

ALPHEUS FENNERI SP. NOV. AND A. WILLIAMSII SP. NOV.,
TWO NEW INDO-WEST PACIFIC ALPHEID SHRIMPS OF
THE *BREVIROSTRIS* SPECIES GROUP.

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ABSTRACT

Two new shrimps of the "*brevirostris*" group of the genus *Alpheus* are described and illustrated. *Alpheus fenneri* sp. nov. was collected from 6 m depth, off Sulawesi, Indonesia, and *A. williamsii* sp. nov. from 18-24 m depth, in the Beagle Gulf, Timor Sea, the former species living in association with the goby *Amblyeleotris fontanesii*. *Alpheus fenneri* sp. nov. is most closely related to another goby-associated species, *A. bellulus* Miya and Miyake, and *A. williamsii* sp. nov. is most closely related to the apparently free-living species *A. pubescens* De Man. A key for the provisional identification of the Indo-West Pacific species of the "*brevirostris*" group is provided.

KEYWORDS: *Alpheus fenneri*, sp. nov., Sulawesi, Indonesia, *A. williamsii* sp. nov., Timor sea, spp. nov., Crustacea, Decapoda, Alpheidae, "*brevirostris*" group, key to Indo-West Pacific species, goby association.

INTRODUCTION

The species of the "*brevirostris*" species group of the shrimp genus *Alpheus* Fabricius, 1798, are of special interest as several species are commonly involved in associations with gobies. *Alpheus* species often feature in underwater photographs in the popular natural history press. Unfortunately, these photographs are usually only accompanied by the identification of "*Alpheus* sp." A wide variety of gobiid genera may be involved in these associations, including *Amblyeleotris*, *Cryptocentroides*, *Cryptocentrus*, *Stonogobiops* and *Vanderhorstia*. The fishes are usually associated with a heterosexual pair of shrimps, which are frequently the possessors of well developed distinctive colour patterns. Although frequently observed and photographed, the shrimps are generally difficult to capture. Those species that have been described have often not had their colour patterns recorded, particularly those described earlier, so that their identification from photographs is generally difficult or impossible. At the present time, the number of *Alpheus* colour patterns that

have been illustrated in association with gobies greatly exceeds the number of species that have been positively identified as goby associates. Much further work will be necessary to clarify the details of these associations and the degree of specificity of the shrimp colour patterns. The diversity of these colour patterns and their constancy suggests that they may be species specific and diagnostic. The associations between gobies and *Alpheus* species have been reviewed by Karplus (1987). Most of the reports of associations with gobies have come from relatively shallow water depths, through the use of scuba diving apparatus and it is at the moment unknown if these associations also occur in the deep-water species. The problems of alpheid shrimp colour patterns are discussed in Banner and Banner (1981).

Fortunately, in the case of the present specimens, collected by Dr J.E. Randall, of the Bishop Museum, Honolulu, and R. Williams, of the Northern Territory Museum, the freshly caught shrimps were photographed. In the case of Dr Randall's specimens, which were collected by hand, the identity of the associated fishes was

also established, and the distinctive colour pattern immediately suggested an unusual species. Mr Williams' specimen was trawl caught and any association thereby obscured. Further examination indicated that these specimens could not be referred to any of the species so far described and they are now here described as new.

SYSTEMATICS

ALPHEIDAE Rafinesque, 1815

Alpheus Fabricius, 1789

Diagnosis of "*brevirostris*" group (modified from Banner and Banner, 1982; Chace, 1988).

Orbital hoods often prominent, generally unarmed, major chela with palm always compressed, subquadrangular in section, often with surfaces delimited by distinct angles; with or without transverse groove ("saddle") proximal to dactylar hinge; minor chela sometimes balaeniceps or sub-balaeniceps in adult males; third pereiopod with dactyl always simple or subspatulate, merus usually distoventrally unarmed.

Alpheus fenneri sp. nov.

(Figs 1-2, 5)

Type Material. HOLOTYPE - 1 ovig. female, 1 male ALLOTYPE, Manado, Sulawesi, Indonesia, off Nusantara Diving Centre, 6 m, mud, 30 October 1991, NTM Cr. 008777. PARATYPE - 1 juv. male, same data as previous, USNM 264747.

The single male specimen is designated allotype and the female as holotype; both deposited in the Northern Territory Museum, Darwin (NTM). The paratype juvenile specimen is placed in the National Museum of Natural History, Washington (USNM).

Diagnosis. ("*brevirostris*" group). Body not unusually compressed or setose; rostrum slender, reaching anteriorly to about 0.6 of length of proximal segment of antennular peduncle, bluntly carinate in the midline posteriorly to slightly beyond bases of orbital hoods, base not abruptly delimited from adrostral grooves; carapace without median tooth or tubercle on gastric region or paired acute teeth overhanging posterior ends of adrostral grooves, anterior margin transverse medial to orbital hoods, curving gradu-

ally into rostral margin, unarmed, region not markedly depressed, orbital hoods unarmed, non-carinate, adrostral grooves comparatively shallow; telson with two pairs of small dorsal spines, posterior margin with two pairs of small spines laterally, with about 27 small spinules along posterior margin; second segment of antennular peduncle about 2.25 times longer than wide; basicerite with small lateral tooth, not reaching to level of tip of stylocerite; scaphocerite with lateral margin feebly concave near midlength, sublinear distally, distolateral tooth small, subequal to distal margin of lamella; third maxilliped with distal segment about 2.80 times length of penultimate segment, both with dense masses of very long fine simple setae; first pereiopod with palm of major chela oval in section, about 3.50 times longer than wide, dactyl straight in longitudinal plane, not double ended, molar process much reduced, defined only by proximal angle, palm without teeth on either side of dactylar articulation, sculpture limited to obsolescent transverse groove proximal to adhesive plaque; merus with small acute distal tooth on ventral medial margin; minor chela about 3.8 times longer than wide, dactyl not broadened, simple in female, sub-balaeniceps in adult male, about 2.2 times as long as palm; merus with small acute distoventral tooth medially; second pereiopod with proximal article of carpus subequal to length of second segment; third pereiopod with dactyl subspatulate, propod with sparse series of small spines along proximal ventral margin, with pair of small distoventral spines, merus unarmed, ischium with small articulated spine; endopod of uropod with about 30 small spinules along posterior margin dorsolaterally, posterior margin of exopod without spinules.

Measurements(mm). Allotype male: total body length (approx.) 55.5; carapace and rostrum 19.5, major chela 19.0, minor chela, 19.0, third pereiopod propod 7.5. Holotype female: total body length (approx.) 60.0, carapace and rostrum 23.0, major chela 20.5, minor chela 19.5, third pereiopod propod 8.5, length of ovum 0.5. Juvenile male, carapace and rostrum 13.0.

Colouration. General body colouration uniform orange brown; antennal peduncles, first pereiopods and caudal fan similar; antennal flagella purplish; tips of fingers of first pereiopods white; second to fifth pereiopods pinkish, dactyls of ambulatory pereiopods white; posterior margins of uropods pale purplish.

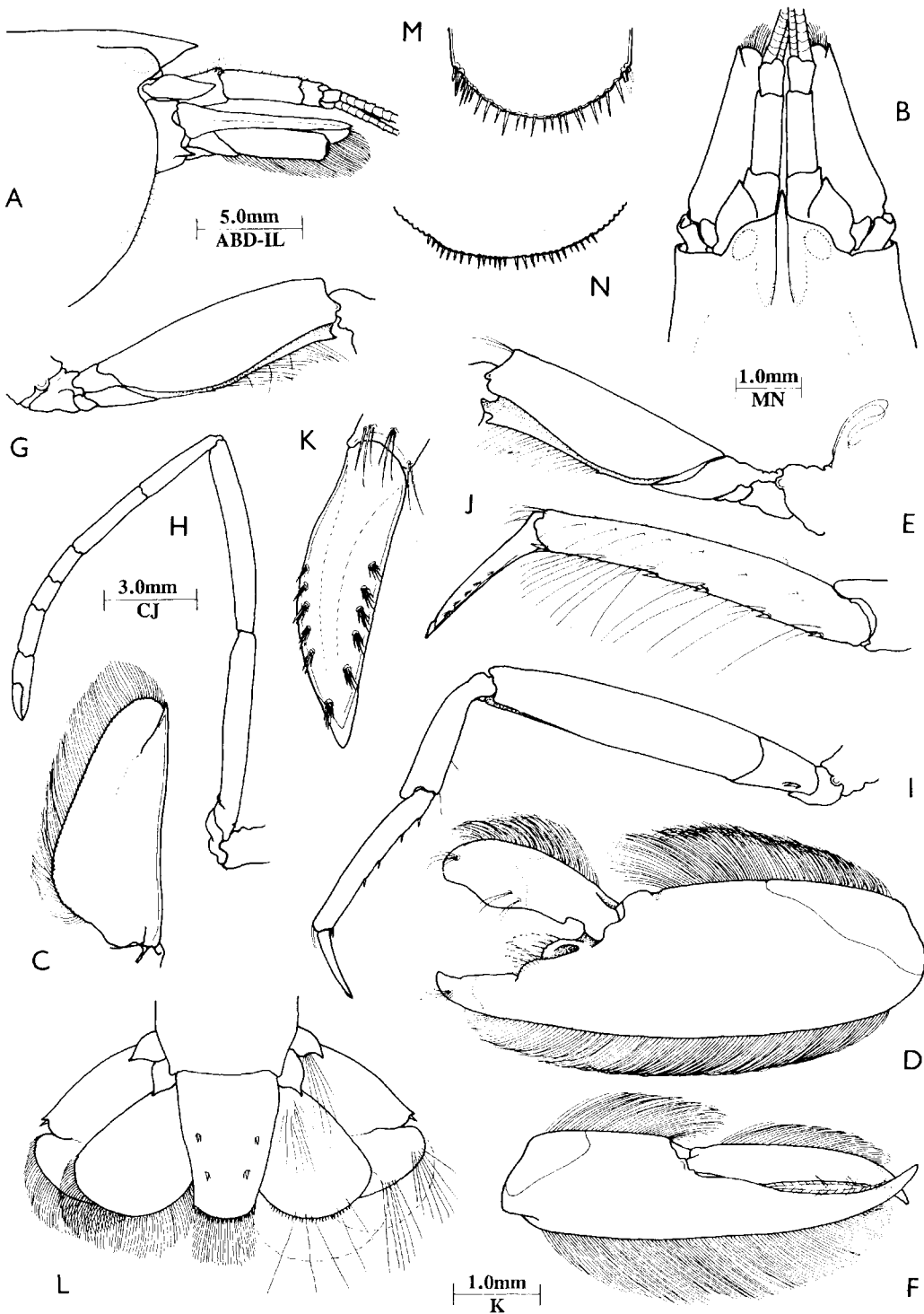


Fig. 1. *Alpheus fenneri* sp. nov., holotype female, Sulawesi. **A**, anterior carapace and antennal peduncles, lateral; **B**, same, dorsal; **C**, scaphocerite; **D**, first pereiopod, major chela, ventral; **E**, same, merus; **F**, minor chela, ventral; **G**, same, merus; **H**, second pereiopod; **I**, third pereiopod; **J**, same, propod and dactyl; **K**, same, dactyl, dorsal; **L**, caudal fan; **M**, telson, posterior margin; **N**, uropod, posterior margin of endopod.

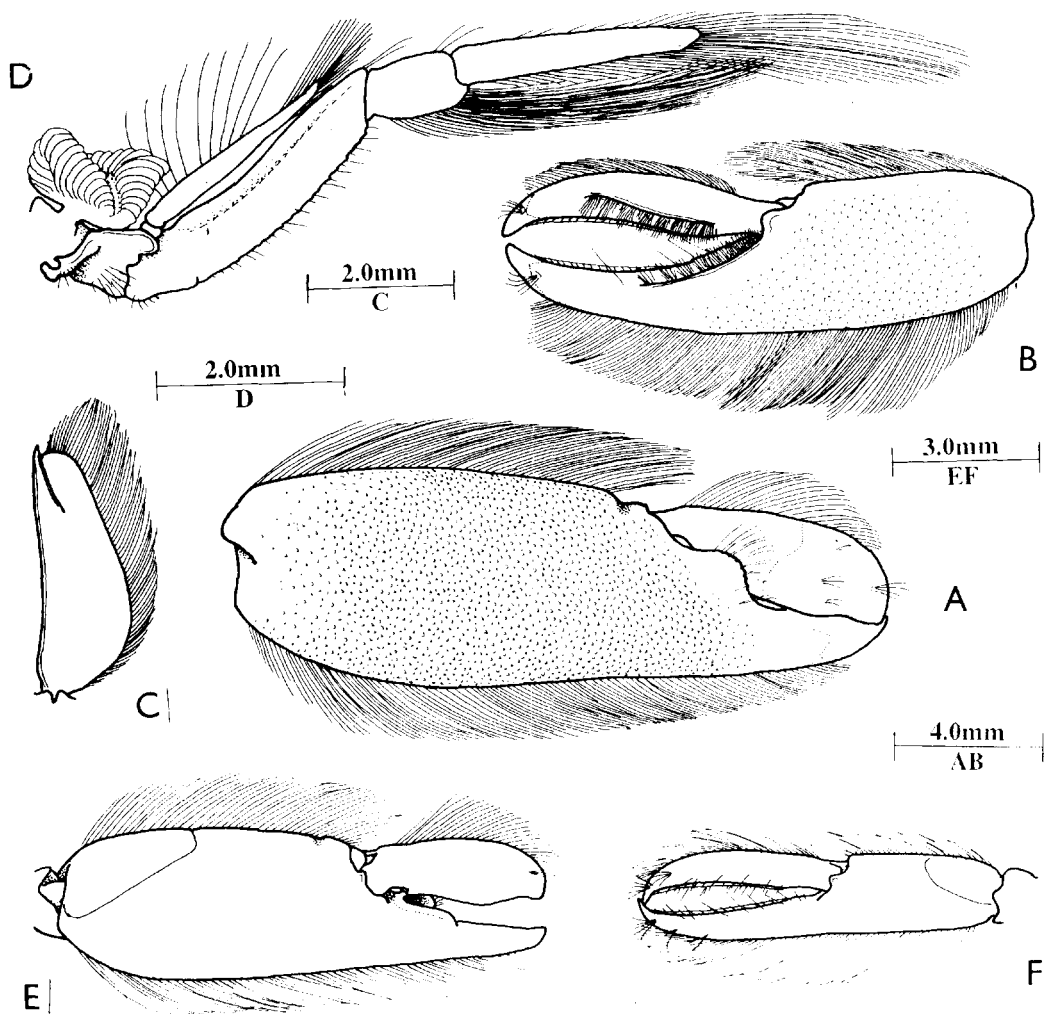


Fig. 2. *Alpheus fenneri* sp. nov., paratype male, Sulawesi. A, first pereiopod, major chela, dorsal; B, same, minor chela, dorsal; C, scaphocerite; D, third maxilliped, lateral. Juvenile male paratype, Sulawesi; E, first pereiopod, major chela, ventral; F, same, minor chela, ventral.

Fish Associate. *Amblyeleotris fontanesii* (Bleeker) [Gobiidae].

Etymology. The species is named in honour of Dr Fenner A. Chace, jr, in recognition of his extensive contributions to the knowledge of alpheid shrimps over many years, and particularly, for his recent study of the alpheid shrimps of the *Albatross* Philippine Expedition.

Systematic Position. *Alpheus fenneri* is most closely related to *Alpheus bellulus* Miya and Miyake, 1969, with which it shares the following major features:

Rostral carina extending posterior to level of orbital hoods, higher than orbital hoods, not reaching to mid-length of carapace; orbital hoods

without acute teeth; palm of major chela with transverse groove proximal to dactylar hinge; dorsal face of palm granular; minor chela of male sub-balaeniceps, fingers up to 1.3 times palm length; minor chela of female normal; third pereiopod with dactyl subspatulate.

Alpheus fenneri differs from *A. bellulus* in the following features:

Rostral tip more acute in *A. fenneri*, not reaching nearly to the anterior margin of the proximal segment of the antennular peduncle, with the carina distinctly less elevated, with the anteromedial margin of the orbital hoods forming a deep concavity with the tip of the rostrum in dorsal view; scaphocerite with lateral border

almost straight, with distolateral tooth not largely exceeding the anterior margin of the lamella; the third maxilliped has the penultimate segment bearing a very dense ventromedial tuft of very long fine setae that exceed the tip of the terminal segment; major chela with palm about 2.0 times longer than deep in female and male (about 1.6 and 1.4 in *A. bellulus*), dactyl about 2.8 times longer than deep in female and male (2.0 and 2.2 in *A. bellulus*), about 0.6 of the palm length in both sexes (about 0.50 and 0.55 in *A. bellulus*), with the distodorsal transverse groove very feebly developed in both sexes (quite distinct in *A. bellulus*); minor chela with palm about 1.75 times longer than deep in female, 1.9 times in male (1.3 times in female, 1.1 in male in *A. bellulus*), fingers about 1.3 times palm length in female, subequal in male (1.1 times in both sexes in *A. bellulus*).

Remarks. The closely related species, *Alpheus bellulus* is also a known goby associate, being found with a partner closely related to that of *A. fenneri*, *Amblyeleotris japonicus* Takagaki (Miya and Miyaki, 1969). It may also be noted that in the juvenile male specimen the minor chela has simple, non-balaeniceps dactyl, as in the female.

Alpheus williamsi sp. nov.

(Figs 3, 5)

Type Material. HOLOTYPE - female, NTM Cr.009495, F.V. *Clipper Bird*, stn RW 92-4, north of Charles Point, Northern Territory, Australia, 12°17.18' S, 130°40.06' N, 18-24m, trawl, soft corals and sponges, 2 September 1992, NTM Cr. 009495.

Diagnosis. ("brevirostris" group). Body not unusually compressed, densely pubescent; rostrum slender, reaching anteriorly to distal margin of proximal segment of antennular peduncle, compressed, postrostral carina distinct to about middle of carapace length, base of rostrum not abruptly delimited from adrostral grooves; carapace without median tooth or tubercle on gastric region, with small median pit, without paired acute teeth overhanging posterior ends of adrostral grooves, anterior margin transverse medial to orbital hoods, curving gradually into rostral margin, unarmed, region not noticeably depressed, orbital hoods glabrous, projecting anteriorly, unarmed, non-carinate, adrostral grooves comparatively deep, glabrous; telson with two pairs of small dorsal spines, posterior margin with two pairs of small lateral spines, about 26 dorsal marginal spinules; second seg-

ment of antennular peduncle about 3.2 times longer than wide; basicerite with acute lateral tooth, not reaching to level of tip of stylocerite; scaphocerite with lateral margin strongly concave, distolateral tooth robust, distinctly exceeding margin of lamella; first pereiopod with palm of major chela oval in section, about 3.5 times longer than wide, dactyl straight in longitudinal plane, not double ended, molar process much reduced, defined only by proximal angle, palm without teeth on either side of dactylar articulation, sculpture limited to distinct transverse groove proximal to adhesive plaque, longitudinal ventral carina setose, dorsal surface rough, setose; merus with small acute distal tooth on ventral medial margin, with several small acute spines; minor chela about 5.0 times longer than wide, dactyl not broadened, simple in female (male unknown), about 1.5 times as long as palm; merus with small acute distoventral tooth medially, with small ventral spines; second pereiopod with proximal segment of carpus about 1.7 times length of second segment; third pereiopod with dactyl feebly subspatulate, about 0.35 of propod length, propod with single row of five stout spines ventrally, with pair of distoventral spines; merus unarmed; ischium with small articulated spine; endopod of uropod with about 50 small posterolateral marginal spinules, rather long, slender laterally, exopod without spinules.

Measurements (mm). Total body length (approx.) 52.5, carapace and rostrum 19.5, major chela 25.5, minor chela 16.75, length of ovum 1.05.

Colouration. Ground colour of body pale yellow-buff, with patches of pale orange-red over rostrum, anterior margin of carapace, gastric region, cardiac region, middle parts of antennal peduncles and scaphocerite; abdomen with articular surface of first tergite deep red-brown, rest yellowish-white, anterior and posterior margins spotted and blotched with red-brown, most marked on the posterior of each segment, pleura more heavily mottled with red-brown; caudal fan mottled with pale red-brown; dorsum of major chela with palm whitish, with proximal, central and distal bands of red-brown, with scattered small red-brown spots, fingers proximally maroon, distally white; minor chela similar, with proximal and distal bands of maroon, fingers largely red-brown, with small white patches, tips white; ambulatory pereiopods whitish, merus with proximal and distal dull reddish bands, carpus with white central band, propod and dactyl white.

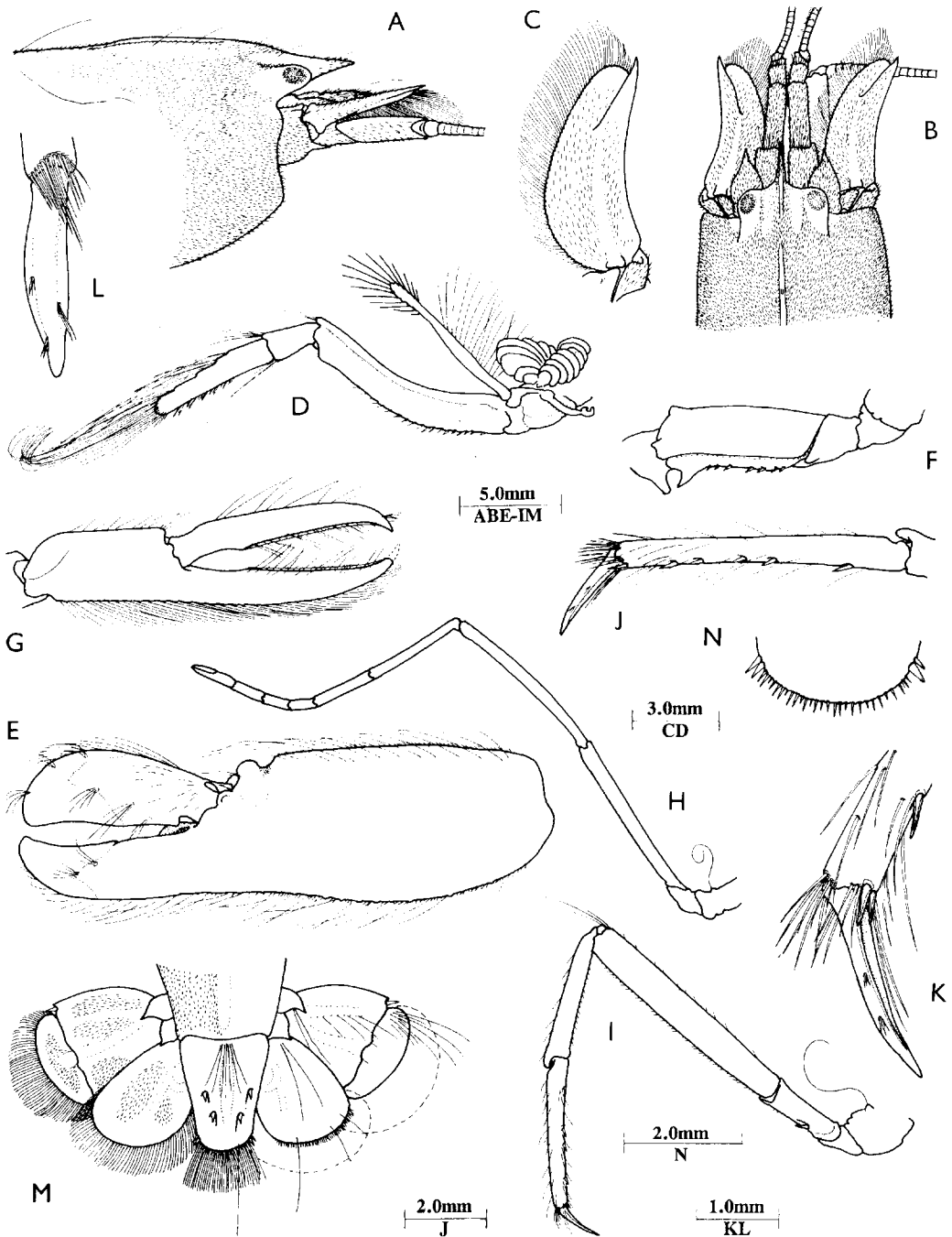


Fig. 3. *Alpheus williamsi* sp. nov., holotype female, Arafura Sea. A, anterior carapace and antennal peduncles, lateral; B, same, dorsal; C, scaphocerite; D, third maxilliped; E, first pereiopod, major chela, ventral; F, same, merus; G, same, minor chela; H, second pereiopod; I, third pereiopod; J, same, propod and dactyl; K, same, distal propod and dactyl, lateral; L, same, dactyl, dorsal; M, caudal fan; N, telson, posterior margin.

Etymology. The species is named in honour of Mr Rex Williams, the collector of this and many other interesting specimens.

Systematic position. *Alpheus williamsi* is most closely related to *A. pubescens* De Man, 1908, the only other species of the genus. *Alpheus*

brevirostris group with a densely pubescent carapace. However, in *A. williamsi* the abdomen is also densely pubescent, a feature that is not present in any other species of the *brevirostris* group. In *A. williamsi* the slender acute rostrum reaches clearly to the level of the anterior end of the proximal segment of the antennular peduncle, in contrast to the broader rostrum of *A. pubescens*, which only reaches to the middle of that segment. The postrostral carina in *A. williamsi* is very distinct, but only feebly discernible in *A. pubescens*. In addition, *A. pubescens* is a small species, about 17-20 mm long (De Man, 1911), while *A. williamsi* is a large species with the total body length over 50 mm.

Remarks. *Alpheus pubescens* is a common species in the intertidal pools of Darwin Harbour (Bruce 1988) and numerous specimens were

available for comparison with *A. williamsi*. The largest ovigerous female specimen had a total body length of 23 mm. Although also a member of the "*brevirostris*" group, there is as yet no indication of any association of this species with fishes.

DISCUSSION

The species of the *Alpheus brevirostris* group are of special interest in view of their frequent associations with gobies, but many of the species remain very poorly known and a considerable number appear to be of rather dubious taxonomic status. Some 32 species can be referred to this group at the present time. The last key to the species of this group was provided by De Man

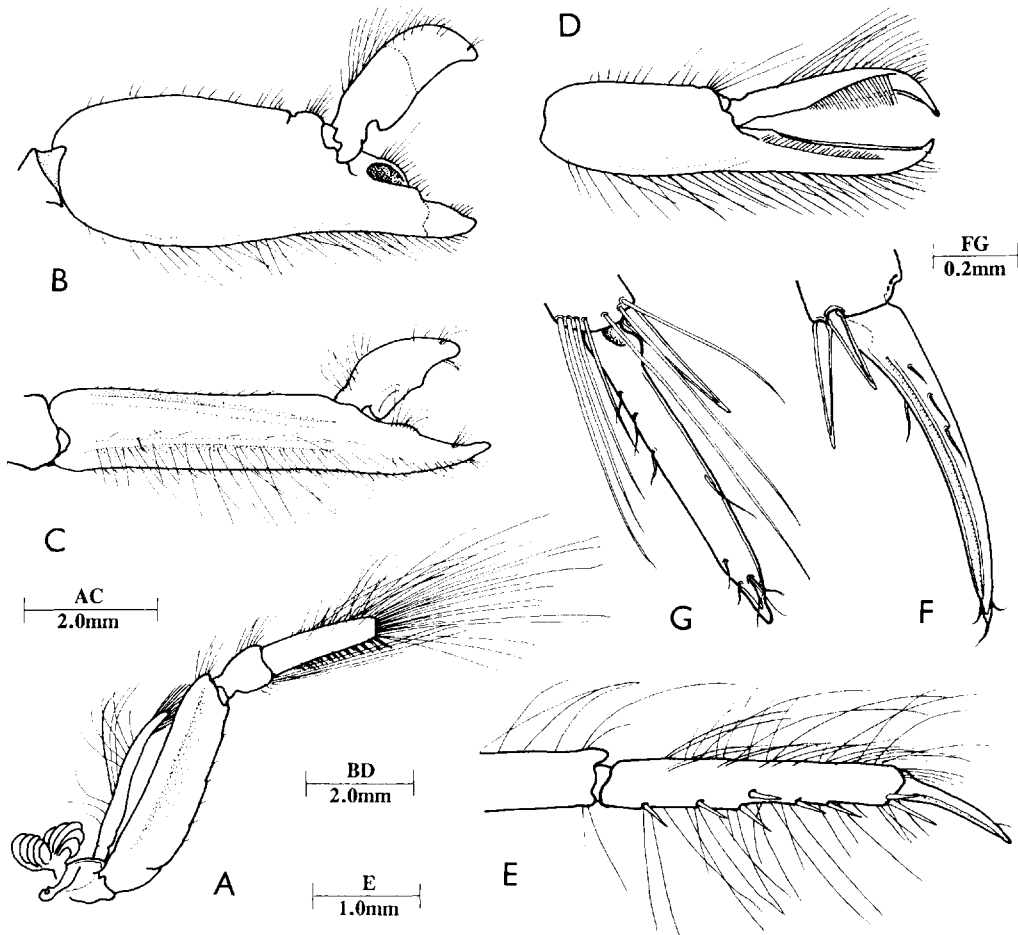


Fig. 4. *Alpheus pubescens* De Man, Darwin Harbour, male, carapace length 8.0mm. A, third maxilliped; B, first pereiopod, major chela, dorsal; C, same, lateral; D, minor chela; E, third pereiopod; F, same, dactyl, lateral; G, same, dorsal.

(1911), and many species have been subsequently described. An attempt is made here to provide a key for the identification of the Indo-West Pacific species, based on the information available in the literature on morphological characters. Many of the species descriptions are insufficiently complete for detailed comparative studies and a satisfactory solution to the problems of species identification for these shrimps will not be possible until many of the type specimens have been redescribed in detail. The study of mated pairs appears to be particularly essential, in view of the differences in the sexes, and the study of specimens without both of the first pair of pereopods is probably best avoided. Many of the species appear to have highly specific colour patterns in life, so that it may ultimately be possible to produce a field guide based on colouration alone.

Professor J.Y. Liu has kindly advised me that the type material of *Alpheus homochirus* and *A. heterocarpus*, both described by Yu (1935, as *Crangon*) are not in the collections of the Institute of Zoology, Beijing, to which the collections of the Fan Memorial Institute of Biology have been transferred, and are no longer extant. Professor Liu considers that the former species was based on an abnormal specimen of *A. brevicristatus* De Haan, and it is therefore omitted from the following key. No further specimens have been reported in Chinese waters since the original description. *Alpheus heterocarpus* is very closely related to *A. distinguendus* De Man (Liu: pers. comm.). Dr Yasuhiko Miya has indicated (2 March 1993: pers. comm.) that he concurs with the views of Professor Liu and that the condition of the aberrant major first pereopod described for *A. homochirus* occurs commonly in Japanese specimens of *A. brevicristatus* and that the distinguishing proportional differences of *A. heterocarpus* all fall within the range of variation of *A. distinguendus*. It is therefore also omitted from the following key. Recently Miya (1990) has provided the preliminary results of a study of some species of the *brevirostris* group that further clarifies the relationships of some of the species of this group. *Alpheus distinguendus* De Man, 1909, is considered to be a synonym of *A. digitalis* De Haan, 1844, and *A. dispar* Randall, 1840, is a synonym of *A. brevisrostris* (Olivier, 1811). Similarly, *A. brevisrostris angustodigitus* De Man, 1911, is also placed in synonymy with *A. brevisrostris* (Olivier, 1811).

Professor Miya's comments (1993: pers. comm.) are as follows:

...D. M. Banner and A. H. Banner (1982; 173) suspected that *A. distinguendus* having the major chela without any transverse groove would be a junior synonym of *A. brevisrostris* (Olivier, 1811) having a major chela with a transverse groove, when the transverse groove would be proved to be variable in a population and to be meaningless in the specific diagnosis. In the same page (173), however, they stated that "But none of the specimens available in the collections [of *A. distinguendus*] had the transverse groove or even approached it."

I cannot accept their hypothesis on the basis of my long research of *A. digitalis* in Japanese waters and the present study on the types of both species [Plate 2 A-B] and the material from Australia and East Asian countries. I have found some male specimens which are referable to *A. brevisrostris* among the Australian specimens identified as *A. distinguendus* and others by the Banners (my résumé, 1990). Few female specimens of *A. brevisrostris* have been examined among Singaporean and Malaysian collections. I agree with them on *Alpheus brevisrostris angustodigitus* De Man, 1911 which may be assigned to Olivier's species.

...Chace (1988) put *A. digitalis* and *A. distinguendus* into a synonymy of *Alpheus dispar* Randall, 1840 on the acceptance of the above Banner's hypothesis. When I examined the holotype of *A. dispar* in the collection of the Academy of Natural Sciences of Philadelphia (ANSP CA246), I knew that Dr Chace, too, examined this dry material which was represented only by the major and minor chelae (Slide 4) [Fig. 6D] and few pieces of little fragments. As shown in Slide 4 [Fig. 6D], the major chela is provided with a distinct transverse groove and appears completely different from the major chela having no transverse groove in *A. digitalis* (Slides 2 & 3) [Fig. 6B-C].

I cannot agree about Chace's statement and, on the contrary, I am inclined to assign the chelae of the holotype of *A. dispar* to those of *A. brevisrostris*. Judging from the material examined of both species, *A. brevisrostris* and *A. digitalis*, they are respectively good species and their distributions may overlap each other from tropical (?) Australia, Irian Jaya, Kalimantan, Brunei (Dr S. Choy's material), Malaysia, Singapore and Philippines...

Yaldwyn (1956) redescribed the species [*A. novaezealandiae* Miers, 1876] in the *Insignis* subgroup of the *Crinitus* group, but, in a personal communication (September 23, 1969), kindly told me his correction: "Examination of fresh material in N.Z. shows that *A.*

novaezealandiae clearly belongs to the *Brevirostris* group as the large chela has a longitudinal ridge on the outer surface and a transverse groove on the upper margin."

It is hoped that the following key will be of some assistance to those wishing to identify specimens, but the results should be regarded as provisional and the specimens should be critically compared with the original and subsequent descriptions, keeping in mind the probability that there are certainly many species yet to be described. It is also quite probable that some of the specimens already recorded in the literature may prove to be distinct species, for example, the specimen from Torres Strait (stn. BAU 27) referred to *A. pubescens* by Banner and Banner (1982). The species referred to in Karplus (1987) under the names of *Alpheus ochrostriatus*, *A. purpurilenticularis* and *A. rubromaculatus* have not been taken into consideration as their descriptions are not yet available and it is not certain that they are members of the *brevirostris* group.

A KEY TO THE INDO-WEST PACIFIC
SPECIES OF THE ALPHEUS
BREVIROSTRIS SPECIES GROUP

- 1 a. Orbital teeth present, pterygostomial margin triangular *A. miyakei* Miya
- b. Orbital teeth absent, pterygostomial margin rounded 2
- 2 a. Without transverse groove proximal to dactylar articulation of major chela 3
- b. With slight to pronounced transverse groove proximal to dactylar articulation 17
- 3 a. Major chela over 6.0 times longer than broad 4
- b. Major chela at most 4.5 times longer than broad 8
- 4 a. Telson 2.6 times longer than proximal width, strongly constricted at half length, posterior margin strongly produced, about 0.15 of telson length; lateral margins of scaphocerite strongly concave; (major chela unknown) *A. notabilis* Stebbing
- b. Scaphocerite with lateral margin sublinear; telson not as above 5
- 5 a. Postrostral carina well developed, extending at least to middle of carapace 6
- b. Postrostral carina not extending posteriorly to orbital hoods 7
- 6 a. Postrostral carina interrupted posterior to orbital hoods by acute median tooth
 *A. acutocarinatus* De Man
- b. Postrostral carina without acute median tooth; (minor chela unknown)
 *A. explorator* Boone
- 7 a. Major chela oval in section, without palmar ridges or carinae; merus with strong preterminal dorsal tooth
 *A. macroskeles* Alcock and Anderson
- b. Major chela with palm subrectangular in section, with strong longitudinal ridges; merus without preterminal dorsal tooth .
 *A. nonalter* Kensley
- 8 a. Carapace pustulose or papillose, especially on anterior region 9
- b. Carapace smooth 10
- 9 a. Major chela very strongly compressed, feebly papillose
 *A. leptocheles* Banner and Banner
- b. Major chela less strongly compressed, densely pustulose
 *A. stephensoni* Banner and Smalley
- 10 a. Body very strongly compressed; exopod of uropod with large lateral flap lateral to diaeresis
 *A. compressus* Banner and Banner
- b. Body not strongly compressed, subcircular in section 11
- 11 a. Rostral carina reaching at most to anterior third of carapace 12
- b. Rostral carina reaching almost to, or to slightly beyond, middle of carapace ... 14
- 12 a. Dactyl of minor chela simple (not balaeniceps) in both sexes; fingers of minor chela not crossing at tips, nearly 1.5 times as long as palm
 *A. quasirapacida* Chace
- b. Dactyl of male minor chela balaeniceps, (dactyl of female unknown); fingers of minor chela crossing at tips, subequal to palm length 13
- 13 a. Dorsal margin of major chela rounded (without any depression proximal to dactylar articulation); minor chela about 6-9 times as long as broad; fingers a little shorter than palm; merus and ischium of first pereopods armed with long acicular spines along ventromedial border
 *A. pustulosus* Banner and Banner
- b. Dorsal margin of major chela with slight depression proximal to dactylar articulation; minor chela slightly more than 4 times as long as broad; fingers 1.2 times longer than palm; merus and ischium of first pereopod unarmed, without acicular spines
 *A. arenicolus* Banner and Banner

- 14 a. Rostral carina with small obtuse median tubercle slightly posterior to orbital hoods; dactyls of ambulatory pereopods slender; dactyl of male minor chela balaeniceps, of female slender, tapering; lateral margin of scaphocerite strongly concave
..... *A. sibogae* De Man
- b. Rostral carina unarmed, without median tubercle; dactyls of ambulatory pereopods spatulate; dactyl of minor chela of both sexes not balaeniceps; lateral margin of scaphocerite almost straight; (*A. lepidus* De Man is placed here with some doubt, as the minor chela is unknown) 15
- 15 a. Major chela with longitudinal ridge on lateral margin; fingers of male minor chela spoon-shaped, deeply excavate medially, approaching 3.0 times palm length, palm about as long as wide; fingers of female minor chela compressed, not medially excavate, approaching twice palm length, palm about 1.5 times as long as wide
..... *A. digitalis* De Haan
- b. Major chela rounded, without ridges on lateral margin (in *A. rapacida* fingers of minor chela of both sexes compressed, not medially excavate); fingers of male minor chela 1.5-2.0 times palm length, palm about 1.5-2.0 times as long as broad 16
- 16 a. Postrostral carina narrow, sharp, extending posteriorly beyond middle of carapace; carpus of second pereopod with second article 10 times longer than wide, 2.6 times longer than first article
..... *A. lepidus* De Man
- b. Postrostral carina obtuse posterior to orbital hoods, extending almost to middle of carapace; carpus of second pereopod with second article 6.0 times longer than wide, 1.5 times longer than first article
..... *A. rapacida* De Man
- 17 a. Carapace with light pubescence 18
- b. Carapace glabrous 19
- 18 a. Abdomen glabrous
..... *A. pubescens* De Man
- b. Abdomen pubescent
..... *A. williamsi* sp. nov.
- 19 a. Dactyl of third pereopod simple, conical 20
- b. Dactyl of third pereopod subspatulate or spatulate 22
- 20 a. Anterior margins of orbital hoods gently rounded, lacking eaves; palm of major chela compressed in cross section
..... *A. savuensis* De Man
- b. Anterior margins of orbital hoods projecting as narrow eaves, palm of major chela more or less circular in cross section .. 21
- 21 a. Orbitorostral groove gently V-shaped, merging medially with postrostral carina, and laterally with broadly inflated orbital hood; merus of third and fourth pereopods armed with small distoventral tooth
..... *A. miersi* Coutière
- b. Orbitorostral groove shallow, broad, flat, demarcated medially by postrostral carina, laterally by narrowly inflated orbital hood; merus of third and fourth pereopods unarmed *A. novaezealandiae* Miers
- 22 a. Major chela with oblique transverse groove proximal to dactylar articulation; dactylus falcate
..... *A. cythereus* Banner and Banner
- b. Major chela with groove proximal to dactylar articulation distinctly transverse in orientation; dactylus non-falcate 23
- 23 a. Rostral carina reaching to middle of carapace *A. mortensis* Banner and Banner
- b. Rostral carina reaching at most to anterior third of carapace 24
- 24 a. Dactyl of minor chela simple (not balaeniceps) in both sexes 25
- b. Dactyl of minor chela balaeniceps in male, simple in female 28
- 25 a. Dactyl of minor chela more than twice as long as palm in both sexes; scaphocerite slender, with distal margin of lamella subtriangular 26
- b. Dactyl of minor chela less than 1.5 times as long as palm in both sexes; scaphocerite broad, distal margin of lamella rounded. 27
- 26 a. Fingers of minor chela spoon-shaped, deeply excavate medially in male, compressed, not medially excavate in female
..... *A. brevirostris* (Olivier)
- b. Fingers of minor chela compressed, not medially spoon-shaped, in both sexes
..... *A. brevicristatus* De Haan
- 27 a. Lateral margin of scaphocerite weakly concave; fingers of minor chela more or less gaping in both sexes; major chela with flat dorsal area, flanked by medial and lateral longitudinal ridges *A. rapax* Fabricius
- b. Lateral margin of scaphocerite concave near midlength, distally convex; fingers of minor chela closing (not gaping) in both sexes; major chela dorsally rounded, without flat area flanked by ridges
..... *A. macellarius* Chace

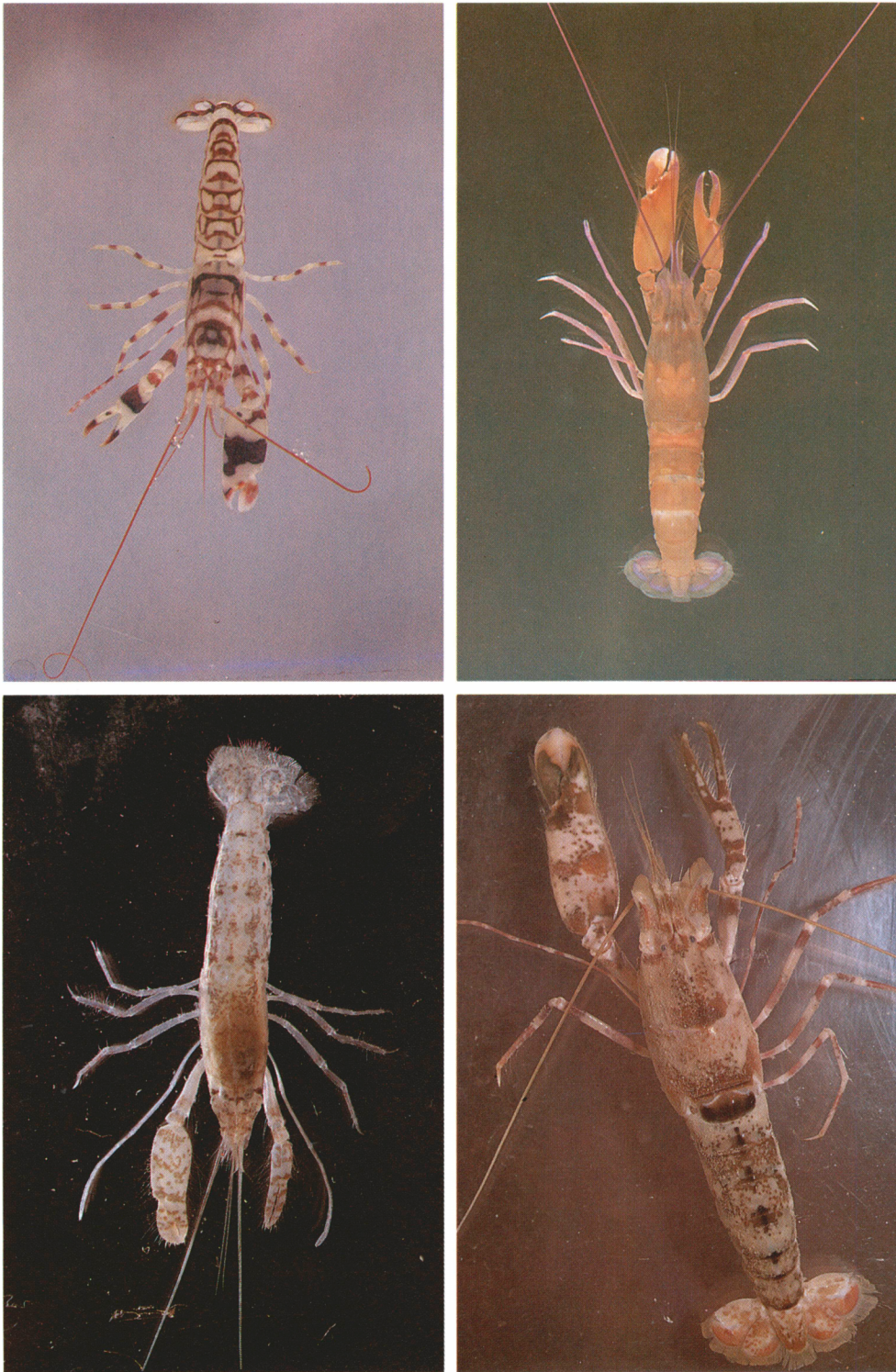


Fig. 5. A (top left), *Alpheus fenneri* sp. nov., holotype and paratype, Manado, Sulawesi (photo. J.E. Randall); B (top right), *Alpheus bellulus* Miya and Miyake, female, Shirahama, Japan. (photo. Y. Miya); C (bottom left), *Alpheus williamsi* sp. nov., ovigerous female holotype, off Charles Point, Northern Territory (photo. A.J. Bruce); D (bottom right), *Alpheus pubescens* De Man, ovigerous female, Darwin Harbour, Northern Territory (photo. A.J. Bruce).

RIJKSMUSEUM VAN NATUURLIJKE HISTORIE LEIDEN

Alpheus digitalis De Haan
holotype

Japan,
1823-1834,
leg. no. 5547, P. Fr. Siebold en Dr. Bürger

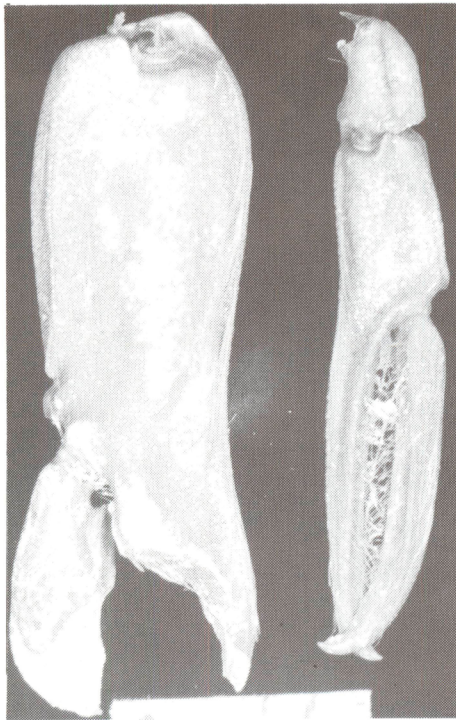
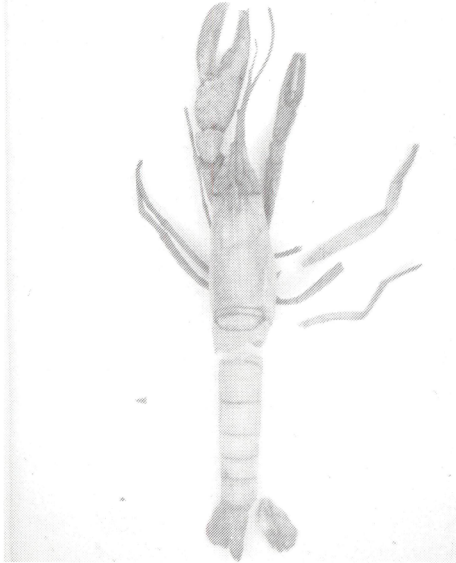


Fig. 6. A (top left), *Alpheus brevicristatus* De Haan, lectotype, Japan (photo. Y. Miya); B (top right), *Alpheus distinguendus* De Man, paratype (=A. *digitalis* De Haan) (photo. Y. Miya); C (bottom left), *Alpheus digitalis* De Haan, holotype, Japan (photo. Y. Miya); D (bottom right), *Alpheus dispar* Randall, holotype, Manila, Philippines, chelae of first pereopods (photo. Y. Miya).

- 28 a. Carpus of second pereopod with second article more than twice as long as first ...
..... *A. platyunguiculatus* Banner
- b. Carpus of second pereopod with first and second articles subequal 29
- 29 a. Rostrum blunt, equilaterally triangular, rostral carina elevated
..... *A. bellulus* Miya and Miyake
- b. Rostrum acute, slender, rostral carina not elevated 30
- 30 a. Rostral carina higher than orbital hood; penultimate segment of third maxilliped with very dense ventrolateral tuft of very long fine setae exceeding tip of terminal segment; major chela with feeble transverse groove proximal to dactylar articulation *A. fenneri* sp. nov.
- b. Rostral carina concealed by orbital hoods laterally; penultimate segment of third maxilliped with tuft of short setae scarcely reaching to tip of terminal segment; major chela with distinct transverse distal palmar groove *A. djeddensis* Coutière

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