

A new species of *Salmoneus* (Crustacea: Decapoda: Alpheidae) from Palau

by Sammy DE GRAVE

Abstract

A new species of the genus *Salmoneus* (Alpheidae) is described from Palau in the Central Pacific. The specimens were sampled by yabby pump from presumed *Alpheus* burrows and provide a further record of commensalism in the genus, although not fully substantiated due to the lack of visual confirmation. The new species can be distinguished from all other Pacific species in the genus, by the absence of ischial spines on the fourth pereiopod, but is closely related to the Japanese *S. gracilipes* and related forms.

Key words: Decapoda, Alpheidae, *Salmoneus*, new species, Palau.

Résumé

Une nouvelle crevette du genre *Salmoneus* (Alpheidae) est décrite à partir de spécimens de l'île de Palau, dans le Pacifique central. Les spécimens étudiés ont été récoltés en utilisant une pompe à crevette sur des terriers suspectés d'appartenir à des *Alpheus*. Ces données suggèrent que la nouvelle espèce est commensale comme c'est le cas chez d'autres *Salmoneus*. Vu l'absence d'observations directes, il n'est cependant pas possible de tirer des conclusions en la matière. La nouvelle espèce se distingue des autres représentants Pacifique du genre par l'absence d'épines ischiales sur le quatrième pereiopode. Elle est cependant étroitement apparentée à l'espèce japonaise *S. gracilipes* et aux formes affines.

Mots-clés: Decapoda, Alpheidae, *Salmoneus*, nouvelle espèce, Palau.

Introduction

The alpheid genus *Salmoneus* HOLTHUIS, 1955, occurs from the Mediterranean southwards through to tropical latitudes. The genus as a whole remains relatively poorly known, with many species known only from a few specimens, while some taxa are assumed to be species complexes (ANKER, 2001, 2003a).

Worldwide, the genus at present contains 22 described species (a key to which is given in ANKER, 2003a), as well as

several undescribed taxa (ANKER, 2003a; ANKER, pers. comm.). These species can be informally divided into two species groups, on the basis of the relative lengths and shapes of the minor to the major cheliped (ANKER, 2003a, b). The *Salmoneus jarli* (HOLTHUIS, 1951) group contains four species, characterised by the minor cheliped being longer (although more slender) than the major cheliped; occurring exclusively in the Atlantic Ocean (HOLTHUIS, 1951; FRANSEN, 1991; DWORSCHAK et al., 2000). The much larger, and morphologically more disparate, *Salmoneus serratidigitus* (COUTIÈRE, 1896) group is characterised by the minor cheliped being much shorter and less robust than the major cheliped (with the exception of the recently described dimorphic *S. seticheles* ANKER, 2003a). The 18 species of this group are distributed across the entire Indo-Pacific (BANNER & BANNER, 1981), as well as in the western and central Atlantic (CHACE, 1972; FELDER & MANNING, 1986; MANNING & CHACE, 1990).

Here, a further species of the genus *Salmoneus* is described from Palau, central Pacific, based on material collected from burrows of *Alpheus* aff. *mackayi* BANNER, 1959. Specimens are deposited in the collections of the Oxford University Museum of Natural History (UK) and the Institut Royal des Sciences Naturelles de Belgique, Brussels (KBIN, Belgium).

Systematics

Alpheidae RAFINESQUE, 1815
Salmoneus HOLTHUIS, 1955
Salmoneus colinorum sp. nov.
(Figs. 1-4)

MATERIAL EXAMINED

Holotype: ovigerous female, post-orbital carapace length (pocl) 3.05 mm; Ngerbeched mangrove, SW of Malakal Harbour, Palau, 07°19.703' N, 134°28.611' E, 1-2 m seaward of

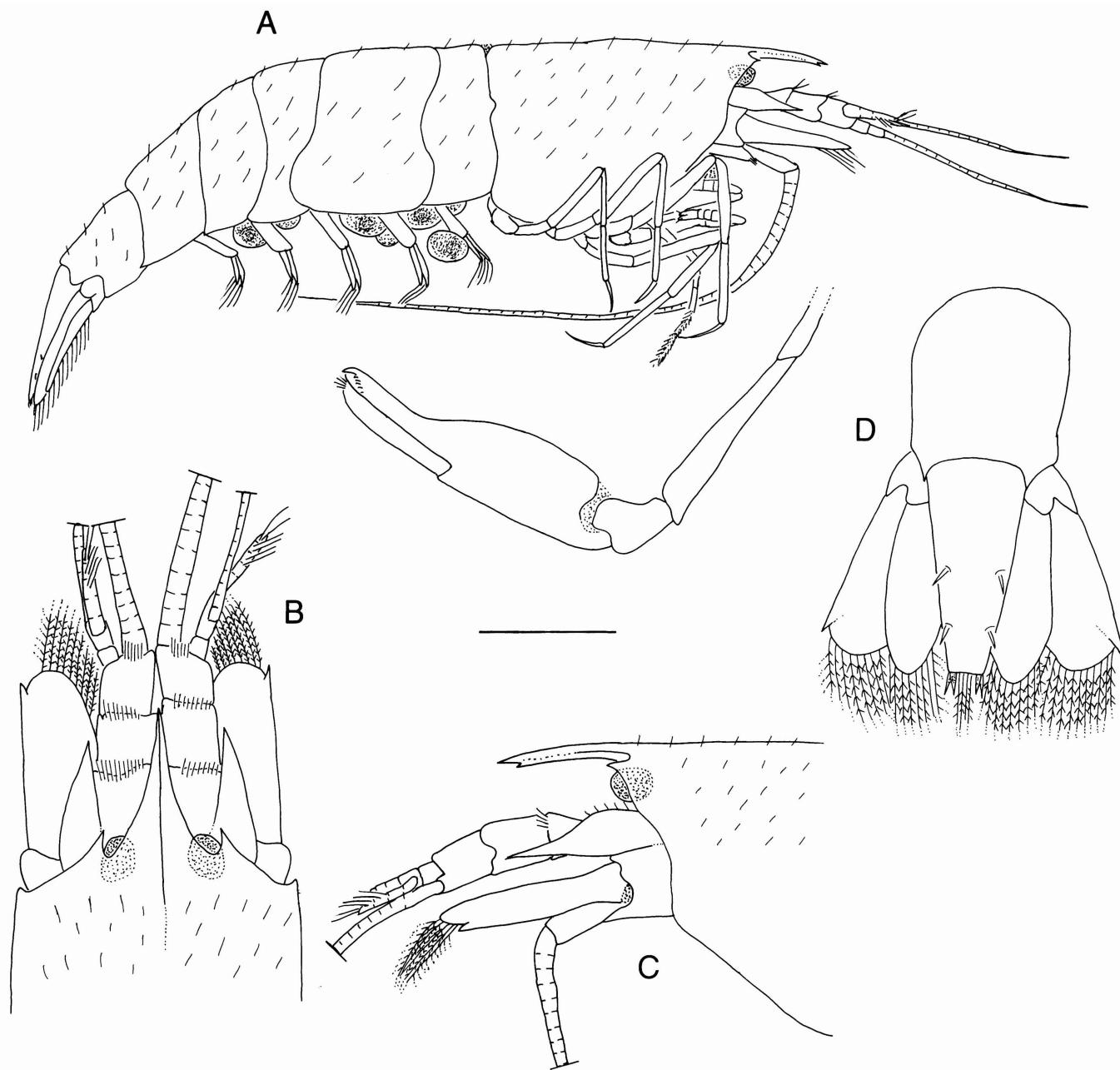


Figure 1. *Salmoneus colinorum* sp. nov, holotype (OUMNH 2002-24-44) (A, B, C), ovig. paratype pocl 3.00 mm (KBIN IG 30230) (D). A: lateral view (major cheliped detached); B: frontal region, dorsal view; C: same, lateral view; D: caudal fan. Scale bar indicates 2 mm (A) or 1 mm (B-D)

mangrove edge, on silty sand; yabby pumping of presumed alpheid burrows (see ecology section); leg. S. DE GRAVE & C. BURRAS, 2 June 2002; field no. 320; OUMNH Zoo. Coll. 2002-24-44. Paratypes: post-ovig. female, pocl 3.55 mm, KBIN IG 30230; ovig. female (partly dissected), pocl 3.00 mm, KBIN IG 30231; ovig. female (fully dissected), pocl 3.35 mm, OUMNH Zoo. Coll. 2002-24-45; two ovig. females (not dissected), pocl 3.25, 3.35, OUMNH Zoo. Coll. 2002-24-46; all paratypes same data as holotype.

DESCRIPTION

Carapace setose, without post-rostral tubercle (Figs. 1A-C). Rostrum long, slender, approximately 0.30 of pocl in holotype, 0.28-0.37 in paratypes, reaching to end of second article of antennular peduncle; inferior margin with small, acute, subdistal tooth (Fig. 1C), tooth reduced to tubercle in one paratype; base of rostrum approximately 0.67 of rostrum length in dorsal view (Fig. 1B). Extra-corneal teeth well-de-

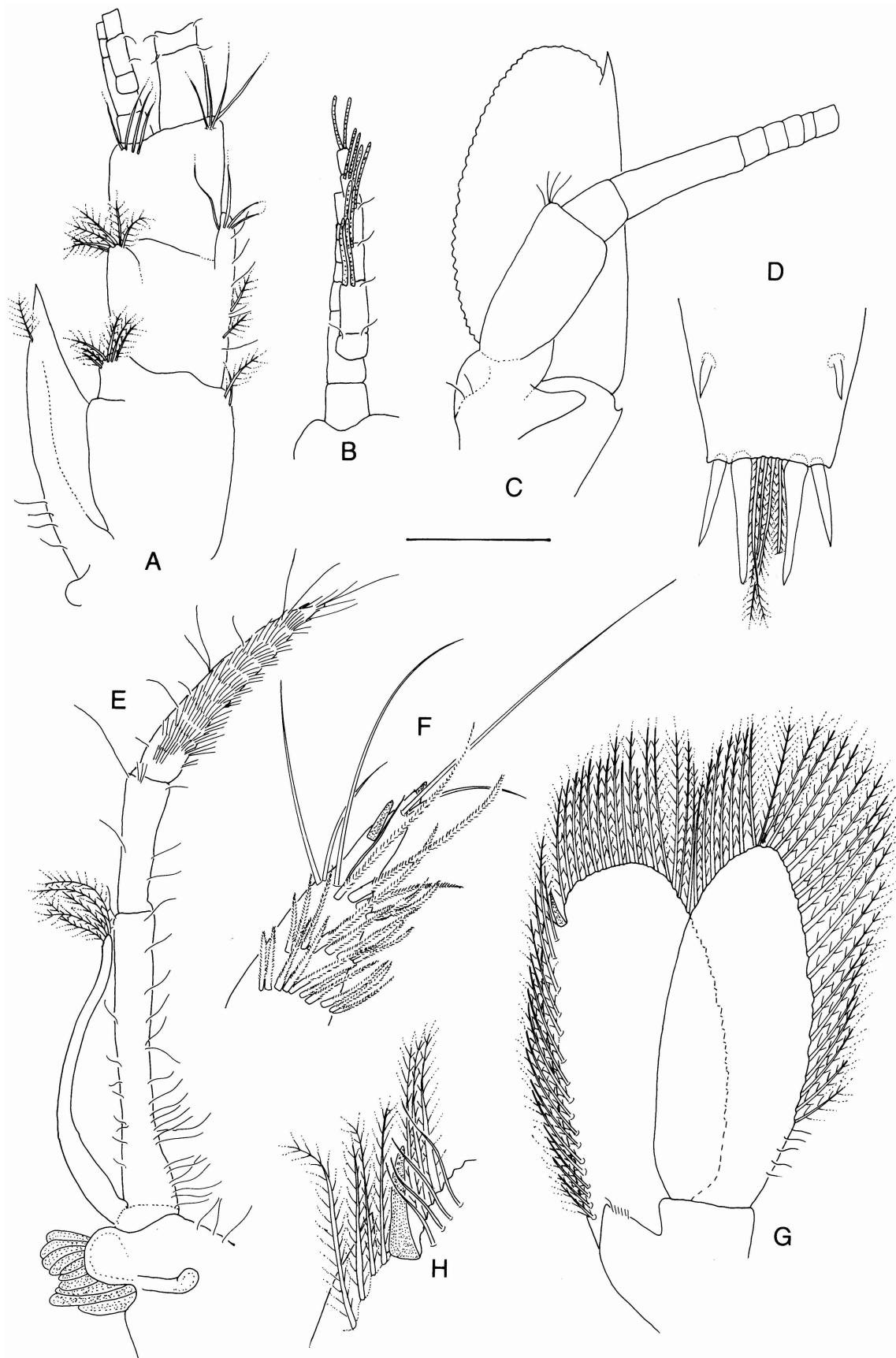


Figure 2. *Salmoneus colinorum* sp. nov, ovig. paratype pool 3.35 mm (OUMNH 2002-24-45). A: antennular peduncle; B: detail of lateral antennular flagellum; C: scaphocerite and antennal peduncle; D: tip of telson, E: third maxilliped; F: tip of same; G: uropod, H: lateral spine of exopod. Scale bar indicates 0.65 mm (A, C, E, G), 0.50 mm (B, D) or 0.20 mm (F, H).

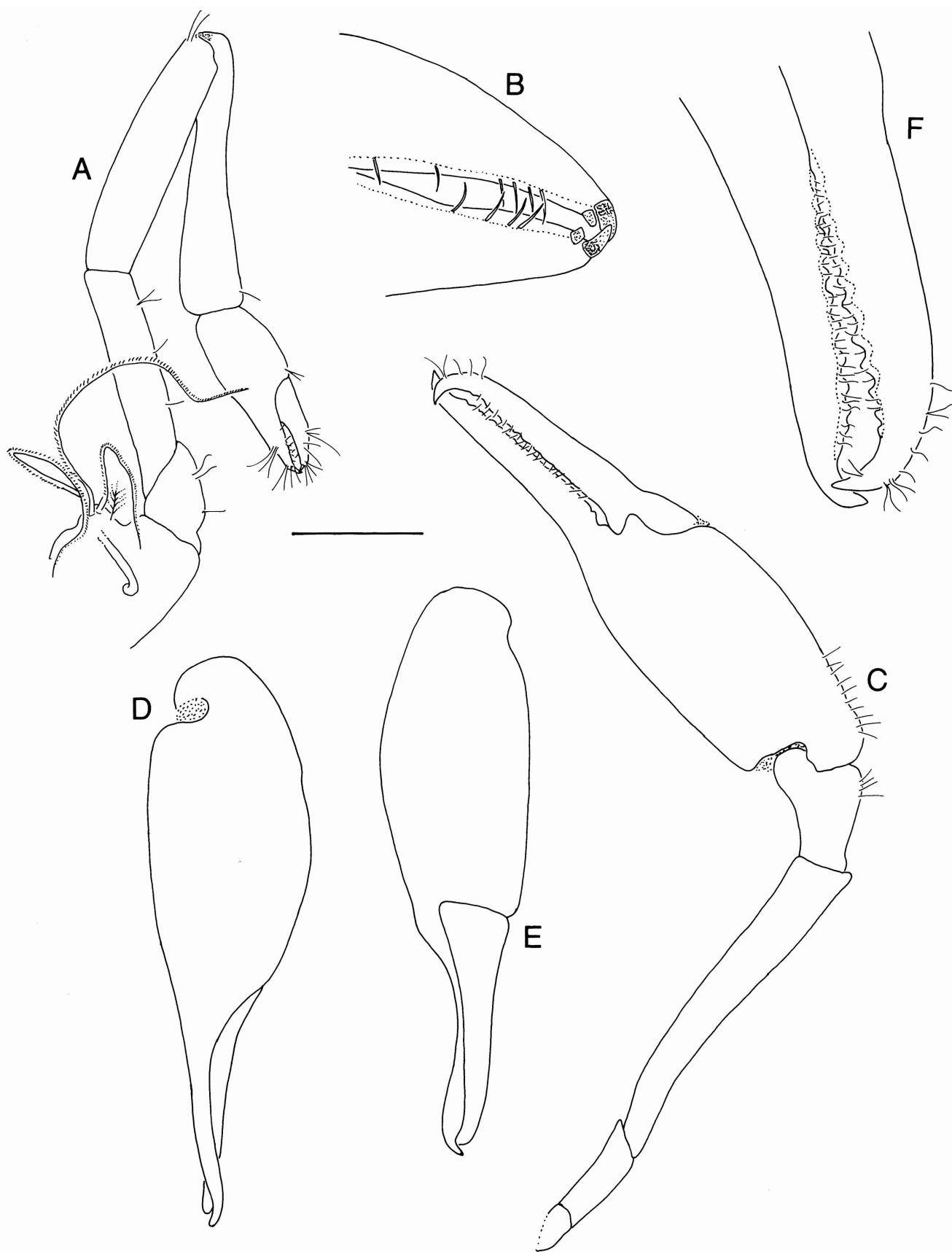


Figure 3. *Salmoneus colinorum* sp. nov, ovigerous paratype pocl 3.35 mm (OUMNH 2002-24-45). A: minor cheliped; B: same, finger tips; C: major cheliped; D: same, palm, dorsal view; E: same, palm, ventral view; F: same, finger tips. Scale bar indicates 1 mm (C, D-E), 0.5 mm (A, F) or 0.1 mm (B).

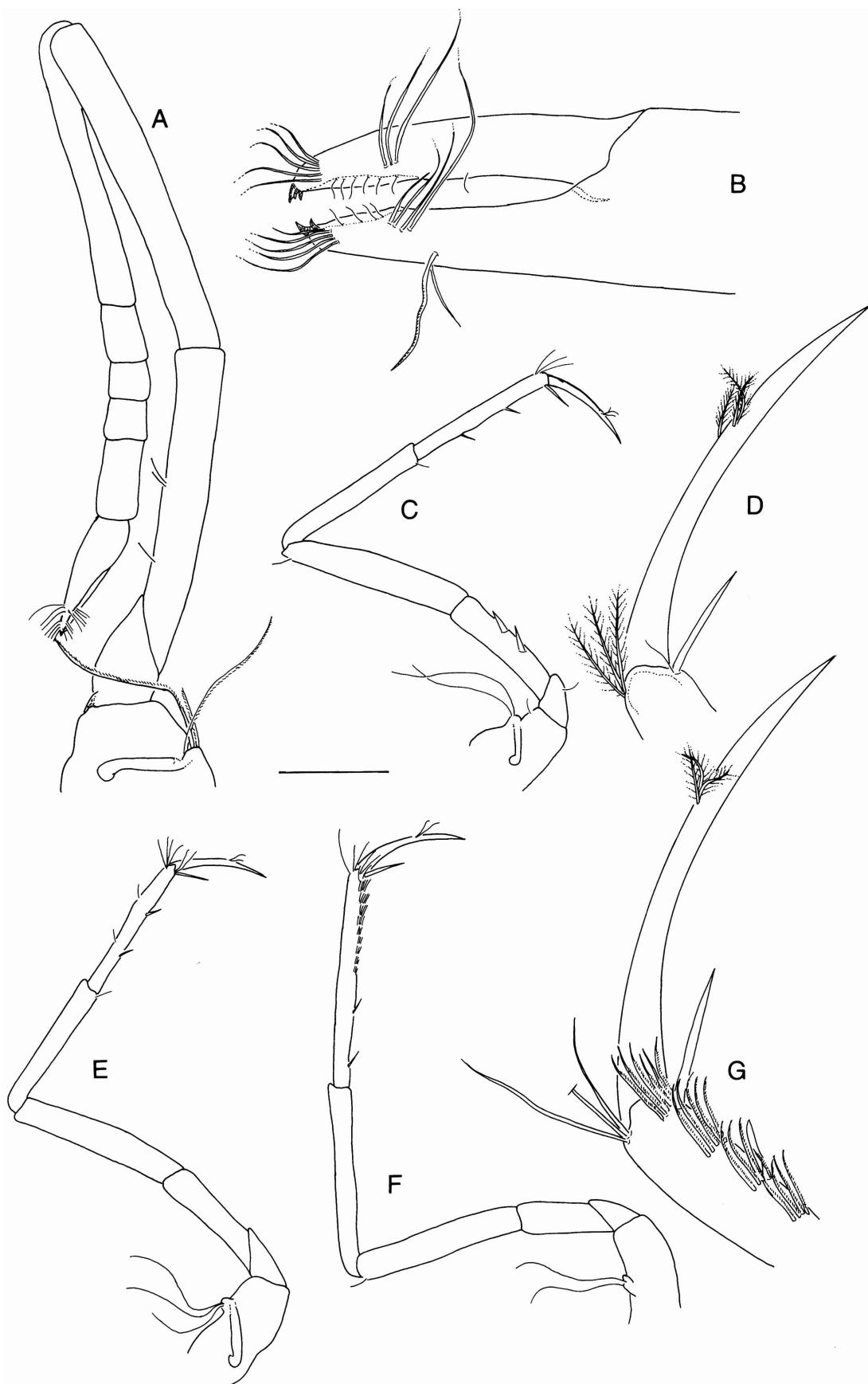


Figure 4. *Salmoneus colinorum* sp. nov, ovigerous paratype pol 3.35 mm (OUMH 2002-24-45). A: second pereiopod; B: same, fingers; C: third pereiopod; D: same, distal part; E: fourth pereiopod, F: fifth pereiopod; G: same, distal part. Scale bar indicates 1 mm (C, E, F), 0.4 mm (A, B, D, G)

veloped, acute. Eyes partially visible in dorsal and lateral views. Pterygostomial angle sub-quadratae (Fig. 1C). Pleura of abdominal segments as illustrated (Fig. 1A), pleura of fourth and fifth somite with acute posterior angle, sixth somite sub-equal in length to fifth somite. Telson approximately 2.25 times as long as proximal width, with two pairs of dorsal spines, situated at 0.48 and 0.78 of telson length (Fig. 1D); distal margin approximately one-third of proximal margin (Fig. 2D), straight, with two pairs of terminal spines, mesial longest; two pairs of plumose setae between mesial pair of spines.

Antennular peduncle robust, proximal article longest, medial and distal article approximately of equal length (Fig. 1A-C, Fig. 2A); stylocerite acute, falling short of distal margin of second article, mesio-ventral carina with blunt tooth (Fig. 2A); lateral flagellum biramous, basal fused portion with two joints, shorter ramus furnished with groups of aesthetascs (Fig. 2B).

Antenna with robust basicerite, bearing acute ventro-lateral tooth (Fig. 2C); carpocerite robust, not reaching distal margin of second antennular article, flagellum nearly as long as body length; scaphocerite reaching to end of antennular peduncle, lateral margin straight, anterior margin slightly convex, medial margin very convex (Fig. 2C); disto-lateral spine strong, reaching but not exceeding anterior margin of blade. Mouthparts not illustrated, typical for genus. Third maxilliped (Fig. 2E) with three articles; ultimate article approximately 1.8 times as long as penultimate article, richly furnished with rows of setae (Fig. 2F), tip with single, small distal spine and single subdistal spine; arthrobranch well-developed (Fig. 2E); lateral plate rounded (Fig. 2E).

First pereiopods (chelipeds) unequal in size and asymmetrical in shape, both held flexed ventrally in resting position (Fig. 1A, 3A). Minor cheliped (Fig. 3A) much shorter than major cheliped; ischium approximately 0.85 times as long as merus, carpus approximately 1.12 times as long as merus; chela simple, both dactylus and pollex distally with single, robust spine and smaller, subdistal spine (Fig. 3B), with sparse setae along cutting edge. Major cheliped nearly twice as long as carapace length (Fig. 1A); ischium short; merus elongate, somewhat excavated along extensor margin, arched; carpus short, semi-quadratae; palm swollen, without ornamentation; pollex and dactylus crossing distally in dorso-ventral plane (Fig. 3D-E), both armed with series of approx. 10-12 small teeth along cutting edge (Fig. 3F). Second pereiopods (Fig. 4A) slender, carpus five-articulated, first article longer than all other combined; length ratio of articles subequal to 5.0:1.0:0.6:0.7:1.4; fingers 0.6 times as long as palm, cutting edge of pollex sinuous, tip furnished with two stout spines; tip of dactylus furnished with three stout spines.

Third pereiopods (Fig. 4C) slender, merus approximately 1.45 times as long as ischium, carpus and propodus subequal in length to merus; ischium armed with two spines, propodus armed with two small, slender spines along ventral margin and single longer spine disto-ventrally; dactylus long, approximately 0.66 times as long as propodus, curved, tip acute (Fig. 4D).

Fourth pereiopod (Fig. 4E) similar to third pereiopod, lacking ventral spines on ischium. Fifth pereiopod (Fig. 4F), ap-

proximately equal in length to third pereiopod, lacking ventral spines on ischium, setal brush on propodus well-developed (Fig. 4G).

Uropods slightly over-reaching telson (Fig. 1D); exopod with well developed spine at diaeresis, diaeresis straight (Fig. 2G-H).

Eggs with well-developed embryos, approximately 0.675 x 0.425 mm in diameter.

DERIVATION OF NAME

Named after Pat and Lori COLIN (Coral Reef Research Foundation, Palau), in recognition of their contribution to the knowledge of Indo-Pacific marine biodiversity.

LIVE COLOURATION

Carapace and abdomen with transverse bands of purple, alternating with transparent banding; telson and uropods with purple dots; major cheliped and pereiopods transparent with scattered purple dots.

ECOLOGY

The specimens were collected from intertidal mudflats, approximately 1-2 m from the seaward edge of a mangrove. Samples were collected by yabby pump, possibly from alpheid burrows. Together with the specimens of *Salmoneus colinorum* sp. nov., two ovigerous females of *Alpheus* aff. *mackayi*, one specimen each of the gobies, *Cristatogobius lophius* HERRE and *Callogobius* sp., and one specimen of the aphroditid polychaete, *Paralepidonotus ampulliferus* (GRUBE) were collected. It is not clear if all these species occurred in the same burrows or not, as samples were collected from several presumed burrows, and perhaps even from the surrounding substrate. Although *Cristatogobius lophius* has been noted as an associate of unidentified alpheids (see AKIHITO & MEGURO, 2000), *Alpheus mackayi* is not known to be part of any such associations. Nevertheless, MACNAE & KALK (1962) reported the closely related *Alpheus malabaricus* (FABRICIUS) to be associated with gobies. Given the previously reported burrow sharing habits of several *Salmoneus* species (FELDER & MANNING, 1986; DE GRAVE & WILKINS, 1997; DWORSCHAK et al., 2000; ANKER, 2003b) and the fact that no specimens were noted on the surface of the mud, it seems plausible that *S. colinorum* sp. nov. lives commensally in burrows, excavated by a species of *Alpheus*. It remains difficult to conclude whether they came from burrows excavated by *A. aff. mackayi* or from burrows excavated by an *Alpheus* species, which evaded capture and which may have shared its burrow with *Cristatogobius lophos*. Alternatively, it remains possible that all three species were sharing the same burrows.

Discussion

Morphologically, the new species exhibits most similarities to *Salmoneus gracilipes* MIYA, 1972, described from the Ryukyu Archipelago (Japan); especially in relation to the overall pilosity of the carapace, the length and width of the

rostrum, the form of the major cheliped, eyes partially exposed dorsally and laterally, and the gracile nature of the pereiopods. However, the presence of a ventral rostral tooth, the lack of spines on the ischium of the fourth and fifth pereiopods, the lack of a medial indentation of the distal margin of the telson, as well as the colour pattern (*S. gracilipes* is quoted as entirely transparent, see MIYA, 1972) do separate both taxa easily. Quite problematically, MIYA (1984) assigned a single specimen from Majuro Atoll (Marshall Islands) to *S. gracilipes*, although the specimen harboured a minute, ventral rostral tooth. No other distinguishing features are mentioned in either the text or the figures, and as this specimen is presently unavailable for study, this record is difficult to fully interpret. It seems likely that this specimen in fact belongs to *S. colinorum* sp. nov., as the presence or absence of a ventral rostral tooth appears diagnostic within the genus. However, the ecology of the Majuro specimen (under a coral rock buried in sand at low tide level of reef flat at ocean side, see MIYA, 1984) does differ from the general ecology of the collecting site of *S. colinorum* sp. nov.; as such the true taxonomic status of this specimen cannot be fully ascertained and must await the collection of new material from Majuro Atoll.

The new species is more distantly related to a number of other species: *S. seticheles* from northern Australia, *S. cavicolus* FELDER & MANNING, 1986 from the Western Atlantic; an undescribed species from Vietnam (ANKER & MARIN, submitted); and two undescribed species, closely related to *S. cavicolus* from the Western Atlantic (ANKER & FELDER, in prep.). *S. tafaongae* BANNER & BANNER, 1966, only known from the mutilated holotype may also belong in this group (ANKER, pers. comm.). This species group is characterised by an elongate, slender rostrum (with a small, sub-distal tooth in *S. colinorum* sp. nov., *S. seticheles* and *S. cavicolus*); dorsally partly exposed eyes; slender dactyli on the third to fifth pereiopods; and with the major chela armed along the entire or near entire length of the cutting edges (ANKER & MARIN, subm.). The new species can be distinguished at once from all other species in this group, by the absence of ischial spines on the fourth pereiopod. Further, it differs from *S. seticheles* primarily by the lack of an indentation on the posterior margin of the telson, and the absence of polymorphic chela, as well as the shape of the lateral plate on the third maxilliped and other minor features. At present it is difficult to fully contrast the new species to the Western Atlantic *S. cavicolus*, as several cryptic taxa have been confused under that name, even in the type series (ANKER, 2003a), a full comparison must await the description of these taxa (ANKER & FELDER, in prep.). Although the major cheliped of *S. tafaongae* is not known (BANNER & BANNER, 1966; ANKER, 2003b), *S. colinorum* sp. nov. differs from *S. tafaongae* in a number of characters: rostrum reaching to end of second antennular peduncular article versus reaching end of antennular peduncle in *S. tafaongae*; extra-corneal teeth much shorter (reaching midlength of first antennular peduncular article in *S. tafaongae*), carpus of third pereiopod disto-ventrally unarmed (versus armed in *S. tafaongae*), propodal brush on fifth pereiopod well developed (versus poorly developed in *S. tafaongae*), and the telson lacking a medial indentation (versus trapeziform in *S. tafaongae*).

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References

- ANKER, A., 2001. Two new species of snapping shrimps from the Indo-Pacific, with remarks on colour patterns and sibling species in Alpheidae (Crustacea: Caridea). *The Raffles Bulletin of Zoology*, 49(1): 57-72.
- ANKER, A., 2003a. New records of *Salmoneus* Holthuis, 1955 (Crustacea: Decapoda: Alpheidae) from northern Australia, with description of one new species and remarks on *S. serratidigitus* (Coutière, 1896). *The Beagle*, 19: 101-118.
- ANKER, A., 2003b. Alpheid shrimps from the mangroves and mudflats of Singapore. Part I. Genera *Salmoneus*, *Athanas* and *Potamalpheops*, with the description of two new species (Crustacea: Decapoda: Caridea). *The Raffles Bulletin of Zoology*, 51(2): 283-314.
- AKIHITO [PRINCE] & MEGURO, K., 2000. Review of the gobiid genus *Cristatogobius* found in Japan with description of a new species. *Ichthyological Research*, 47(3): 249-261.
- BANNER, A. H., 1959. Contributions to the knowledge of the alpheid shrimp of the Pacific Ocean. Part IV. Various small collections from the Central Pacific area, including supplementary notes on alpheids from Hawaii. *Pacific Science*, 13: 130-155.
- BANNER, A. H. & BANNER, D. M., 1966. Contributions to the knowledge of the alpheid shrimp of the Pacific Ocean. Part X. Collections from Fiji, Tonga and Samoa. *Pacific Science*, 20: 145-188.
- BANNER, D. M. & BANNER, A. H., 1981. Annotated checklist of the alpheid shrimp of the Red Sea and the Gulf of Thailand. *Zoologische Verhandelingen, Leiden*, 190: 1-99.
- CHACE, F. A. Jr., 1972. The shrimps of the Smithsonian-Bredin Caribbean expeditions with a summary of the West Indian shallow-water species (Crustacea: Decapoda: Natantia). *Smithsonian Contributions to Zoology*, 98: 1-179.
- COUTIÈRE, H., 1896. Note sur quelques genres nouveaux ou peu connus d'alpheidés formant la sous-famille des alphéopsides. *Bulletin du Muséum d'Histoire Naturelle, Paris*, 2 (6): 380-386.
- DE GRAVE, S. & WILKINS, H. K. A., 1997. A new record of *Salmoneus rostratus* Barnard, 1962 (Decapoda, Alpheidae) from Hansa Bay, Papua New Guinea. *Crustaceana*, 70(5): 633-636.
- DWORSCHAK, P. C., ANKER, A. & ABED-NAVANDI, D., 2000. A new genus and three new species of alpheids (Decapoda: Caridea) associated with thalassinids. *Annalen des Naturhistorischen Museums in Wien*, 102B: 301-320.
- FELDER, D. L. & MANNING, R. B., 1986. A new genus and two new species of alpheid shrimp (Decapoda: Caridea) from south Florida. *Journal of Crustacean Biology*, 6: 497-508.
- FRANSEN, C. H. J. M., 1991. *Salmoneus sketi*, a new species of alpheid shrimp (Crustacea: Decapoda: Caridea) from a submarine

- cave in the Adriatic. *Zoologische Mededelingen, Leiden*, 65(11): 171-179.
- HOLTHUIS, L. B., 1951. The caridean Crustacea of tropical West Africa. *Atlantide Report*, 2: 1-187.
- HOLTHUIS, L. B., 1955. The recent genera of the caridean and stenopodidean shrimp (class Crustacea, order Decapoda, supersection Natantia) with keys for their determination. *Zoologische Verhandelingen, Leiden*, 26: 1-157.
- MACNAE, W. & KALK, M., 1962. The fauna and flora of sand flats at Inhaca Island, Mozambique. *Journal of Animal Ecology*, 31(1): 93-128.
- MANNING, R.B. & CHACE, F. A. JR., 1990. Decapod and stomatopod Crustacea from Ascension Island, South Atlantic Ocean. *Smithsonian Contributions to Zoology*, 503: 1-91.
- MIYA, Y., 1972. The Alpheidae (Crustacea, Decapoda) of Japan and its adjacent waters. Part I. *Publications from the Amakusa Marine Biological Laboratory, Kyushu University*, 3(1): 23-101.
- MIYA, Y., 1984. Alpheid shrimps from the Truk, Ponape and Majuro Atoll (Crustacea, Decapoda). *Proceedings of the Japanese Society of Systematic Zoology*, 27: 67-100.

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