A new species of the enigmatic shrimp genus *Pseudocheles* (Decapoda: Bresiliidae) from Sulawesi (Indonesia), with the designation of a new family *Pseudochelidae*.

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Abstract.—A new species of caridean shrimp, *Pseudocheles neutra* sp. nov. is described from Sulawesi, Indonesia. The new species can be distinguished from its congeners by a suite of characters, including the presence of a distinct tooth on the posterolateral margin of the fifth pleuron, as well as several differences in spination. A new family, *Pseudochelidae* is created to accommodate the genus. This family can be distinguished from the Bresiliidae and Alvinocarididae in the presence of well developed exopods on the ambulatory pereiopods and the fusion of the ischium and merus of the first and second pereiopods, and from the Disciadidae primarily in the absence of a disc-shaped dactylus of the first pereiopod. The new family differs from all known Caridean families in the presence of pseudochelate ambulatory pereiopods.

Introduction

The genus *Pseudocheles* was erected by Chace & Brown (1978) to accommodate a peculiar shrimp, *Pseudocheles enigma* from the Great Barrier Reef. This taxon differed from all known caridean shrimps, by having pseudochelae on the ambulatory pereiopods, with all other carideans (except Procarididae) being characterised by one, or usually two, anterior pairs of chelate pereiopods. A further species, *Pseudocheles chacei* Kensley was established by Kensley (1983) for specimens from Florida and Belize. Both species are only known from their respective type series.

The present contribution reports on further specimens from this rare genus from the Tukangbesi Archipelago in south-eastern Sulawesi (Indonesia), validating the prediction by Kensley (1983) that additional species may be found between the two presently known localities. As the specimens could not be confidently attributed to either species, a new species is described to accommodate them. Further, a new family is erected to accommodate the genus. The holotype will be deposited in the collections of the Bogor Museum, Indonesia, whilst the paratype is in the collections of the Royal Belgian Institute of Natural Sciences (KBIN).

Taxonomy

Genus *Pseudocheles* Chace & Brown, 1978

*Pseudocheles neutra*, new species

(Figs. 1–4)

Material examined.—Male holotype, post-orbital carapace length (pocl) 1.70 mm; Kaledupa Reef, Kaledupa, Tukangbesi Archipelago, south-eastern Sulawesi, Indonesia; from coral rubble collection, -10 m deep, leg. S. De Grave, 11/07/2000 (field sample number 62); ovigerous female paratype (rostrum damaged) pocl 0.70 mm, KBIN IG.30003; Kaledupa Reef, Kaledupa, Tukangbesi Archipelago, south-eastern Sulawesi, Indonesia; from coral rubble collection, -10 m deep, leg. S. De Grave, 12/07/2000 (field sample number 72).
Fig. 1. *Pseudocheles neutra*, new species; a–b, f–i from male holotype, remainder from female paratypes (KBIN IG.30003). a, carapace; b, pleonites 3–6; c, telson; d, tip of telson; e, uropod; f, pleopod 1; g, endopod of pleopod 1; h, pleopod 2; i, appendices interna and masculina. Scale bar indicates 1.5 mm (a–b), 0.5 mm (c, e, f, h), 0.25 mm (d) or 0.12 mm (g, i).
NEW SPECIES OF *PSEUDOCHELUS* AND *PSEUDOCHELIDAE*, NEW FAMILY

Fig. 2. *Pseudocheles neutra*, new species, female paratype (KBIN IG.30003). a, antennular peduncle; b, scaphocerite and antennal peduncle; c, left mandible; d, maxillule; e, maxilla; f, third maxilliped; g, tip of third maxilliped. Scale bar indicates 0.4 mm (a-b), 0.2 mm (c-f) or 0.1 mm (g).

Description.—Rostrum slender (Fig. 1a), nearly reaching to distal margin of second segment of antennular peduncle; dorsally armed with 6 near equidistant teeth, one of which is situated post-orbitally; ventrally armed with subapical, single tooth. Carapace
Fig. 3. *Pseudocheles neutra*, new species, female paratype (KBIN IG.30003). a, first pereiopod; b, tip of chelae of first pereiopod; c, second pereiopod; d, third pereiopod; e, fourth pereiopod; f, fifth pereiopod; g, dactylus of fifth pereiopod. Scale bar indicates 0.4 mm (a, c-f) or 0.12 mm (b, g).
NEW SPECIES OF *PSEUDOCHLELES* AND *PSEUDOCHELIDAE*, NEW FAMILY

with low denticle in posterior 0.88 of dorsal margin; antennal spine (Fig. 1a) small but distinct, arising just ventral to broadly rounded orbital lobe. Thoracic sternites unarmed.

Abdomen (Fig. 1b) with third somite projecting as low cap over anterior part of fourth somite; pleuron of fourth somite posteroverentral angle slightly angular, pleuron of fifth somite posterovertrally rounded with strong tooth on posterolateral margin; sixth somite 1.1 times length of telson, posterovertral angle angular, posterolateral margin produced into a sharp tooth.

Telson (Fig. 1c) 3.2 times as long as anterior width, armed with three pairs of dorsolateral spines, anterior-most pair situated at 0.5 of telson length, median pair situated at 0.75; posterior-most pair overreaching bases of lateral pair of posterior spines; posterior margin subtriangular (Fig. 1d), indented, tip with sharp median point; three pairs of posterior spines; lateral pair longest, sinuous, inner margin denticulate in proximal half; intermediate and medial pair subequal in length, distal two-thirds plumose.

Uropods slightly shorter than telson, endopod and exopod subequal in length (Fig. 1e), strap-like; exopod with movable spine mesial to distolateral tooth; spine slightly overreaching distal margin of exopod.

Antennular peduncle (Fig. 2a) reaching to distal third of scaphocerite; stylocerite tapering to acute tip, reaching to distal third of basal peduncle segment; latter approximately twice as long as second segment; third segment slightly longer than second; dorsolateral flagellum approximately 2.3 times as long as carapace; ventromesial flagellum shorter.

Antenna with basicerite bluntly produced ventro-laterally; scaphocerite (Fig. 2b) approximately 3.8 times as long as wide, narrower in distal third; distolateral tooth small, just overreaching distal margin; antennal flagellum approximately 3.9 as long as carapace. Epistome without anteriorly directed process.

Mandible (Fig. 2c) with two-segmented palp, incisor process broad, with 11 teeth; molar process small, lobe-like, not distinctly separated from incisor, bearing row of short setae. Maxillule (Fig. 2d) with proximal endite distally rounded, bearing 11 plumose setae along inner margin, outer margin with few spines; distal endite armed with row of distal and subdistal spines on mesial margin; palp bifurcate, single simple seta on each bifurcation. Maxilla (Fig. 2e) with two endites; proximal endite single lobe; distal endite bilobed, proximal lobe reduced; palp with single distal seta; scaphognathite broad, not over-reaching palp. First and second maxilliped lost during dissection. Third maxilliped (Fig. 2f) slender, 5-segmented (ischium and merus fused); distal segment bearing 5 rows of serrate setae; tip furnished one serrate and one simple seta; exopod nearly reaching distal margin of penultimate segment.

First pereiopod (Fig. 3a) short, reaching to distal margin of basal antennular peduncle segment; fingers slightly less than half length of palm, distally curved, tips crossing when flexed; dactylus obscurely dentate in proximal half, fixed finger with truncated spine in distal third (Fig. 3b); carpus very short, recessed in distal meral hollow; ischiomerus with single spine in distal quarter of flexor margin; exopod reaching to midlength of palm.

Second pereiopod (Fig. 3c) slightly over-reaching first pereiopod; more slender than first; fingers slightly more than half length of palm; cutting edges both with series of spines; dactylus overreaching tip of fixed finger; ischiomerus with single spine in distal quarter of flexor margin; exopod reaching to midlength of palm.

Third to fifth pereiopod with curved dactyi opposing a subequally long, serrate, spiniform seta, resembling pincers (Fig. 3g). Third pereiopod (Fig. 3d) longest, over-reaching scaphocerite by half of propodus plus chela; dactylus subequal to propodus in length, with row of spines along proximal three-quarters; propodus distally with spiniform seta, opposing dactylus; propodus 2.8
times as long as carpus; merus 1.5 times as long as propodus, furnished with three spines along flexor margin; ischium short, with single spine on flexor margin; no spinose process on basis; exopod reaching to half length of merus. Fourth pereiopod (Fig. 3e) and fifth pereiopod (Fig. 3f) similar to third; propodus proportionally shorter; three near equidistant spines along flexor margin of merus; ischium with two spines on flexor margin, no spinose process on basis.

First pleopod of male (Fig. 1f) with endopod reduced, 0.24 times length of exopod, endopod distally slightly tapering, approximately 2.82 times as long as wide (Fig. 1g), with 3 plumose setae along mesial margin (broken off during dissection, insertion points still visible), and 5 plumose setae in medial row, extending to tip. Second pleopod of male (Fig. 1h) furnished with appendices interna and masculina; appendix masculina (Fig. 1i) reaching to 0.5 of length of endopod, tip furnished with 5 simple spiniform setae of varying length; appendix interna reaching 0.73 of appendix masculina, tip with six cincinnuli.

Derivation of name.—The specific name is derived from the Latin neuter, meaning neither one nor the other, in reference to it being distinct from either of the two previously described species.

Habitat.—Both specimens were collected from loose, unconsolidated rubble, which also harboured specimens of Alpheus collu- 
mianus Stimpson, Synalpheus cf. gra-
cilirostris De Man and Thalassocaris crinita (Dana). Although the rubble samples contained examples of encrusting sponges, ascidians, hydroids and bryozoans, no specific associations were observed.

Remarks.—Pseudocheles neutra new species can be distinguished from its congenerics on the basis of a number of characters. Pseudocheles enigma does not possess a pleural tooth on the fifth abdominal segment, a character present in P. neutra new species. Further differences are in the strongly developed antennal spine in P. enigma (versus minute in P. neutra new species), the presence of a pair of dorsal setae on the telson tip in P. enigma (versus none in P. neutra new species), as well as differences in spination of the merus, ischium and carpus of the ambulatory pereiopods in both species. Although P. enigma new species shares with P. chacei the possession of a pleural tooth on the fifth abdominal somite and a minute antennal spine, both species can be distinguished by the absence of a spiniform process on the basis of the third and fourth pereiopods in P. neutra (versus present in P. chacei), a differently shaped stylocerite (tapering to an acute tip in P. neutra versus with a distinct shoulder in P. chacei) as well as differences in spination of the merus, ischium and carpus of the ambulatory pereiopods in both species. P. neutra differs from both species in the absence of a spine on the flexor margin of the carpus of the ambulatory pereiopods.

Discussion

Although the species of the genus Pseudocheles are very distinct and relatively unique amongst carideans, in view of their pseudochelate ambulatory pereiopods, their familial assignment amongst the bresilioid families remains problematic. In 1977, Forest (1977) discussed the then known genera and maintained the separation of the family Bresiliidae Calman, containing the single genus Bresilia Calman and the Disciadidae Rathbun, containing the genera Discias Rathbun and Lucaya Chace. However, Chace & Brown (1978) noted intermediate character states of Pseudocheles and synonymised both families. This morphologically disparate concept of the Bresiliidae was further enlarged with the discovery of several deep-sea vent or seep taxa, such as Alvinocaris Williams & Chace, and others. Christoffersen (1986) applied a cladistic analysis to the bresilioid genera (which he placed in the Atyoidea, rather than a separate superfamily) and once again separated the families Bresiliidae and Disciadidae, whilst also establishing the fam-
ily Alvinocarididae and maintained the Agostocarididae as a distinct family in 1990 (Christoffersen, 1990). This concept was taken further by Vereshchaka (1997), who recognised three families and added a fourth one, Mirocarididae (since synonymised with Alvinocarididae by Komai & Segonzac, 2003), but included Agostocaris in the Bresiliidae, a move not followed by other authors. This historical confusion has resulted in some authors following Christoffersen (1986) and Vereshchaka (1997) in recognising 3-4 families (e.g. Komai & Segonzac, 2003), whilst other authors have maintained the Bresiliidae sensu lato (e.g. Martin & Hessler, 1990; Williams & Dobbs, 1995). Komai & Segonzac (2003) recently re-diagnosed the family Alvinocarididae, with its monophyletic status appearing to be supported by a suite of synapomorphies. Although this has reduced the morphological disparity in the remaining bresilioid clade, problems still remain with the classification of the other genera into two separate families, Bresiliidae sensu stricto and Disciadidae. As Pseudocheles occupies an intermediate morphological position between Bresiliidae sensu lato (e.g. Martin & Hessler, 1990; Williams & Dobbs, 1995). Komai & Segonzac (2003) recently re-diagnosed the family Alvinocarididae, with its monophyletic status appearing to be supported by a suite of synapomorphies. Although this has reduced the morphological disparity in the remaining bresilioid clade, problems still remain with the classification of the other genera into two separate families, Bresiliidae sensu stricto and Disciadidae. As Pseudocheles occupies an intermediate morphological position between Bresiliidae sensu lato (e.g. Martin & Hessler, 1990; Williams & Dobbs, 1995). Komai & Segonzac (2003) recently re-diagnosed the family Alvinocarididae, with its monophyletic status appearing to be supported by a suite of synapomorphies. Although this has reduced the morphological disparity in the remaining bresilioid clade, problems still remain with the classification of the other genera into two separate families, Bresiliidae sensu lato and Disciadidae. As Pseudocheles occupies an intermediate morphological position between Bresiliidae sensu stricto and the disciadid genera (for a full discussion of this, see Chace & Brown, 1978), either a more inclusive Bresiliidae sensu lato family concept needs to be once again supported, or Pseudocheles needs to be placed into its own monogeneric family. As Bresilia itself is quite clearly closely allied to the Alvinocarididae (Williams & Chace, 1982; Bruce, 1990), the return to a Bresiliidae sensu lato family concept would jeopardise the continued recognition of the Alvinocarididae, therefore we suggest the removal of Pseudocheles from the Disciadidae sensu Christoffersen (1986) and Vereshchaka (1997), and the establishment of a new family, Pseudocheelidae to accommodate it. Disciadidae sensu stricto is thus restricted to Discias, Tridiscias and Lucaya. Two other genera are difficult to place in either family: Encantada Wicksten and Kirnasia Burukovsky. Bruce (1990) is followed in regarding Encantada as closely related to Bresilia, and as such is placed in the Bresiliidae sensu stricto; Kirnasia remains incertae sedis, as the description is based on juvenile specimens (see Vereshchaka, 1997), although Bruce (1990) placed it in the disciadid clade.

Family Pseudocheelidae, new family

Differential diagnosis.— Carapace with antennal spine, no other spines present. Thoracic sternites unarmed. Telson posteriorly with triangular endpiece, with three pairs of lateral spines. Mandible with two-segmented palp, indistinctly divided into molar and incisor, molar obsolescent. First and second pereiopods with ischium and merus fused; first pereiopod more robust than second; carpus partially recessed into merus. Chelae not provided with disc-shaped dactylus. Third to fifth pereiopods chelate (or pseudochelate). Exopods well developed on all pereiopods.

Composition.— Monogeneric, containing Pseudocheles Chace and Brown, 1978; with three species (Pseudocheles enigma Chace and Brown, 1978; Pseudocheles chacei Kensley, 1983; Pseudocheles neutra new species)

Remarks.— Christoffersen (1986) separated Bresilia (and thus Bresiliidae) from a clade containing Psalidopus Wood-Mason and Alcock, Pseudocheles, Lucaya, Tridiscias Kensley and Discias, on the basis of a single apomorphy, the ischium and merus of the first and second pereiopods not being fused in Bresilia, versus fused in the other genera. Psalidopus was separated from the remaining genera (united in the Disciadidae) on the basis of several unique synapomorphies for Psalidopus, and the presence of a bilobed epitop on the second maxillipede in the remaining genera. As Psalidopus has usually been placed placed in its own superfamily, Psalidopoidea, rather than amongst the Atyoida (see Chace, 1992), its autapomorphies should bear no relevance to the bresilioid-disciadid separation. Vereshchaka
(1997) provided a short diagnosis of both families, noting the only difference being that Bresiliidae (containing the genera *Bresilia* and *Agostocaris*) have exopods on the first two pereiopods only, versus Disciadidae (*Discias, Lucaya, Tridiscias, Pseudocheles*) harbouring exopods on all pereiopods. Further, Disciadidae was diagnosed as having a “dactylus in pereiopods 1-2 semicircular and compressed”, a character which clearly does not apply to *Pseudocheles*. Komai & Segonzac (2003) in their rediagnosis of Alvinocarididae mentioned one further character as potentially useful in separating both families, the second maxilliped being six-segmented in Disciadidae versus seven-segmented in Bresiliidae). The latter character is probably not of familial significance, as *Bresilia antipodarum* Bruce and *Bresilia plumifera* Bruce, also have a six-segmented second maxilliped, due to *Pseudocheles*. It differs further from the Disciadidae primarily in the development of the chelae of the first pereiopods, which in all Disciadidae consists of a disc-shaped dactylus, although slightly reduced in *Lucaya*. In contrast, the chelae of *Pseudocheles* are more mainstream caridean-like, with a relatively unspecialized carpus. It differs further in the form of the endites of the maxilla and the form of the third maxilliped (see Chace & Brown, 1978). Members of Pseudocheleidae differ from Bresiliidae primarily in the presence of well developed exopods on the ambulatory pereiopods and the fusion of the ischium and merus of the first and second pereiopods. Both these families differ further from each other in the presence of ornately armed thoracic sternites in Bresiliidae versus unarm in Pseudocheleidae. A further difference between the three families lies in the structure of the mandible, which is distinctly bifurcate with a well developed molar process in both Disciadidae and Bresiliidae (and Alvinocarididae), but with a poorly developed molar process in Pseudocheleidae. Pseudocheleidae differs from all other bresilioid families, in the presence of pseudochelate ambulatory pereiopods, a character of unknown evolutionary and ecological significance, but one which remains unique amongst the Caridea.

Acknowledgements

Dr. T. Coles is acknowledged for the invitation to carry out fieldwork in Hoga, which was made possible by the assistance of staff and student volunteers of Operation Wallacea. Prof. K. Wouters (KBIN, Brussels) procured additional financial support, whilst Dr. T. Komai (Chiba) and Dr. A.J. Bruce (Brisbane) are acknowledged for a critical reading of an earlier version of the manuscript.

Literature Cited


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