

A NEW GENUS AND NEW SPECIES OF ALPHEID SHRIMP (CRUSTACEA: DECAPODA) FROM PAPUA NEW GUINEA

Sammy De Grave

Oxford University Museum of Natural History, Parks Road, Oxford, OX1 3PW, U.K.
Email: sammy.degrave@oum.ox.ac.uk

Arthur Anker

Laboratoire de Biologie des Invertébrés Marins et Malacologie, CNRS-UPESA 8044, Muséum National d'Histoire Naturelle, 55 Rue de Buffon, 75005 Paris, France. Email: anker@mnhn.fr

ABSTRACT. - *Orygmalpheus polites*, new genus, new species, is described on the basis of a single, female specimen from Hansa Bay, Papua New Guinea. The new genus is characterised by the absence of a rostrum, orbital teeth, the absence of an articulated plate on the sixth pleosomite and by the sub-symmetrical feebly armed and sculpted first chelipeds. The specimen was obtained from a burrow inhabited by *Alpheus rapacida* and a goby, *Vanderhorstia* sp.

KEY WORDS. - *Orygmalpheus*, new genus, Alpheidae, Decapoda, Papua New Guinea.

INTRODUCTION

During the course of an investigation into the gobiid fish-alpheid shrimp associations in Hansa Bay, Madang Province, Papua New Guinea, numerous specimens of Alpheidae were obtained. The majority of these belong to the genus *Alpheus*, although a single alpheid shrimp was obtained which could not be assigned to a known genus. The new genus and new species is described herein.

The holotype is deposited in the collections of the Royal Belgian Institute of Natural Sciences, Brussels, Belgium.

SYSTEMATICS

FAMILY ALPHEIDAE RAFINESQUE

Orygmalpheus, new genus

Type species. - *Orygmalpheus polites*, new species, by monotypy.

Derivation of name. - From the Greek *orygma* meaning mine or excavation, in reference to the specimen being obtained from a burrow, and *Alpheus*, a generic name first used by Fabricius in 1798.

Description. - Carapace smooth, glabrous; pterygostomial angle rounded; cardiac notch well developed; branchiostegal margin furnished with setae. Frontal margin broadly rounded, without rostrum or orbital teeth. Eyes partially visible in lateral view, not visible in dorsal view. Abdomen smooth, sixth somite without articulated plate. Telson with two pairs of dorsal spines, posterior margin convex with two pairs of lateral spines, anal tubercles lacking. Eyes partially visible in lateral view, not visible in dorsal view. Antennular peduncle with stylocerite not appressed and with strongly developed ventral carina; external flagellum with deep bifurcation. Antennal scale with lateral tooth hardly overreaching margin. Mouthparts typical for family; mandible with two-jointed palp; third maxilliped distally unarmed, with serrated setae on medial margin of ultimate segment and acute lateral plate above epipod. First pereiopods similar, sub-symmetrical, carried extended; with dactylus in dorso-lateral position; cutting edges of fingers weakly crenulated; shallow transverso-oblique depression on outer side of palm, and weakly developed adhesive discs. Second pereiopod short; carpus five-segmented, proximal segment longest. Third pereiopod with unarmed propodus, simple dactylus, ischium armed with two movable spines on inferior margin. Fifth pereiopod with well developed propodal brush. Uropodal diarsis incomplete, slightly sinuous; lateral spine strong.

Table 1. Branchial formula as follows (1 single appendage present, * number variable):

	Maxillipeds			Pereiopods				
	1	2	3	1	2	3	4	5
Pleurobranch	-	-	-	1	1	1	1	1
Arthrobranch	-	-	1	-	-	-	-	-
Podobranch	-	-	-	-	-	-	-	-
Setobranch	-	-	-	*	*	*	*	*
Epipod	1	1	1	1	1	1	1	-
Exopod	1	1	1	-	-	-	-	-

Systematic position. - The new genus can be diagnosed by the combination of the following characters: (1) absence of rostrum and orbital teeth, (2) absence of inflated orbital hoods, (3) absence of articulated plate on sixth pleosomite, (4) sub-symmetrical first chelipeds carried extended, with dactylus in dorsal position, (5) slender chelae with feebly armed cutting edges of fixed and movable fingers, shallow transverso-oblique depression on outer side of palm, and weakly developed adhesive discs, (6) pereiopods 3 to 5 with ischium armed with one or two spines, unarmed propodus, and simple, slender dactylus.

It is difficult to place *Orygmalpheus* unequivocally in proximity of any other alpheid genus. The frontal margin of the carapace is very similar to that of *Leptalpheus* Williams, 1965 and two other related genera *Fenneralpheus* Felder & Manning, 1983 and *Amphibetaeus* Coutière, 1897. However, *Leptalpheus* shows very asymmetrical first chelipeds, which are in many aspects different from the chelipeds of the new genus. Also, the members of *Leptalpheus* have the stylocerite appressed to the first antennular article, strong spines on the propodus of the robust third to fifth pereiopods, an articulated plate on the sixth pleosomite and rounded processes on the mesio-anterior margin of the eyestalks; all these features are absent in *Orygmalpheus*. *Neoalpheopsis* Banner, 1953 and several species of *Alpheopsis* Coutière, 1897 (e.g. *A. aequalis* Coutière, 1897) have similarly shaped first chelae, but they all differ from *Orygmalpheus* in the presence of an articulated plate on the sixth pleosomite and the presence of a well developed rostrum.

In a preliminary phylogenetic study of the Alpheidae, made by one of the authors (AA), *Orygmalpheus* appears to be closest to *Notalpheus* Méndez & Wicksten, 1982, and *Nennalpheus* Banner & Banner, 1981. *Orygmalpheus* has indeed some affinities to these two genera, common features being the sub-symmetrical first chelipeds carried extended,

slender third to fifth pereiopods with reduced propodal armature and with ischium bearing movable spines; similar eyestalks, identical branchial formulas. The branchiostegal margin of the carapace in *Orygmalpheus* bears numerous conspicuous setae; similar setae have also been observed in *Notalpheus* (pers. obs.) and the not closely related genus *Pseudathanas* (Holthuis, 1993), but are lacking in many other alpheid genera (pers. obs.). The presence of a small, triangular articulated plate at the postero-ventral angle of the sixth pleosomite, presently considered as an important generic character in Alpheidae (see key in Holthuis, 1993), is lacking in *Orygmalpheus* and *Nennalpheus inarticulatus* Banner & Banner, 1981 but is distinct in *Nennalpheus sibogae* De Man, 1910 and *Notalpheus*. However, both *Notalpheus* and *Nennalpheus* can be distinguished from *Orygmalpheus* by more or less developed rostrum and orbital teeth, eyes partially visible in dorsal view (except *N. sibogae*), and a different shape and armature of the carpus and chela of the first chelipeds. As the unique specimen of *Orygmalpheus* is a non-ovigerous female, the shape of the chelae in adult males may be somewhat different (e.g. more pronounced armature of opposable margins of fingers); therefore more specimens of the new species are needed to make more reasonable assumptions on its phylogenetic relationships.

Orygmalpheus polites, new species

(Figs. 1-4)

Material examined. - Holotype, female, post orbital carapace length 3.50 mm; KBIN IG 27951/NAT64; Laing Isl. Lagoon, about 4°10'30"S 144°52'47"E, Hansa Bay, Madang Province, Papua New Guinea; coll. H. Wilkins, 16 Oct. 1992, diver-operated suction sampler, muddy substrate, 10 m depth, field no. G106.

Derivation of name. - From the Greek *polites* meaning citizen, in reference to its occurrence in the

same burrow as *Alpheus rapacida* De Man, 1908 and *Vanderhorstia* sp. (Gobiidae, Teleostei).

Description. - Body form sub-cylindrical, laterally slightly compressed, smooth, glabrous (Fig. 1A). Carapace with rostrum lacking, frontal region broadly rounded (Fig. 1C). Orbital hoods not inflated, completely covering eyes in dorsal view, only partially in lateral view; eyes visible in frontal view (Fig. 1B, C). Pterygostomial angle rounded. Branchiostegal margin setose, cardiac notch distinct. Eyestalks short, without antero-mesial projection or spine, corneas well developed.

Abdomen with pleura of first two segments broadly rounded; third pleuron with slightly produced postero-ventral angle; fourth and fifth pleura with more rounded postero-ventral angle; sixth pleuron with postero-ventral angle non-articulate, concave (Fig. 1A).

Telson (Fig. 3M) subequal to sixth segment length, without anal tubercles; lateral margins feebly convex; two pairs of dorsal spines, situated at 0.5 and 0.7 of telson length; posterior margin broadly rounded, laterally with two pairs of slender spines, medial pair longer than external, and medially with 13-segmented, plumose setae (Fig. 3N).

Antennular peduncle robust; proximal segment about 2.0 x longer than wide, with well defined ventro-medial carina ending in large tooth; stylocerite well developed, slender, acute, not apressed, slightly overreaching proximal segment; distal segment 0.7 x as long as intermediate segment (Fig. 2A); external flagellum biramous, rami fused for proximal 3 segments, shorter free ramus with one incomplete and one complete free segment, longer free ramus slender, approximately 0.38 of carapace length; mesial flagellum slender, filiform, about 0.64 of carapace length (Fig. 2B). Antennal peduncle stout; basicerite stout with blunt, triangular ventro-lateral tooth; carpocerite elongate, overreaching antennal scale and antennular peduncle; scaphocerite 2.7x longer than wide, lateral tooth reaching to rounded anterior margin of lamella (Fig. 2C). Mandible robust, with two-segmented palp (Fig. 2I); molar process well developed, obliquely truncated anteriorly; incisor process stout, bearing five teeth. Maxillula (Fig. 2J) with bilobed palp, each lobe with one distal seta; upper lacinia broad, with numerous distal and single disto-dorsal rows of serrate spines; lower lacinia slender, with disto-dorsally a single row of serrulate setae. Maxilla (Fig. 2H) with short palp,

non-setose; basal endite moderately well developed, bilobed, densely fringed with serrulate setae; coxal endite small, with few setae; scaphognathite well developed; basal part of medial margin produced. First maxilliped (Fig. 2D) with slender two-segmented palp, medial margin fringed with plumose setae, distally with single plumose setae; basal endite broad, fringed with marginal and sub-marginal plumose and setulose setae; coxal endite not bilobed; exopod well developed, flagellum slender, caridean lobe well developed; epipod large, triangular. Second maxilliped (Fig. 2E) with basis relatively short; ischiomerus short, propodal segment expanded anteromedially, medial margin with stout, serrulate setae; dactylar segment narrow, margin densely setose; exopod slender; epipod oval, simple, without annexed podobranch. Third maxilliped (Fig. 2F) slender; antepenultimate segment about 6.4x longer than basal width, medially sparsely setose; penultimate segment elongated, about 0.37x length of preceding segment, medially sparsely setose, disto-lateral angle with single, elongated strong seta; ultimate segment slender, almost twice as long as penultimate segment; medial margin with numerous groups of serrulate setae (Fig. 2G), without spines; exopod well developed, reaching almost to middle of penultimate segment; coxa with acutely produced lateral plate above strap-like epipod; arthrobranch well developed.

First pereopods subsymmetrical, relatively small, slender, carried extended with dactylus in dorsal-lateral position (Fig. 1A, 3A, 4); coxa robust, unarmed; ischium slender, unarmed; merus slender, unarmed, distally widening, about 1.8x length of ischium; carpus robust, short, without distinct distal teeth; chelae elongate, fingers about 0.7x length of palm, palm sub-cylindrical, length about 2.23x central width; with shallow, transversal, oblique depression at basis of fixed finger on its outer side (Fig. 4); adhesive plaques at dactylo-propodal articulation weakly developed; fingers similar, fixed finger slightly overreaching dactylus; both fingers with stout, slightly hooked tip; cutting edges with weak crenulations and short setae (Fig. 3B).

Second pereopod short, slender (Fig. 3C); ischium and merus unarmed, merus about 1.3x length of ischium; carpus five-segmented, segment length ratio (proximal to distal) 1.0:0.4:0.3:0.3:0.8; chelae short; palm sub-cylindrical, about 1.43x longer than wide; fingers setose; fingers about 1.25x length of palm; cutting edges entire, ending in blunt tips, distal half with short, submarginal setae; fixed finger with single

accessory small, blunt spine on tip; dactylus with two accessory blunt spines on tip (Fig. 3E).

Third pereiopod slender (Fig. 3F); basis short; ischium with two strong spines on ventral margin; merus elongate, unarmed, about 2.05x length of ischium; carpus elongate, about 0.66x length of merus, disto-ventral margin armed with small spine; propodus elongate, subequal to carpus, ventral margin sparsely setose; dactylus simple, elongate, about 0.58x length of propodus, with short plumose setae close to apex (Fig. 3G); without distinct unguis.

Fourth pereiopod (Fig. 3H) very similar to third. Fifth pereiopod (Fig. 3I) similar to third and fourth, but more slender; ischium bearing a single movable spine, merus shorter and lacking spine at disto-lateral corner of carpus; propodus with grooming brush composed of four bunches of setae at distal portion of ventro-lateral margin; three most proximal bunches consisting of several short, plumose and two-three short, serrate setae, and distal bunch consisting of six serrate setae and four non-serrate setae (Fig. 3J).

Pleopods of usual alpheid type.

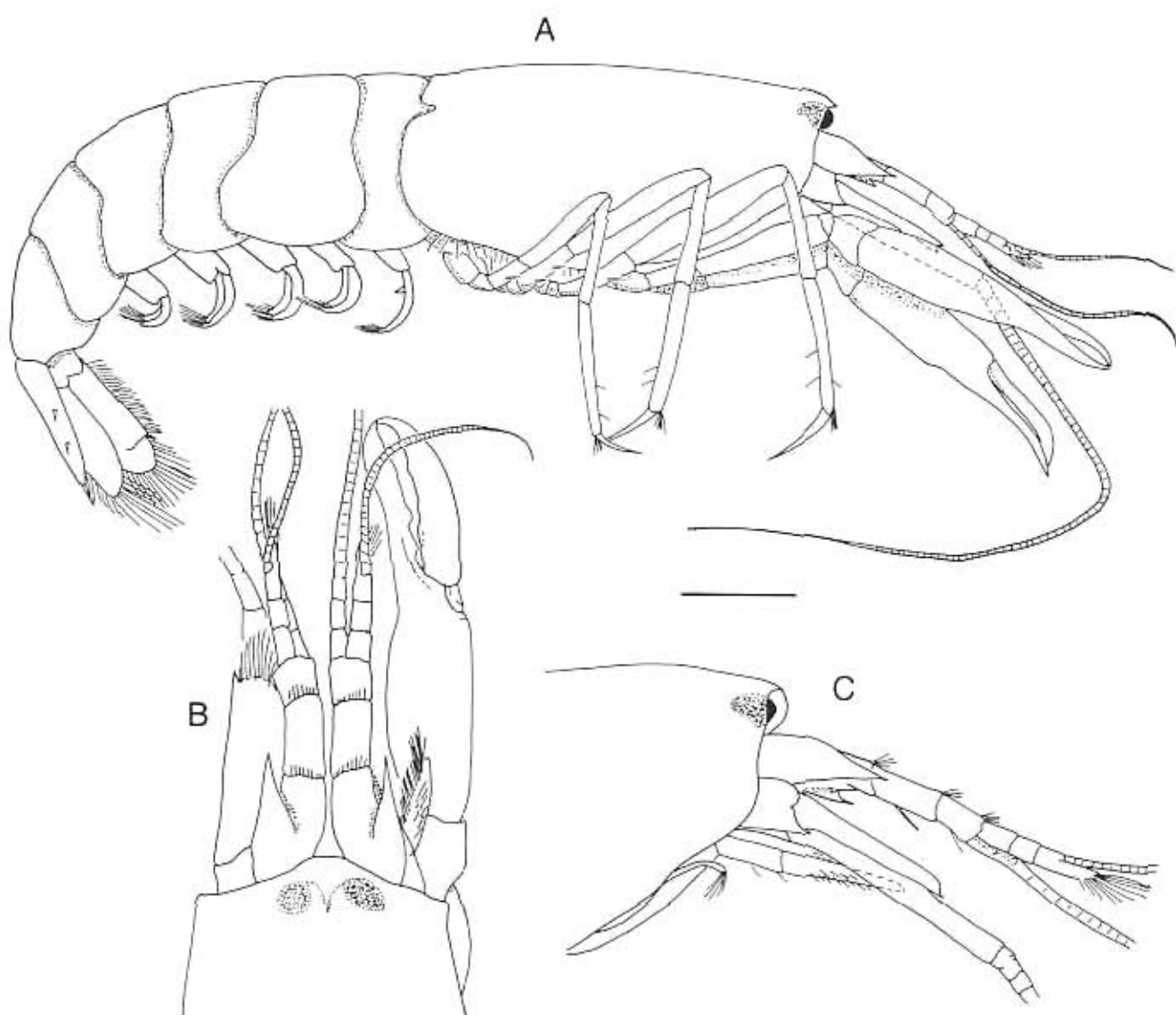


Fig. 1. *Orygmalpheus polites*, new genus, new species. A, lateral view; B, lateral view of frontal region; C, dorsal view of frontal region. Scale bar indicates 1 mm (A) or 0.5 mm (B, C).

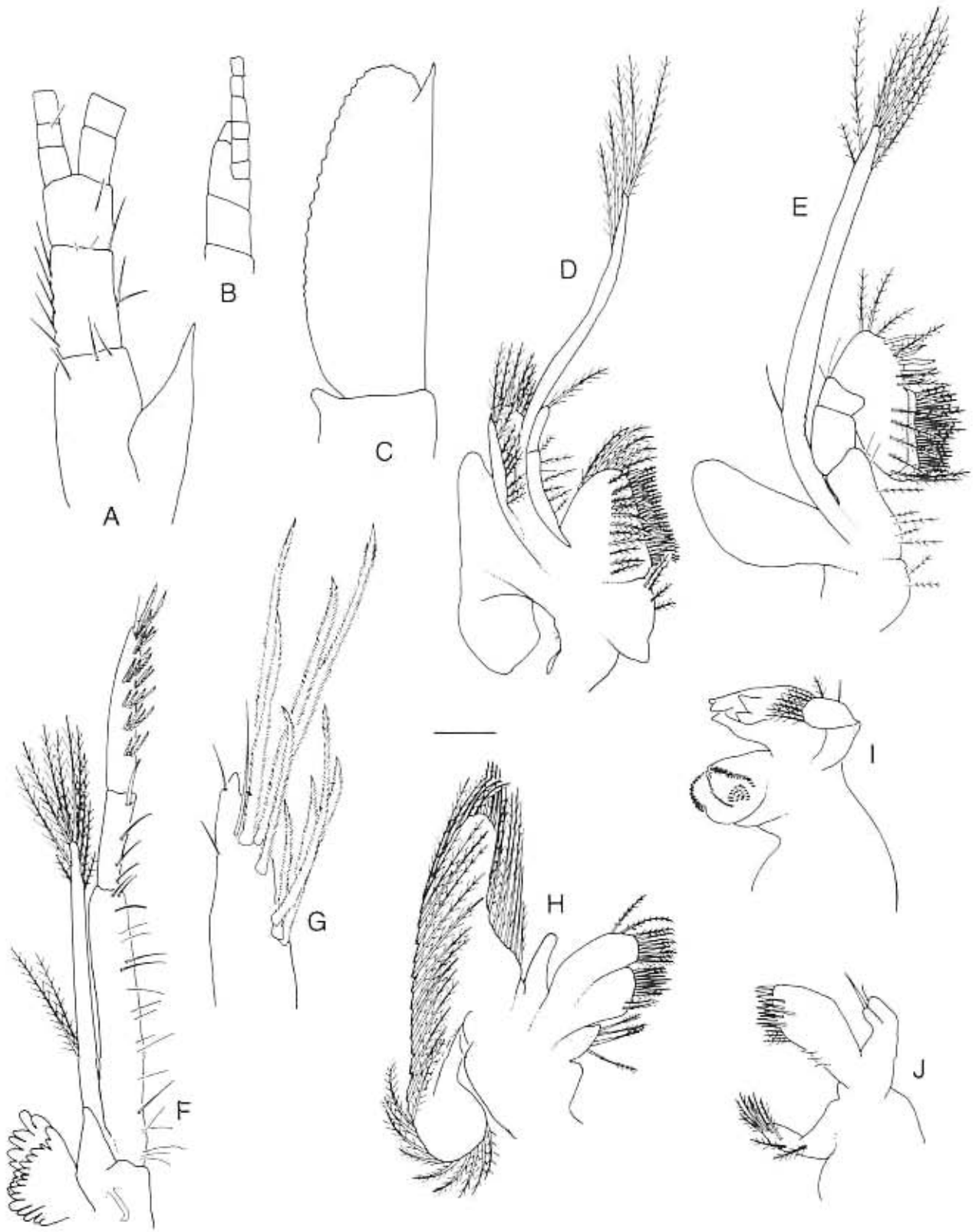


Fig. 2. *Orygmalpheus polites*, new genus, new species. A, antennule; B, bifurcation of antennular flagella; C, antennal scale (setae omitted); D, first maxilliped; E, second maxilliped; F, third maxilliped; G, tip of third maxilliped; H, maxilla; I, mandible; J, maxillula. Scale bar indicates 0.2 mm (B, C-E, H-J), 0.3 mm (A, F) or 0.05 mm (G).

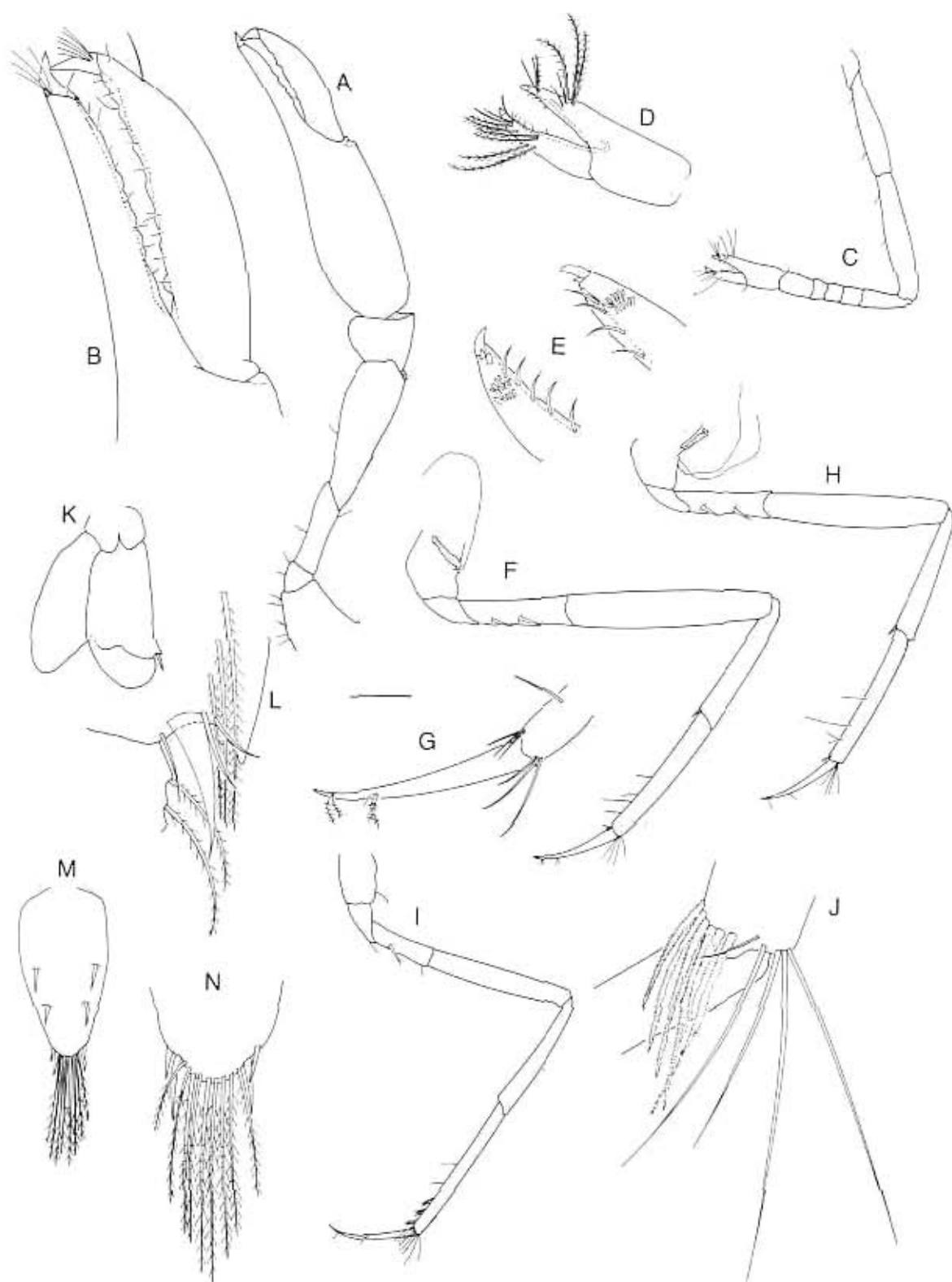


Fig. 3. *Orygmalpheus polites*, new genus, new species. A, first pereopod; B, chelae of first pereopod; C, second pereopod; D, chelae of second pereopod; E, same, detail; F, third pereopod; G, dactylus of third pereopod; H, fourth pereopod; I, fifth pereopod; J, propodal brush of fifth pereopod; K, uropod (setae omitted); L, lateral part of exopodal diarsis; M, telson; N, tip of telson. Scale bar indicates 0.5 mm (A, C, F, H-I, K, M), 0.2 mm (B, D, G, N) or 0.075 mm (E, J, L).

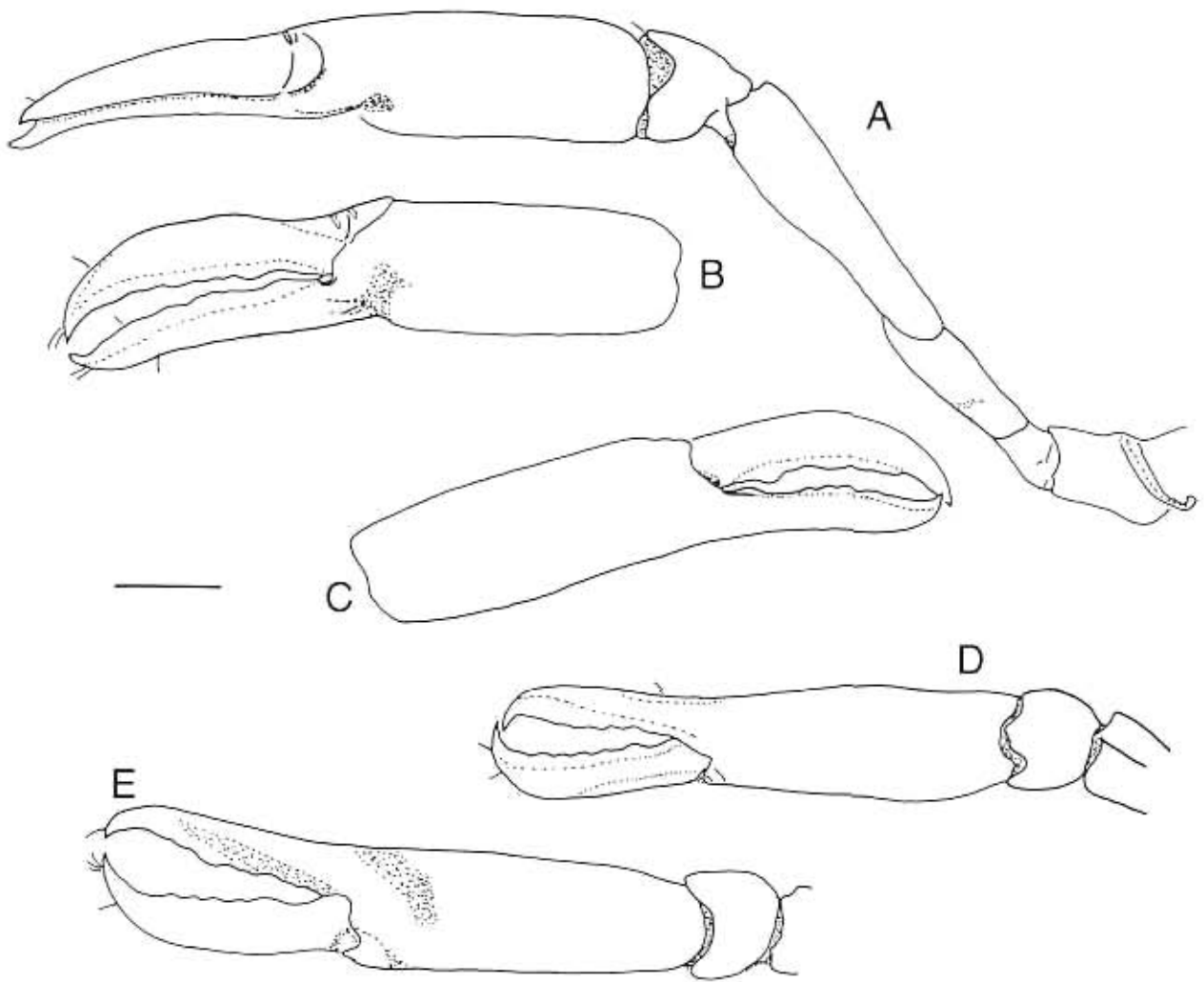


Fig. 4. *Orygmalpheus polites*, new genus, new species. A, right first pereiopod, superior view; B, chelae of same, outer view; C, detail; D, inner view; E, left first pereiopod, inner view; F, outer view. Scale bar indicates 0.4 mm.

Uropods robust (Fig. 3K), slightly over-reaching telson; protopodite robust, bilobed; exopod oval, 1.6x longer than wide, with strong lateral spine; well marked diarsis at about 0.8 of length, simple, slightly curved in middle, ending in small lateral tooth above lateral spine (Fig. 3L); endopod oval, subequal in length to exopod; medial and lateral margins densely fringed with plumose setae.

Ecology. - The single specimen was found in a burrow shared by the shrimp *Alpheus rapacida* (non-ovigerous female) and the gobiid fish, *Vanderhorstia* sp. (single specimen). Although the possibility that the *O. polites* specimen was sampled from the

vicinity of the burrow rather than the burrow itself can not be totally discounted, it appears more likely, in view of the small nozzle of the suction sampler, that the specimen was caught inside the burrow.

Remarks. - The ecology of alpheid-goby associations was reviewed by Karplus (1987) with approximately 15 species of alpheid shrimps (several of which remain undescribed) taking part in the association (Karplus, 1987; Bruce, 1994) and over 100 species of fish (Karplus, 1987). So far, only species of the genus *Alpheus*, in particular of the *brevirostris* and *edwardsii* groups, are known to take part in the association. Nevertheless, De Grave & Wilkins

(1997) reported *Salmoneus rostratus* Barnard, 1962 from a burrow inhabited by a goby or the sediment immediately surrounding it. As these specimens were not observed in situ, a definitive association could not be ascertained. With the discovery of yet another genus of alpheid shrimp from such burrows, the possibility must be considered that other shrimp genera than *Alpheus*, take part in this association, either as obligate or facultative mutualists.

In addition to the alpheid - goby associations noted above, several non-burrowing alpheid species are known to live in associations with burrowing crustaceans. All species of *Leptalpheus*, *Chelomalpheus koreanus* Kim, 1998 and some species of *Betaeus* Dana, 1852 are reported to live commensally in the burrows of thalassinids (Hart, 1964; Williams, 1965; Hayashi, 1998). Both *Fenneralpheus chacei* Felder & Manning, 1986 and *Salmoneus cavicolus* Felder & Manning, 1986 are also thought to be associated with burrowing stomatopods or thalassinids, although no actual specimens were simultaneously collected (Felder & Manning, 1986). Recently, *Athanas amazone* Holthuis, 1951 has been reported from the burrows of the stomatopod, *Squilla mantis* (L.) in the eastern Mediterranean (Frogliia & Atkinson, 1998).

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LITERATURE CITED

- Banner, A. H., 1953. The Crangonidae, or snapping shrimp, of Hawaii. *Pac. Sci.*, **7**: 3-144.
- Banner, A. H. & D. M. Banner, 1981. Decapod Crustacea : Alpheidae. *Mem. ORSTOM*, **91**: 217-235.
- Barnard, K. H., 1962. New records of marine Crustacea from the East African region. *Crustaceana*, **3**: 239-245.
- Bruce, A. J., 1994. *Alpheus fenneri* sp. nov. and *A. williamsi* sp. nov., two new Indo-West Pacific alpheid shrimps of the *brevirostris* group. *The Beagle*, **11**: 15-28.
- Coutière, H., 1897. Note sur quelques genres nouveaux ou peu connus d'Alphéidés, formant la sous-famille des Alphéopsidés. *Bull. Mus. nat. Hist. Nat., Paris*, **2**: 380-386.
- Dana, J. D., 1852. Conspectus crustaceorum. Conspectus of the Crustacea of the exploring expedition under Capt. Wilkes, U.S.N. *Proc. Acad. Nat. Sc. Phil.*, **1852**: 10-28.
- De Grave, S. & H. K. A. Wilkins, 1997. A new record of *Salmoneus rostratus* Barnard, 1962 (Decapoda, Alpheidae) from Hansa Bay, Papua New Guinea. *Crustaceana*, **70**: 633-636.
- Felder, D. L. & R. B. Manning, 1986. A new genus and two new species of alpheid shrimps (Decapoda: Caridea) from South Florida. *J. Crust. Biol.*, **6**: 497-508.
- Frogliia, C. & R. J. A. Atkinson, 1998. Association between *Athanas amazone* (Decapoda: Alpheidae) and *Squilla mantis* (Stomatopoda: Squillidae). *J. Crust. Biol.*, **18**: 529-532.
- Hart, J. F. L., 1964. Shrimps of the genus *Betaeus* on the Pacific coast of North America with descriptions of three new species. *Proc. US Nat. Mus.*, **115**: 431-466.
- Hayashi, K.-I., 1998. A new genus and a new species of alpheid shrimp (Decapoda, Caridea) from Japan. *Zoosystema*, **20**: 229-238.
- Holthuis, L. B., 1951. The caridean Crustacea of tropical West Africa. *Atlantide Rep.*, **2**: 1-187.
- Holthuis, L. B., 1993. *The recent genera of the caridean and stenopodidean shrimps (Crustacea, Decapoda) with an appendix on the order Amphionidacea*. Nationaal Natuurhistorisch Museum, Leiden, 328 pp.
- Karplus, L., 1987. The association between gobiid fishes and burrowing alpheid shrimps. *Oceanogr. Mar. Biol. Ann. Rev.*, **25**: 507-562.
- Kim, W., 1998. *Chelomalpheus koreanus*, a new genus and species of snapping shrimp from Korea (Crustacea: Decapoda: Alpheidae). *Proc. Biol. Soc. Wash.*, **111**: 140-145.
- Man, J. G., De, 1908. Diagnoses of new species of macrurous decapod Crustacea from the „Siboga-Expedition“. *Notes from the Leyden Museum*, **30**: 98-112.
- Man, J. G., De, 1910. Diagnoses of new species of macrurous decapod Crustacea from the „Siboga-Expedition“. *Tijdschr. Nederl. Dierk. Ver.*, ser. 2, **11**: 287-319.
- Méndez, G. M. & M. K. Wicksten, 1982. *Notalpheus imarpe*: a new genus and species of snapping shrimp from western South America (Decapoda: Alpheidae). *Proc. Biol. Soc. Wash.*, **95**: 709-713.
- Williams, A. B., 1965. A new genus and species of snapping shrimp (Decapoda, Alpheidae) from the southeastern United States. *Crustaceana*, **9**: 192-198.