005-007.1): a, frontal region, dorsal view; b, same, lateral view; c, first segment of right antennular peduncle, lateral view; d, mandible, mesial view; e, maxillule, lateral view; f, maxilla, lateral view; g, first maxilliped, lateral view; h, second maxilliped, lateral view; i, third maxilliped, lateral view; j, posterolateral margin of carapace, detail of cardiac notch; k, endopod of second pleopod; l, same, detail of appendix masculina; m, sixth pleonite and tail fan, setae omitted, lateral view; n, left uropod, dorsal view; o, right uropod, detail of exopod, setae omitted, dorsal view; p, telson, dorsal view; q, same, ventral view (showing anal tubercles). Scale bars = 1 mm; l drawn without scale.

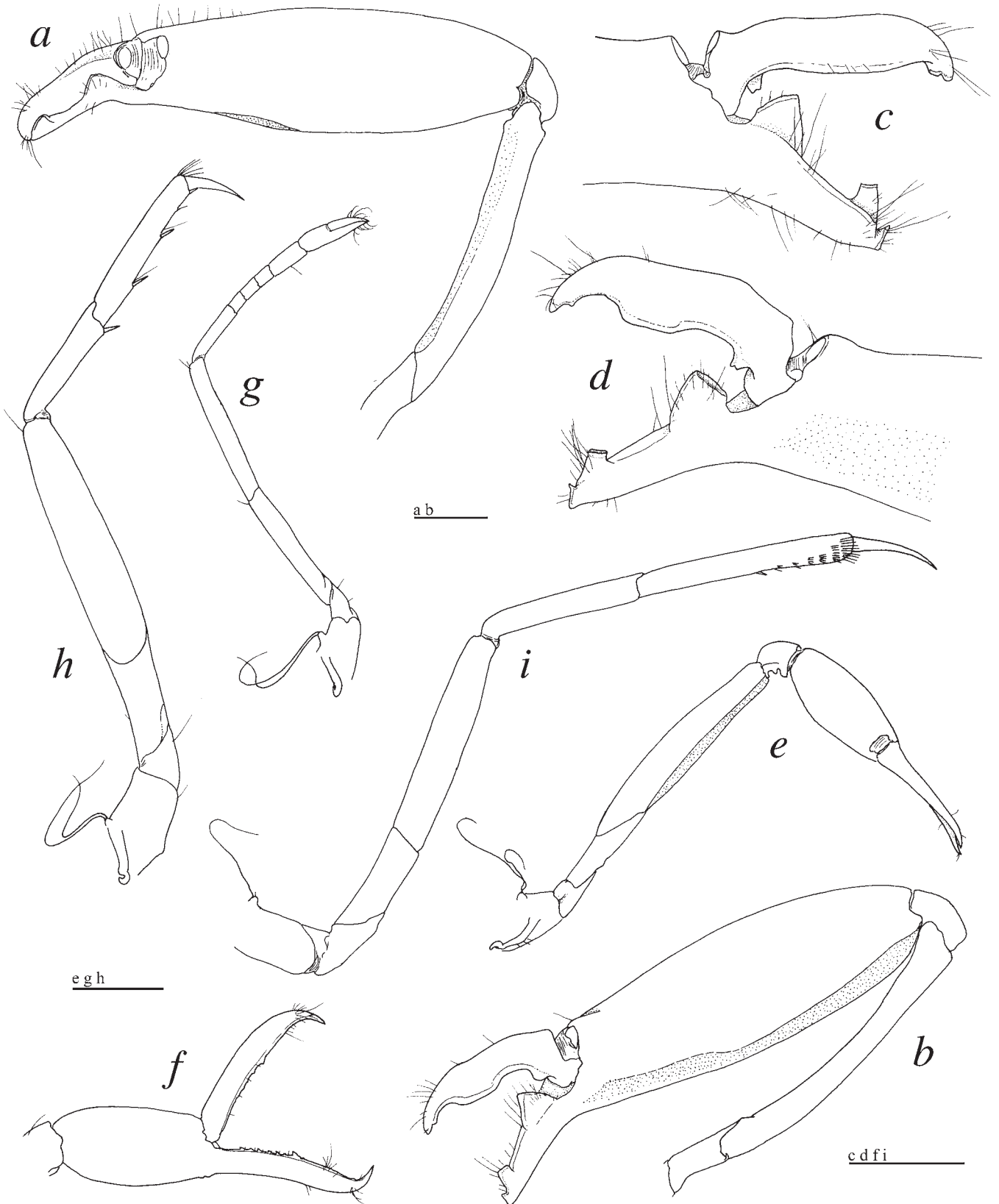


Fig. 6. *Leptalpheus denticulatus*, new species, male from Yaqara Bay, Viti Levu, Fiji (LACM CR 2005-007.1): a, major (left) cheliped, lateral view; b, same, ventrolateral view; c, same, distal chela, ventromesial view; d, same, distal chela, ventrolateral view; e, minor (right) cheliped, lateral view; f, same, chela, ventrolateral view. g, second pereiopod, lateral view; h, third pereiopod, lateral view; i, fifth pereiopod, lateral view. Scale bars = 1 mm.

subtidal sand flats, fringed by mangroves. In Nhatrang, most specimens were collected from burrows of *Glypturus* cf. *armatus* (A. Milne-Edwards, 1870) [IM, pers. obs.], whereas the two Panglao specimens were collected from burrows of *Neocallichirus calmani* (Nobili, 1904) [field notes by P. C. Dworschak]. None of the Fijian specimens was collected together with a host, but one specimen of *Neocallichirus* sp. was collected at the same locality and the presence of typical mounds of *Glypturus* sp. was also noted [AA, pers. obs.].

Remarks. – *Leptalpheus denticulatus*, new species, is closely related to *L. pacificus*. These two species share a great number of characters, e.g., they have a very similar frontal margin of the carapace and a nearly identical dentition on the major chela. However, *L. denticulatus*, new species, can be separated from *L. pacificus* by the presence of a small tooth on the central portion of the uropodal diaeresis, just before the diaeresis slopes abruptly into the large mesial incision (Figs. 1i, 5o), and the slightly more slender second pereopod, with a smaller chela and shorter first carpal segment (cf. Figs 2h, 6g and Fig. 7f). The figures of *L. pacificus* in Banner & Banner (1974) must be used with some caution for they appear to be slightly inaccurate. For instance, the stylocerite was illustrated with tip overreaching the distal margin of the first segment of the antennular peduncle (see Banner & Banner, 1974: Fig. 1A) and the lateral lobe of the uropodal protopod as bluntly rounded (Banner & Banner, 1974: fig. 1M). However, examination of these two features in *L. pacificus* (FLMNH UF12473) shows that the stylocerite actually falls short of the distal margin of the first segment (Fig. 7e), while the lateral lobe of the uropodal protopod bears two broadly rounded teeth or lobes (Fig. 7g, h), although the latter appear to be blunter than the more distinctly protruding, subacute teeth of *L. denticulatus*, new species (compare with Figs. 1h, 5n). More specimens of *L. denticulatus*, new species, and *L. pacificus* must be examined in order to conclude whether the configuration of the lateral lobe of the protopod (blunt vs. subacute teeth) can be reliably used to distinguish these two species.

Some intraspecific variation was observed among specimens of *L. denticulatus*, new species, either from the same or from different localities. For instance, the Nhatrang specimens (Figs. 1–4) differ from the Fijian specimens (Figs. 5–6) by the proportions of the third pereopod, particularly in the merus being somewhat broader and having more convex margins (cf. Figs. 2i, 6h). The two illustrated Nhatrang paratypes, a 10 mm CL female and a 14.5 mm CL breeding female, differ from each other by the extension of the blunt tooth on the cutting edge of the major chela dactylus, which is relatively short and more protruding in the smaller female (Fig. 3c), and distinctly longer and more flattened in the large female (Fig. 4b); this latter configuration is similar to that of the Fijian specimens (Fig. 6b, c) and especially to the Hawaiian *L. pacificus* (Fig. 7c, d). They also differ by the ratio of the fingers to the palm, which is closer to 1/3 in the smaller female (Fig. 3c) and almost 1/2 in the larger female (Fig. 4a), approaching the ratio observed in *L. pacificus* (Fig. 7c, d). These differences are possibly due

to the age-related allometry of the major cheliped, but we feel that further studies, involving morphometric studies and DNA sequencing, are needed to elucidate the nature of this variation.

***Leptalpheus dworschaki*, new species**
(Figs. 9–12)

Leptalpheus sp. 7 aff. *pacificus* – Anker et al, 2006: Table 1.

Type material. – **Philippines:** Holotype: male, CL 7.7, TL 21.9 (NMCR 27540), Panglao Island, Sungcolan Bay, Sta. M11, 9°38.3'N 123°49.6'E, intertidal flat, fringed with mangrove and seagrass, bait suction pump, from burrow of *Glypturus* sp., coll. P. C. Dworschak, 7 Jun.2004 [fcn PD-37; specimen dissected]. Paratype: 1 female, CL 7.7, TL 23.9 (ZRC 2005.0085), same collection data as for holotype [fcn PD-36].

Description. – Body not particularly slender or stout (Fig. 10a), carapace and abdomen slightly compressed laterally, glabrous. Carapace with inconspicuous suture proximal to base of antenna (Fig. 9b, c). Frontal margin protruding and broadly rounded, without rostral projection or orbital teeth, without orbital crests (Fig. 9a, b, k). Pterygostomial angle rounded (Fig. 9c); branchiostegial region with pronounced “lip” anteriorly; cardiac notch fairly deep (Figs. 9c, 10a). Eyes not visible in dorsal view, anterior portion visible in lateral view (Fig. 9a, c); anteromesial process feebly marked; cornea small, lateral, pigmented. Ocellar beak not conspicuous.

Antennular peduncle relatively stout, flattened dorsoventrally; second segment about twice as long as broad, about as long as dorsally visible portion of first segment; stylocerite not reaching distal margin of first segment, subacute distally (Fig. 9a, b, k); ventromesial carina of first segment with strong tooth (Fig. 9d); lateral flagellum biramous, with shorter ramus well developed, situated at third segment. Antenna with basicerite bearing strong ventrolateral tooth (Fig. 9b); scaphocerite broadly ovate, anterior margin of blade convex but not protruding beyond distolateral tooth (Fig. 9a); carpoperite long, stout, reaching far beyond scaphocerite.

Mouthparts and third maxilliped as in previous species (Fig. 10b–h; for description see above).

Chelipeds strongly asymmetrical in shape, unequal in size (Figs. 11, 12a, b), carried folded when not in use (Fig. 10a). Major cheliped (on either left or right side) enlarged, elongate (Fig. 11); ischium short, ventromesial margin without subtriangular tooth; merus long, slender, with smooth margins, distally not widening, ventrally flattened, distally more depressed, distal margin with blunt lobes; carpus short, cup-shaped, with blunt distal process; chela subcylindrical, palm smooth, ventromesially excavated, about 2.5 times as long as high (Fig. 11c); adhesive discs well developed (Fig. 11b, c); fingers about 1/3 length of palm; dactylus moderately curved distally, with subacute tip, cutting edge with one median subtriangular-rounded tooth, about 1/2 as high as long, without proximal tooth; pollex shorter than dactylus,

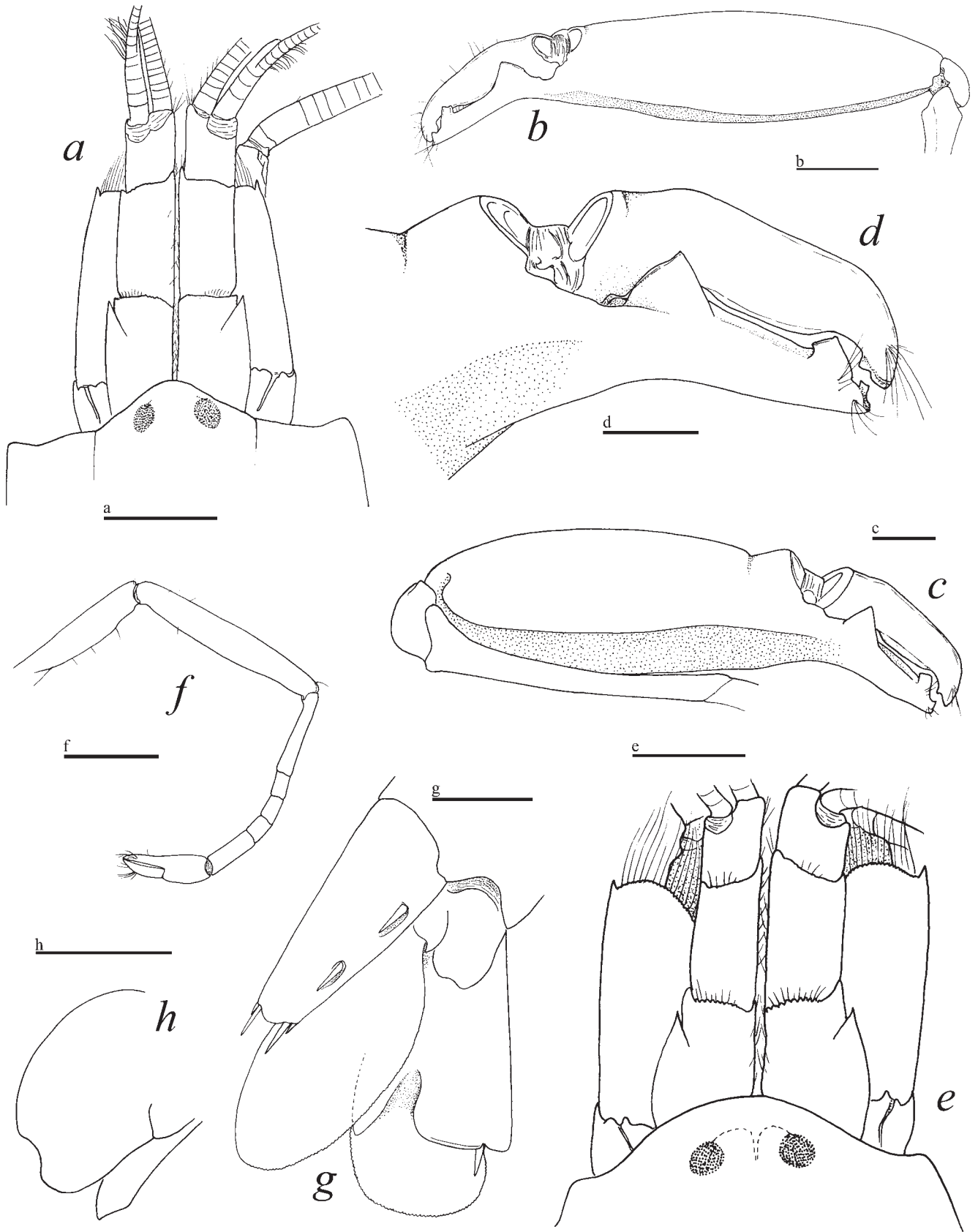


Fig. 7. *Leptalpheus denticulatus*, new species (a, b), male from Panglao, Philippines (ZRC 2005.0086): a, frontal region, dorsal view; b, major (left) cheliped, carpus and chela, lateral view. *Leptalpheus pacificus* Banner & Banner, 1974 (c–h), female from Hawaii (USNM 205907): c, major (right) cheliped, ventrolateral view; d, same, detail of fingers; breeding female from Hawaii (FLMNH UF Arthropoda 12473): e, frontal region, dorsal view; f, second pereiopod, lateral view; g, right uropod and telson, dorsolateral view, setae omitted; h, left uropod, detail of protopod. Scale bars: a–g = 1 mm; h = 0.5 mm.

abruptly ending, with one blunt terminal tooth, cutting edge with two teeth: one much larger subtriangular proximal tooth and one smaller truncate distal tooth (Fig. 11c, d). Minor cheliped shorter and weaker than major cheliped (Fig. 12a); ischium short, unarmed; merus slender, ventrally depressed; carpus very short, cup-shaped; chela smooth, subcylindrical, with fingers about 1.2 times as long as palm, tips crossing when chela closed; cutting edges of dactylus and pollex with small curved teeth proximally and two larger opposing teeth at about mid-length (Fig. 12b).

Second pereiopod slender; ischium about 3/4 length of merus; carpus five-segmented, segments with ratio approximately equal to: 4/1/1/1/2.5 (Fig. 12c); chela simple, about as long as first carpal segment; fingers as long as palm. Third pereiopod moderately slender (Fig. 12d); ischium unarmed; merus flattened mesially, about 2.5 times as long as ischium, about five times as long as wide; carpus less than 1/2 length of merus, with distoventral spiniform seta; propodus longer than carpus, with three ventral spiniform setae and one distoventral spiniform seta proximal to dactylus; dactylus simple, conical, about 2/5 length of propodus, curved (Fig. 12d). Fourth pereiopod (Fig. 12e) generally similar to third. Fifth pereiopod (Fig. 12f) much more slender than third and fourth pereiopods; ischium and merus not flattened mesially, unarmed; carpus without distal spiniform seta; propodus as long as merus, without spiniform setae, distally with at least seven rows of setae; dactylus similar to that of third and fourth pereiopods.

First to fifth pleomeres with minute pits on surface; posteroventral angles rounded; sixth pleonite with large articulated plate posteroventrally (Fig. 10a). First pleopod with very short endopod, latter fringed with setae apically

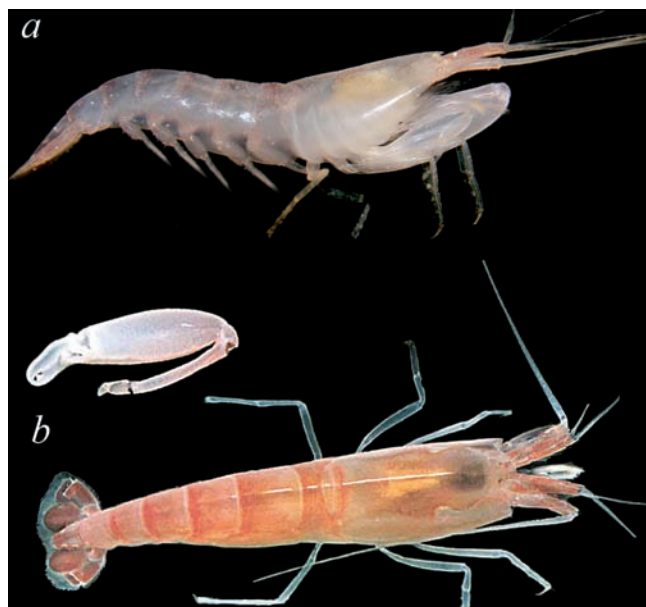


Fig. 8. *Leptalpheus denticulatus*, new species, colour pattern in life: a, non-type male from Yaqara Bay, Viti Levu, Fiji (MNHN-Na 15776); b, large female paratype from Nhatrang Bay, Vietnam (MNHN-Na 17065), major (left) cheliped detached (photograph by O. Savinkin).

(Fig. 9f). Male second pleopod (Fig. 9g) with appendix interna and appendix masculina, latter almost twice as long as former, and bearing numerous slender, spiniform apical and subapical setae (Fig. 9h).

Uropod with lateral lobe of protopod bearing two small acute teeth distally (Fig. 9i); endopod somewhat longer than exopod, without specific features; exopod with truncate posterior margin and without distinct distolateral tooth adjacent to distolateral spine; lateral portion of diaeresis straight, not curved into tooth centrally; mesial portion deeply incised forming large triangular tooth proximal to mesial margin (Fig. 9i).

Telson moderately slender, more than twice as long as wide proximally (Fig. 9j); dorsal surface pitted, with two pairs of robust spiniform setae inserted at short distance from lateral margin, at about 1/3 and 2/3 length of telson, respectively; posterior margin feebly rounded, posterolateral angles each with pair of spiniform setae, mesial at least four times as long as lateral; anal tubercles small, feebly sclerotised.

Gill/exopod formula as in previous species (see above).

Colour pattern. – Field notes indicated: “Translucent, slightly pink, ovary green”.

Size. – The CL of both specimens is 7.7 mm; the TL ranges from 21.9 mm in the male holotype to 23.9 mm in the female paratype.

Etymology. – The new species is named after Peter C. Dworschak (Naturhistorisches Museum in Wien, Vienna, Austria), the collector of the present specimens, our estimated friend and colleague, and also a well known specialist of the Thalassinidea.

Type locality. – Panglao Island, southwest of Bohol, the Philippines.

Ecology. – Both specimens were collected from a *Glypturus* cf. *armatus* burrow, together with gastropods (Phenacolepadidae) and sentinel crabs, *Macrophthalmus* sp. (Ocypodidae) [field notes by P. C. Dworschak].

Distribution. – Western Pacific: presently known only from the type locality in the Philippines.

Remarks. – *Leptalpheus dworschaki*, new species, is closely related to *L. pacificus* and the above-described *L. denticulatus*, new species, but can be separated from both species by the armature on the major chela fingers, in particular by the presence of a distinct blunt tooth on the dactylus (absent in *L. pacificus* and *L. denticulatus*, new species, although larger individuals may have a broad bulge at the same position); the absence of a small proximal tooth on the dactylus (present in *L. pacificus* and *L. denticulatus*, new species); and the shorter hiatus between the larger proximal and smaller distal teeth on the pollex (this hiatus is almost twice as long in *L. pacificus* and *L. denticulatus*, new species) (compare

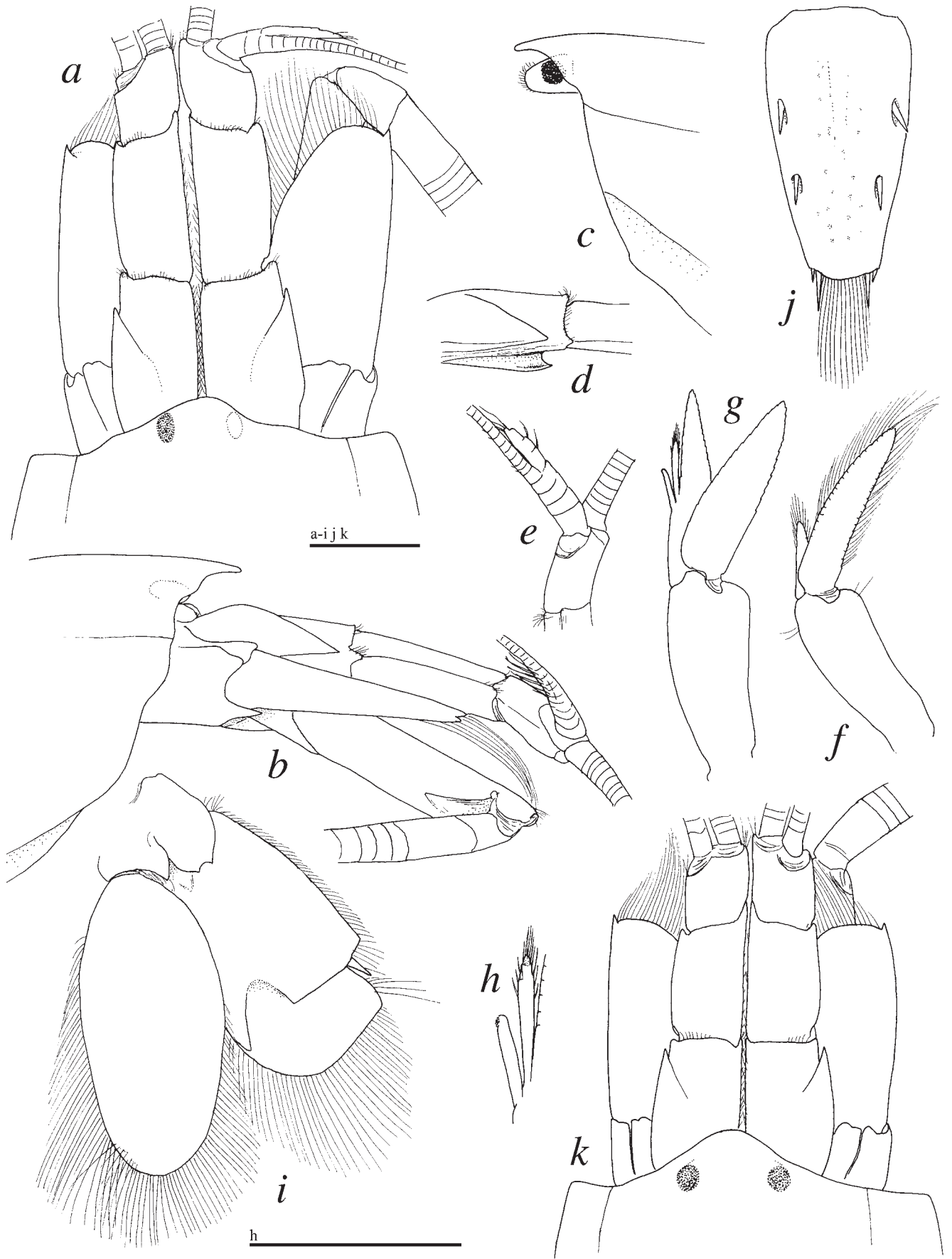


Fig. 9. *Leptalpheus dworschaki*, new species, male holotype (NMCR 27540): a, frontal region, dorsal view; b, same, lateral view; c, frontal margin of carapace, lateral view; d, first segment of right antennular peduncle, lateral view; e, lateral flagellum of right antennule, lateral view; f, first pleopod, mesial view; g, second pleopod, mesial view; h, same, appendix masculina and appendix interna; i, right uropod, dorsal view; j, telson, dorsal view; female paratype (ZRC 2005.0085): k, frontal margin, dorsal view. Scale bars = 1 mm.

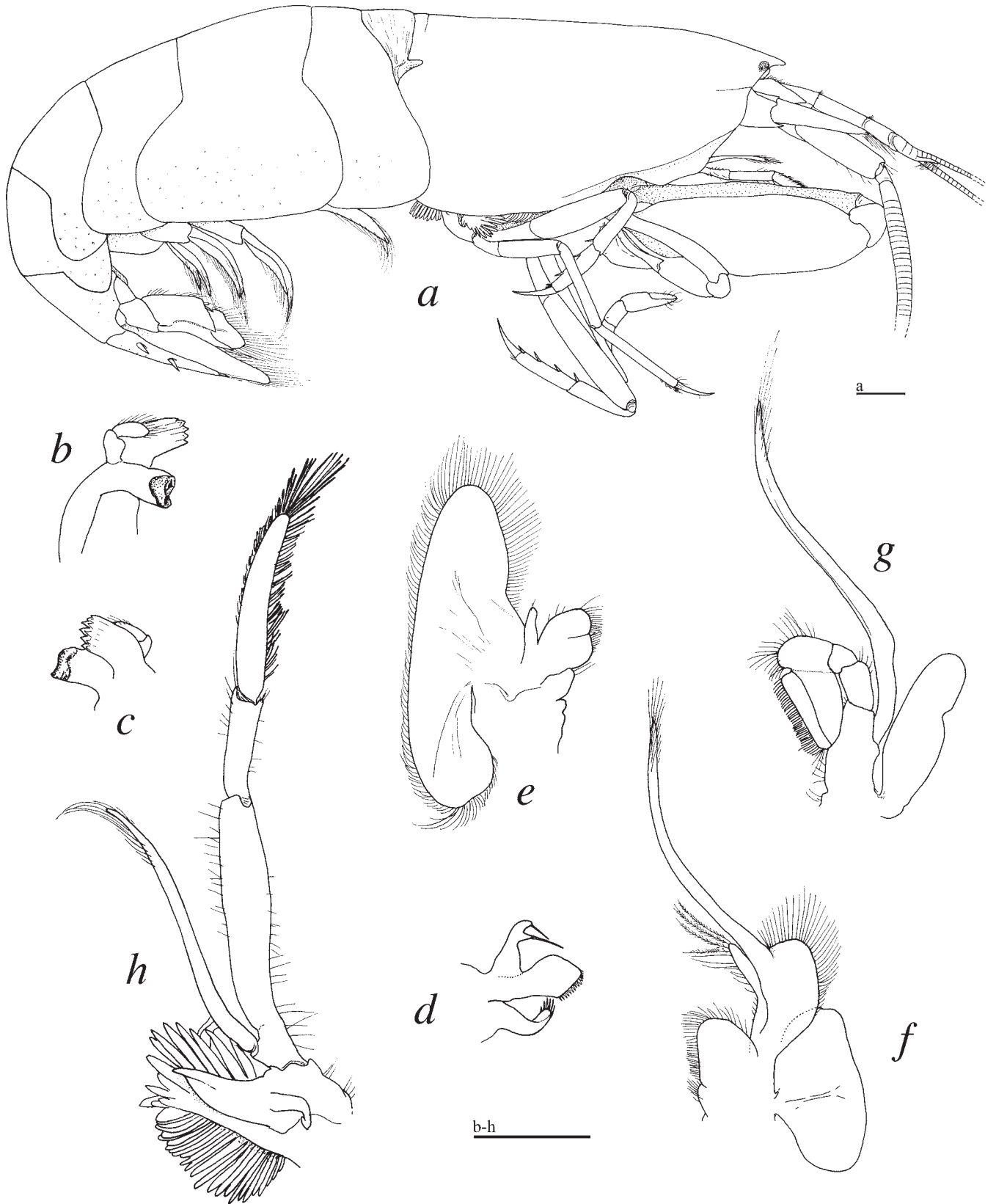


Fig. 10. *Leptalpheus dworschaki*, new species, female paratype (ZRC 2005.0085): a, habitus; male holotype (NMCR 27540): b, mandible, mesial view; c, same, dorsolateral view; d, maxillule, lateral view; e, maxilla, lateral view; f, first maxilliped, lateral view; g, second maxilliped, lateral view; h, third maxilliped, lateral view. Scale bar = 1 mm.

Figs. 11c, d and Figs. 3c, d; 4 b, c; 7c, d). *Leptalpheus dworschaki*, new species, can be also separated from *L. denticulatus*, new species, by the absence of a small tooth on the central portion of the uropodal diaeresis. We were unable to find any other obvious morphological differences between *L. dworschaki*, new species, and *L. pacificus* and *L. denticulatus*, new species.

The length of the second segment of the antennular peduncle and the shape of the frontal margin appear to be somewhat variable in both *L. dworschaki*, new species (Fig. 9a, k), and *L. denticulatus*, new species (Figs. 1a, 5a); the latter species is also variable in the proportions of the merus of the third pereiopod (Figs. 2i, 6h; see also above). Therefore, these features cannot be reliably used to distinguish *L. dworschaki*, new species from *L. denticulatus*, new species, or from *L. pacificus*.

ACKNOWLEDGMENTS

We are grateful to A. Richard Palmer (University of Alberta, Edmonton, Canada) for supporting research on the family Alpheidae from an NSERC operating grant (A7245). Steve Dunbar (Loma Linda University, Loma Linda, USA) invited one of us (AA) to participate in the Marine Cryptofauna Survey of the Yaqara Bay, Fiji, in January 2005. Leslie Harris and George Davis (LACM) arranged the loan of LACM specimens. All Panglao specimens were collected by Peter C. Dworschak (Naturhistorisches Museum in Wien, Austria) during the Panglao Biodiversity Project 2004, made possible through grants from the Total Foundation, the French Ministry of Foreign Affairs, and the ASEAN Regional Centre for Biodiversity Conservation, and coordinated by Philippe Bouchet (MNHN) and Danilo Largo (University of San Carlos, Cebu, the Philippines). Peter K. L. Ng, S. H.

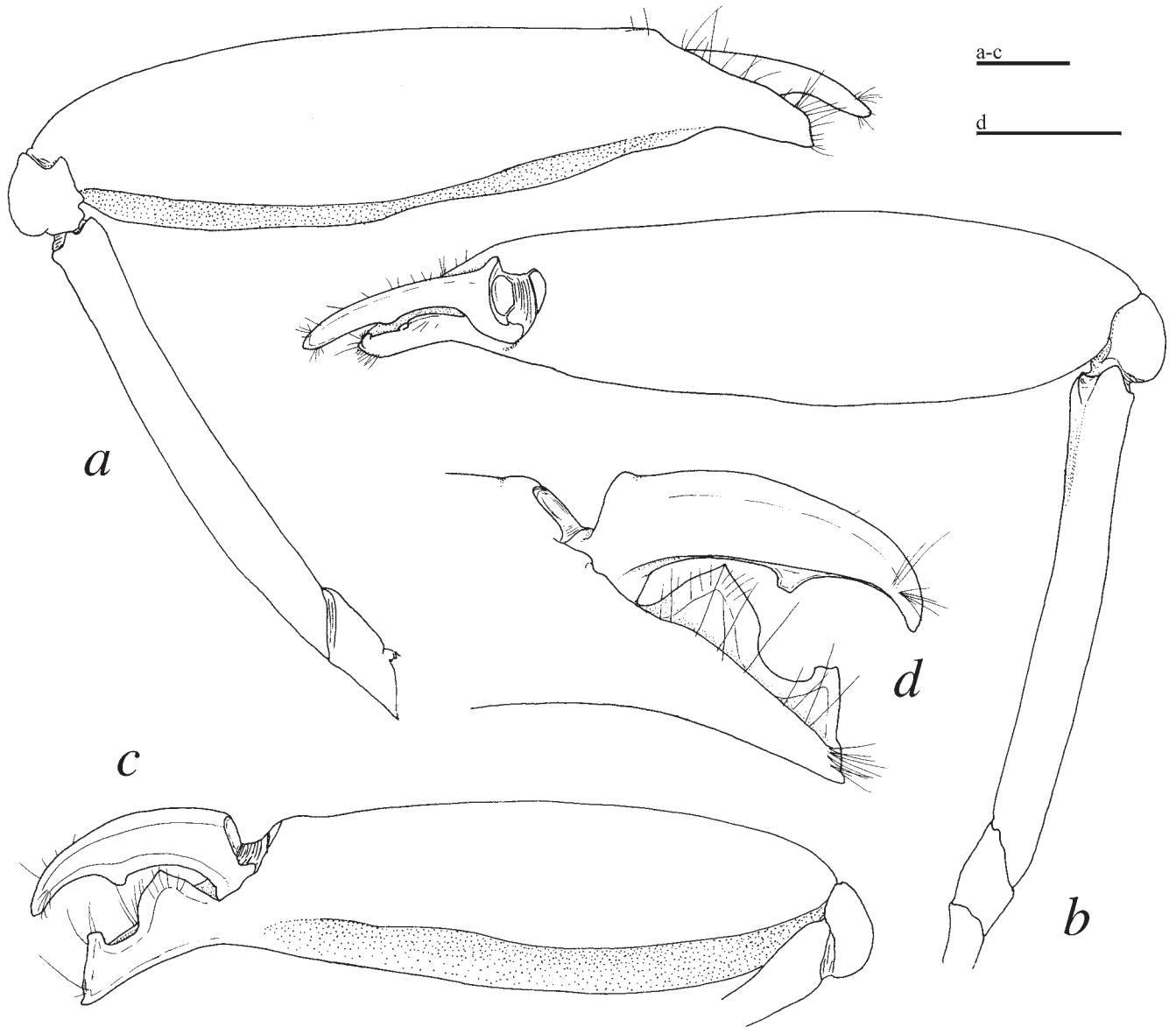


Fig. 11. *Leptalpheus dworschaki*, new species, male holotype (NMCR 27540): a, major (left) cheliped, mesial view; b, same, lateral view; c, same, chela, carpus and distal merus, ventrolateral view; d, same, distal chela, ventromesial view. Scale bars = 1 mm.

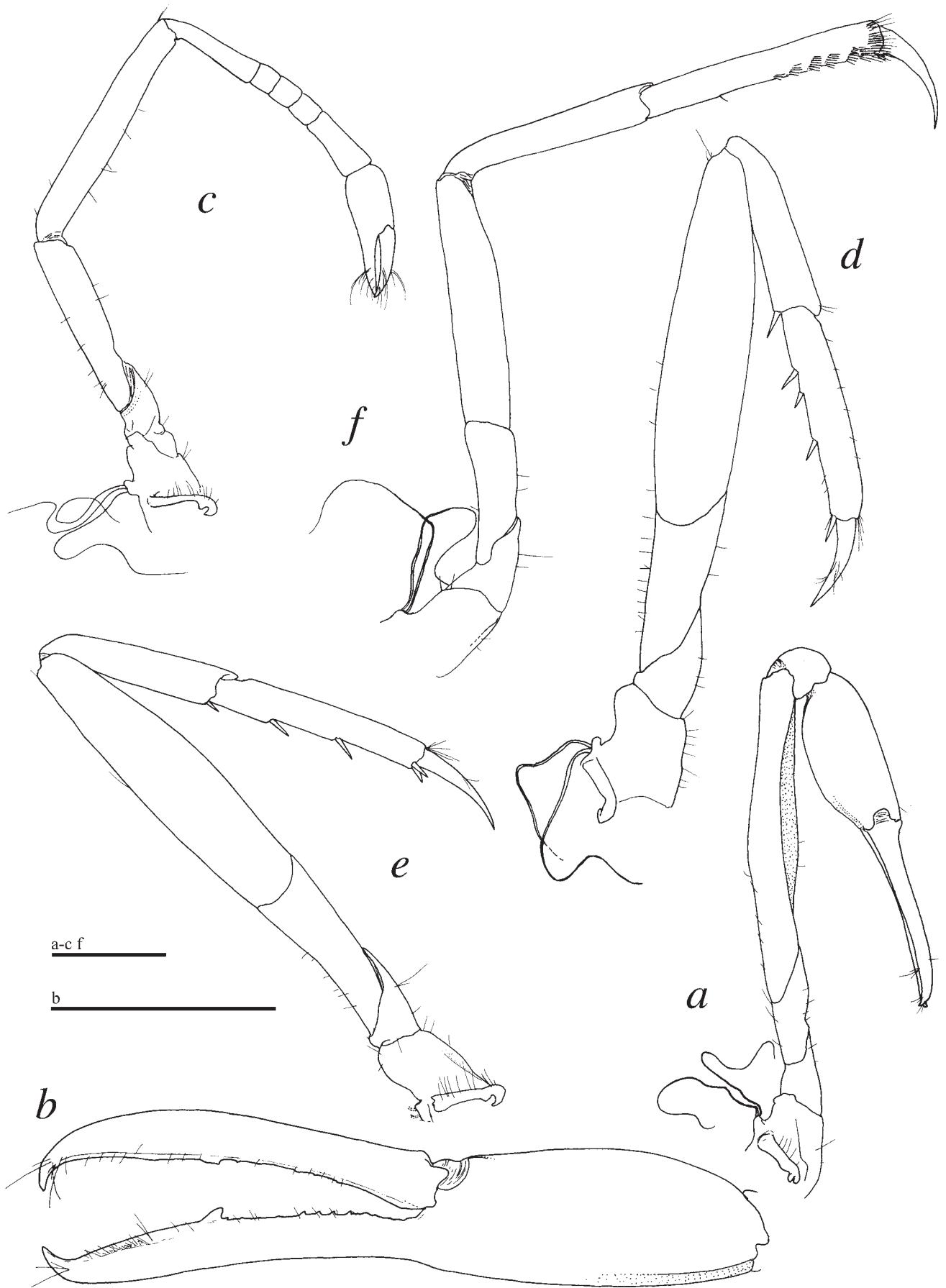


Fig. 12. *Leptalpheus dworschaki*, new species, female paratype (ZRC 2005.0085): a, minor (right) cheliped, lateral view; b, same, chela, mesial view; male holotype (NMCR 27540): c, second pereopod, lateral view; d, third pereopod, lateral view; e, fourth pereopod, lateral view; f, fifth pereopod, lateral view. Scale bars = 1 mm.

Tan, Joelle Lai, the late K. L. Yeo (National University of Singapore, Singapore) and Chia-Wei Lin (National Taiwan Ocean University, Keelung, Taiwan) were helpful during the sorting of the Panglao 2004 material; S. H. Tan and late K. L. Yeo arranged the loan of this material. Oleg V. Savinkin (Moscow, Russia) helped with photography of some Nhatrang specimens. Karen Reed (USNM) provided collection data for the USNM specimen of *L. pacificus* and checked a USNM paratype specimen at our request. Two anonymous reviewers made very useful suggestions improving the quality of the manuscript.

LITERATURE CITED

- Anker, A., 2008. The shrimp genus *Leptalpheus* Williams, 1965 in the southeastern Caribbean Sea, with description of one new species from Panama (Crustacea, Decapoda, Alpheidae) *Zoosystema*, **30**: 781–794.
- Anker, A., J. A. Vera Caripe & C. Lira, 2006. Description of a new species of commensal alpheid shrimp (Crustacea, Decapoda) from the southern Caribbean Sea. *Zoosystema*, **28**: 683–702
- Banner, A. H. & D. M Banner, 1974. Contributions to the knowledge of the alpheid shrimp of the Pacific Ocean, part XVII: additional notes on the Hawaiian alpheids: new species, subspecies and some nomenclatorial changes. *Pacific Science*, **28**: 423–437.
- Banner, A. H. & D. M Banner, 1983. An annotated checklist of the alpheid shrimp from the western Indian Ocean. *Travaux et Documents de l'ORSTOM*, **158**: 1–164.
- Dworschak, P. C. & V. R. Coelho, 1999. On two alpheids from Araça (São Paulo, Brazil) with a description of a new species of *Leptalpheus* (Decapoda: Caridea: Alpheidae). *Annalen des Naturhistorischen Museums in Wien*, **101B**: 475–488.
- Felder, D.L. & R. B. Manning, 1986. A new genus and two new species of alpheid shrimps (Decapoda: Caridea) from South Florida. *Journal of Crustacean Biology*, **6**: 497–508.
- Milne-Edwards, A., 1870. Révision du genre *Callianassa* (Leach) et description de plusieurs espèces nouvelles de ce groupe faisant partie de la collection du Muséum. *Nouvelles Archives du Muséum d'Histoire Naturelle de Paris*, **6**: 75–102, Pls. 1, 2.
- Nobili, G., 1904. Diagnoses préliminaires de vingt-huit espèces nouvelles de stomatopodes et décapodes macroures de la Mer Rouge. *Bulletin du Muséum d'Histoire Naturelle, Paris*, **10**: 228–238.
- Ríos, R. & A. Carvacho, 1983. *Leptalpheus mexicanus*, new species (Crustacea, Decapoda, Alpheidae). Caridean shrimps of the Gulf of California III. *Journal of Crustacean Biology*, **3**: 306–313.
- Williams, A. B., 1965. A new genus and species of snapping shrimp (Decapoda, Alpheidae) from the southeastern United States. *Crustaceana*, **9**: 192–198.