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On a new genus and new species of pilumnid crab from Taiwan, and the generic placements of *Heteropanope changensis* (Rathbun, 1909) and *Pilumnopeus pereiodontus* Davie and Ghani, 1993 (Crustacea: Decapoda: Brachyura)

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Specimens of a small pilumnid crab found inside intertidal sediment rocks in Taiwan are here described as a new genus and new species, *Cryptopilumnus taiwanensis*. While superficially similar to species of *Aniptumnus* Ng, 2002, *Heteropanope* Stimpson, 1858 and *Pilumnopeus* A. Milne-Edwards, 1867, it nevertheless differs markedly in several key characters (the low or indistinct anterolateral teeth, the absence of a transverse suture between male thoracic sternites 1 and 2, and the presence of teeth on the ischium and merus of the third and fourth ambulatory legs). In addition, the taxonomy of two problematic species, *Heteropanope changensis* (Rathbun, 1909) and *Pilumnopeus pereiodontus* Davie and Ghani, 1993, are discussed and both are transferred to the new genus.

Keywords: *Cryptopilumnus taiwanensis*; new genus; new species; *Heteropanope changensis*; *Pilumnopeus pereiodontus*

Introduction

Recently, a small species of pilumnid crab was collected from sedimentary rocks on the coasts of Taiwan. Although the taxon is superficially similar to species of *Heteropanope* Stimpson, 1858, *Pilumnopeus* A. Milne-Edwards, 1867 and *Aniptumnus* Ng, 2002, it nevertheless differs from the type species of these genera in having indistinct anterolateral teeth, the absence of a transverse suture between male thoracic sternites 1 and 2, and the possession of tubercles on the ischium and merus of the third and fourth ambulatory legs. A new genus, *Cryptopilumnus*, is therefore established for the new species, here named *Cryptopilumnus taiwanensis*. Two species of pilumnid crabs whose generic classification has been problematic, *Actumnus changensis* Rathbun, 1909 and *Pilumnopeus pereiodontus* Davie and Ghani, 1993, also possess the same suite of characters present in *C. taiwanensis* sp. nov., and are transferred to the new genus.

Specimens examined are deposited in the National Museum of Natural Science (NMNS), Taiwan; the Queensland Museum (QM), Brisbane, Australia; and the Zoological Reference Collection (ZRC) of the Raffles Museum of Biodiversity Research, National University of Singapore. The abbreviations G1 and G2 are used

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for the male first and second pleopods, respectively. The abbreviations P2 to P5 refer to the first to fourth ambulatory legs, respectively. Measurements provided are given as the carapace width (CW) by the carapace length (CL).

Taxonomy

Family **PILUMNIDAE** Samouelle, 1819

Cryptopilumnus gen. nov.

Type species

Cryptopilumnus taiwanensis sp. nov., by present designation.

Diagnosis

Carapace with poorly defined regions; front broadly bilobed; suborbital margin unarmed; orbital hiatus open; supraorbital margin entire; anterolateral margin arcuate, teeth/lobes poorly defined or almost indiscernible, low; posterolateral margins distinctly converging towards posterior carapace margin; outer surface of chelae covered with numerous granules and setae; dactylo-propodal lock present on P2–P5; ischium of P5 with short tubercles ventrally (may be comb-like); ventral margins of P5 with prominent tubercles proximally; thoracic sternites 1–3 completely fused without trace of sutures; all male somites free, completely covering sternite 8 when closed; G1 slender, S-shaped, distally tapering.

Etymology

The name is derived from the Latin for hidden, in combination with the name *Pilumnus*, alluding to the habits of the type and constituent species. The gender is masculine.

Remarks

Of the 25 genera now recognized in the Pilumninae (Ng et al. 2008), *Cryptopilumnus* gen. nov. superficially resembles species in *Heteropanope* Stimpson, 1858 (type species *Heteropanope glabra* Stimpson, 1858), *Pilumnopeus* A. Milne-Edwards, 1867 (*Pilumnopeus crassimanus* A. Milne-Edwards, 1867), and *Aniptumnus* Ng, 2002 [type species *Pilumnus* (*Parapilumnus*) *quadridentatus* De Man, 1895]. This is especially with regard to poorly defined carapace regions, shape of the front, the presence of small granules along the frontal margin, setae covering the palms of the chelipeds, armature on the ventral margins of the ischium and merus of P4 and P5. However, the most important character that separates *Cryptopilumnus*, new genus, from these genera is the lack of a transverse suture between male thoracic sternites 1 and 2, a feature evident on the other genera (see Davie 1989; Ng 2002; Ng and Clark 2008). The relatively more rounded carapace with low anterolateral teeth or lobes, and the ambulatory merus and ischium armed with tubercles are also distinguishing features.

Two problematic pilumnine species merit comment, *A. changensis* Rathbun, 1909, and *P. pereiodontus* Davie and Ghani, 1993. *Actumnus changensis* Rathbun, 1909 was briefly described on the basis of only one female (5.7 by 3.8 mm) collected from coral at a depth of one fathom from the island of Koh Chang in the Gulf of

Thailand (Rathbun 1909, p. 114). Rathbun (1910, p. 357, figures 41, 42) later provided more information and figures and noted that the type female was from a series of three males and two females, all collected at the same time. Only the original female mentioned by Rathbun (1909) can be considered to be type material. The species was transferred to *Heteropanope* Stimpson, 1858, by Balss (1933) without much comment. Davie (1989, p. 130) provisionally left it in *Heteropanope* as one of the three recognized species although he did not have specimens of the species to hand at the time. With regard to *P. pereiodontus* Davie and Ghani, 1993, the species was described from two males and one female from Churna Island in Pakistan, but the authors expressed uncertainty about its generic placement because of several unusual characters (i.e. the less protruding frontal lobes, the more strongly tubercular chelipeds and the armature of the fourth ambulatory leg), which are not seen in other members of the genus. Davie and Ghani (1993, p. 65) also commented that "Because of the apparent strong similarities, the two species [*Heteropanope changensis* and *P. pereiodontus*] could be considered congeneric and therefore *H. changensis* should be transferred to *Pilumnopeus*. The main difficulty with this action is that *P. pereiodontus* itself does not fully agree with the generic diagnosis of *Pilumnopeus* given by Davie (1989). The points of departure are that the lateral frontal teeth are almost obsolete, and sternite 8 is not visible laterally beside the closed male abdomen." Peter Davie kindly re-examined the type male specimen of *P. pereiodontus* at our request. He comments (personal communication) that the thoracic sutures 1–3 are totally fused, and mostly fused to sternite 4 as well, except for clear short lateral incision/sulcus; and sternite 8 is not visible with the abdomen closed. The anterior edge of sternite 8 is also in line with the lateral leading edge of the third abdominal segment, but it is clearly hidden behind this structure.

In the ZRC is a good series of specimens of *H. changensis* collected in Singapore which agree very well with the descriptions of Rathbun (1909, 1910) (Figures 1, 2, 5E,F). Although Rathbun (1909, 1910) does not describe the structure of P5, her figure shows the armature on the merus and ischium very well (Rathbun 1910, figure 41). Comparing these with the detailed descriptions and drawings of *P. pereiodontus* by Davie and Ghani (1993), we agree with Davie and Ghani (1993) that the two species are very close and clearly congeneric. Both species, however, are also very close to *C. taiwanensis*. All three species have indistinct regions of the carapace, have a broadly bilobed front, lack a tooth or spine on the suborbital margin, possess low to indistinct anterolateral teeth, have the outer surfaces of the cheliped palms prominently granular and setose, have the ventral margins of the ischia and meri of the P5 armed with tubercles, have thoracic sternites 1–3 completely fused, have the male sternite 8 completely hidden when the male abdomen is closed, and have a triangular telson and a sinuous G1 which is distally tapering (Table 1). As such, *H. changensis* (Rathbun, 1909) and *P. pereiodontus* Davie and Ghani, 1993, are here also transferred to *Cryptopilumnus*.

Interestingly, all three species of *Cryptopilumnus* apparently live inside non-coral rock. Specimens of *C. changensis* were collected by the third author from between slabs of soft sedimentary rock in the intertidal zone, in areas with strong wave action. These rocks have numerous deep crevices and cracks in which the crabs live. *Cryptopilumnus pereiodontus* lives "in holes and crevices in stones" (Davie and Ghani, 1993, p. 62), although the type of stone was not specified.

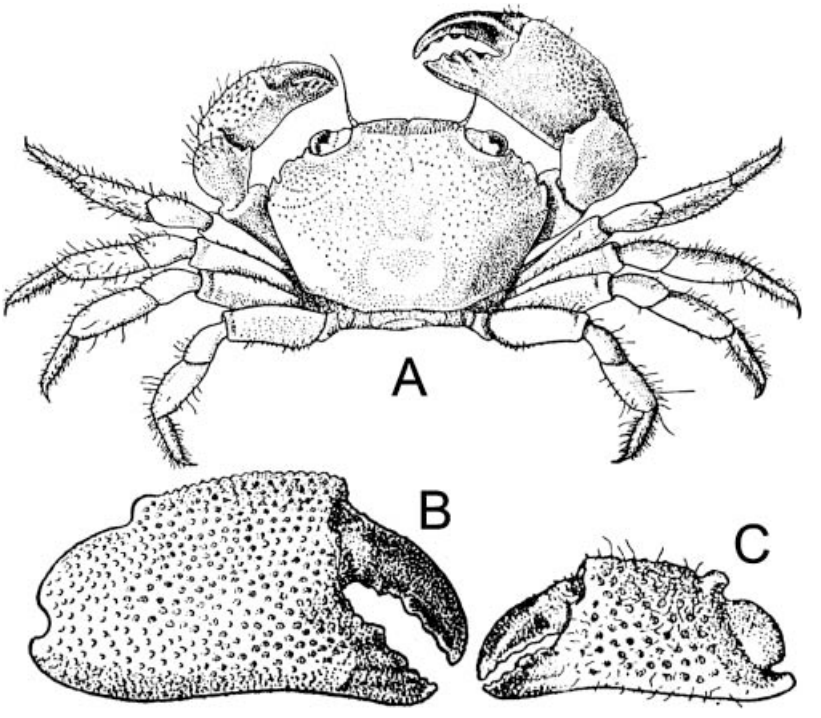

Figure 1. *Cryptopilumnus changensis* (after Rathbun, 1910, figures 41, 42). (A) Overall view; (B) right chela; (C) left chela.

Comparative material

Cryptopilumnus changensis (Rathbun, 1909), 1 male (5.9 by 4.4 mm), 9 females (5.6–7.1 by 3.9–4.7 mm; 3 ovigerous) (ZRC 1970.1.20.32-41), Horsburg Lighthouse (Pulau Pedra Blanca), Singapore, coll. A. Monterio, 1965; 5 males, 6 females (3 ovigerous) (ZRC 1970.1.20.32), Horsburg Lighthouse (Pulau Pedra Blanca), Singapore, coll. A. Monterio, 10 August 1965; 7 males (2.8–7.3 by 2.2–5.2 mm), 12 females (3.1–5.5 by 2.2–4.1 mm; 9 ovigerous) (ZRC 1987.475.495), Pulau Kukor, Singapore, coll. P. K. L. Ng, 30 December 1986. *Aniptumnus quadridentatus* (De Man, 1887), 1 male (13.82 by 8.89 mm) (ZRC 1989.3649-3660), Singapore. *Pilumnopeus makiana* (Rathbun, 1931), 1 male (12.71 by 9.23 mm) (ZRC 2001.0099), Hong Kong.

Cryptopilumnus taiwanensis sp. nov.
(Figures 3, 4, 5A–D)

Material examined

Holotype male (4.5 by 3.0 mm) (NMNS5771-001), Sunsheintai (23°06.899′ N, 121°24.012′ E), Taitung County, coll. P.-W. Hsueh, 6 May 2005. Paratypes: 1 female (3.5 by 1.9 mm) (NMNS5771-002), same data as holotype; 1 male (3.8 by 2.7 mm) (NMNS5771-002), Shihmen (25°17.84′ N, 121°34.23′ E), Taipei County, coll. P.-W. Hsueh, 1 November 2003; 3 males (4.4 by 3.2 mm, 4.4 by 2.7 mm, 3.8 by 2.2 mm), 3

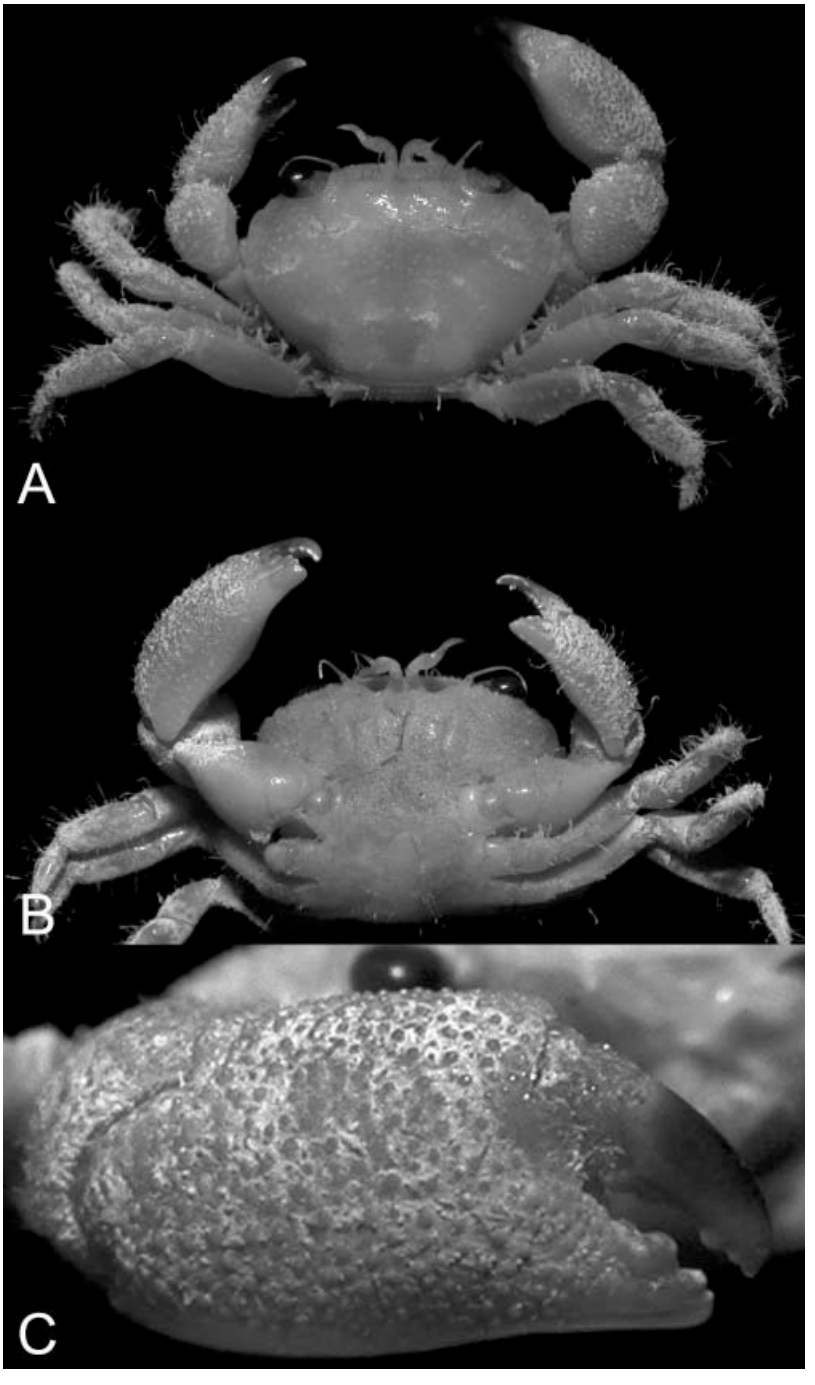

Figure 2. *Cryptopilumnus changensis*, male (4.6 by 3.3 mm) (ZRC 1970.1.20.32). (A) Overall dorsal view; (B) ventral view; (C) outer view of right chela.

Table 1. Comparisons on external characters among *Aniptumnus quadridentatus* (De Man, 1895), *Cryptopilumnus changensis* (Rathbun, 1909), *Cryptopilumnus pereiodontus* (Davie and Ghani, 1993) and *Cryptopilumnus taiwanensis* gen. nov., sp. nov.

Character	*Aniptumnus quadridentatus*	*Cryptopilumnus changensis*	*Cryptopilumnus pereiodontus*	*Cryptopilumnus taiwanensis*
Carapace regions	distinct	indistinct	indistinct	indistinct
Carapace regions	marginal areas distinctly granulate	almost smooth or with minute granules	with scattered granules	minute granules on marginal areas
Frontal margin (relative to carapace width)	relatively narrow	relatively broad (Figures 1A, 2A)	relatively broad	relatively broad (Figures 3A, 4A)
Front margin	lined with blunt granules	lined with very small rounded granules	lined with small granules	lined with small rounded granules
Suborbital margin	with distinct inner tooth	without inner tooth	without inner tooth	without inner tooth
Anterolateral teeth	distinct	distinct but low teeth (Figures 1A, 2A)	very low lobes	low or indistinct lobes (Figures 3A, 4A)
Size of granules on palms of chelipeds	small	medium-size (Figures 1B, C, 2C)	large	medium-size (Figures 3C, 4E)
Covering of setae on palms of chelipeds	scattered	scattered (Figure 2C)	dense	dense (Figure 3C)
Armature on ischium and merus of ambulatory leg 3	present	weaker than that on leg 4 but visible	absent	weaker than that on leg 4 but visible
Armature on ischium and merus of ambulatory leg 4	present	present (Figure 5F)	present	present (Figure 4D)
8th thoracic sternite when male abdomen closed	visible	not visible	not visible	not visible
Male thoracic sternites 1 and 2	visible	absent	absent	absent
Distal part of G1	blunt, subtruncate	tapering sharply, gently hooked (Figure 5E)	tapering to rounded tip	tapering sharply, gently directed upwards (Figure 5A–C)

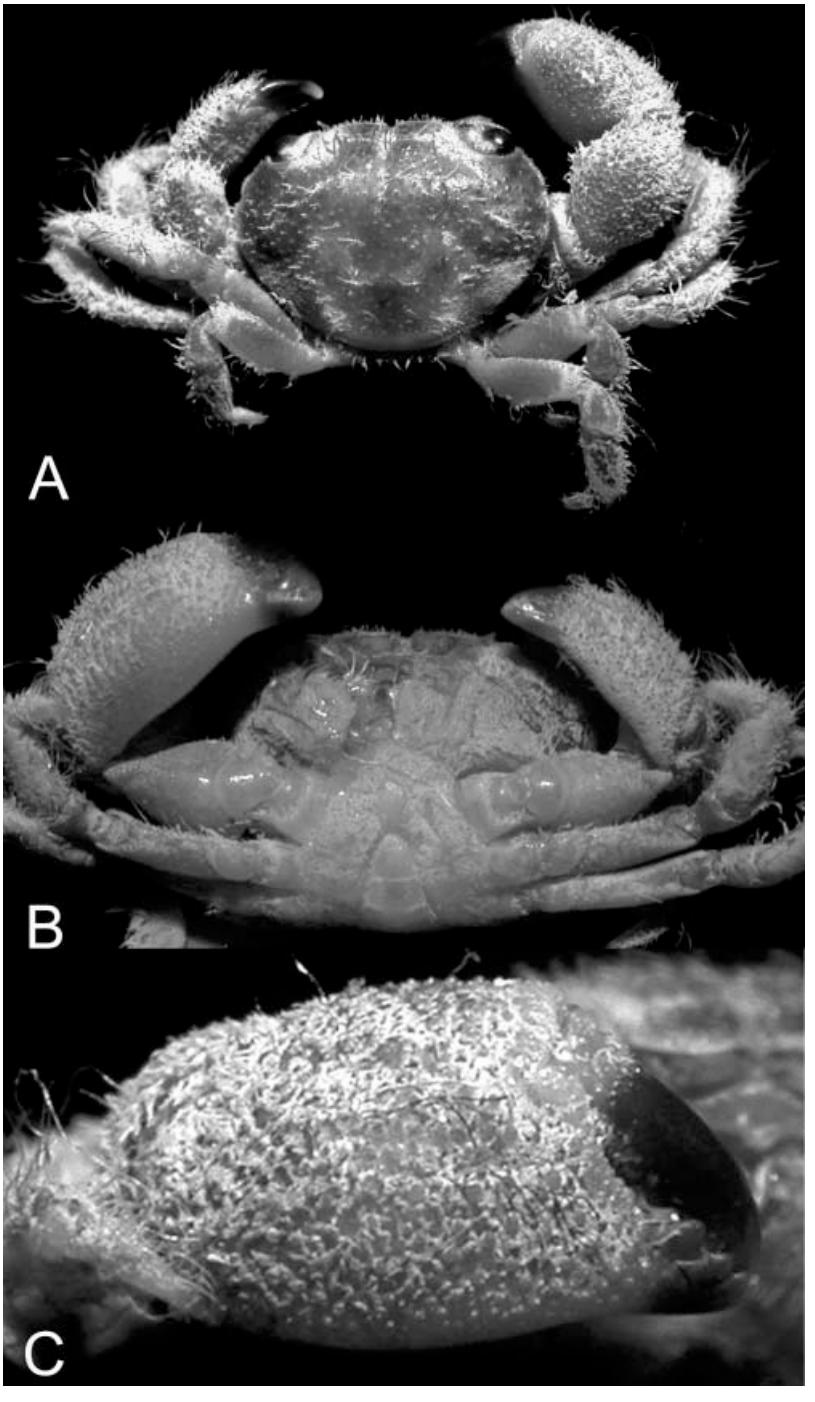

Figure 3. *Cryptopilumnus taiwanensis* gen. nov., sp. nov., male (4.4 by 3.2 mm) (ZRC). (A) Overall dorsal view; (B) ventral view; (C) outer view of right chela.

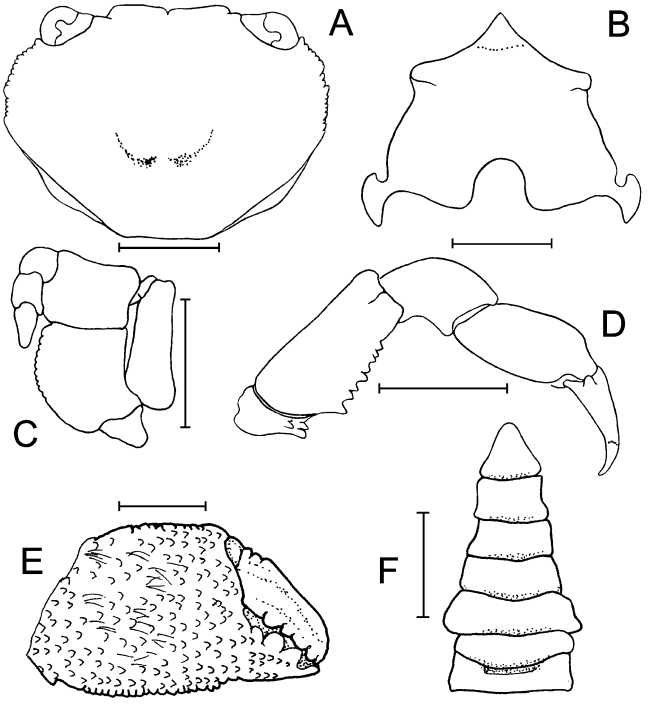

Figure 4. *Cryptopilumnus taiwanensis* gen. nov., sp. nov. Holotype male (4.5 by 3.0 mm) (NMNS5771-001). (A) Carapace, denuded; (B) anterior thoracic sternum (denuded); (C) left third maxilliped (denuded); (D) right fourth ambulatory leg (denuded); (E) outer surface of right chela (denuded); (F) abdomen. Scale bars: A, E, F, 1.0 mm; B–D, 0.5 mm.

females (3.4–5.0 by 2.2–3.3 mm) (ZRC 2008.0496), Sunsheintai (23°06.899′ N, 121°24.012′ E), Taitung County, coll. P.-W. Hsueh, 20 May 2005; 2 males (3.8 by 2.7 mm, 3.4 by 2.4 mm) (NMNS5771-003), 3 females (2 ovigerous; 4.0–4.6 by 3.0–3.4 mm) (NMNS5771-004), Shihmen (25°17.84′ N, 121°34.23′ E), Taipei County, coll. P.-W. Hsueh, 1 November 2003; 5 males, 4 females, 1 juvenile, Sunsheintai (23°06.899′ N, 121°24.012′ E) (ZRC 2008.0497), Taitung County, coll. P.-W. Hsueh, 14 October 2007; 2 males, 2 females, Wunlitung (21°59.44′ N, 121°42.16′ E) (QM W28477), Pingtung County, southern Taiwan, lower intertidal coral reefs, coll. P.-W. Hsueh, 15 December 2007. All localities are in Taiwan.

Diagnosis

Carapace with regions almost smooth; suborbital margin lined with small rounded granules; with three low granular lobes, separated from low external orbital tooth by a depression; outer surface of chelae covered with numerous granules and setae; ischium of P4, P5 with five to nine short comb-like tubercles ventrally; ventral margins of P4, P5 with prominent tubercles proximally, that of P5 with 10–12 small and large tubercles on outer margin; G1 slender, S-shaped.

Description

Carapace ovoid, about 1.5 times as broad as long (Figures 3A, 4A); regions poorly defined, surface without distinct granules, areas around lateral margins minutely

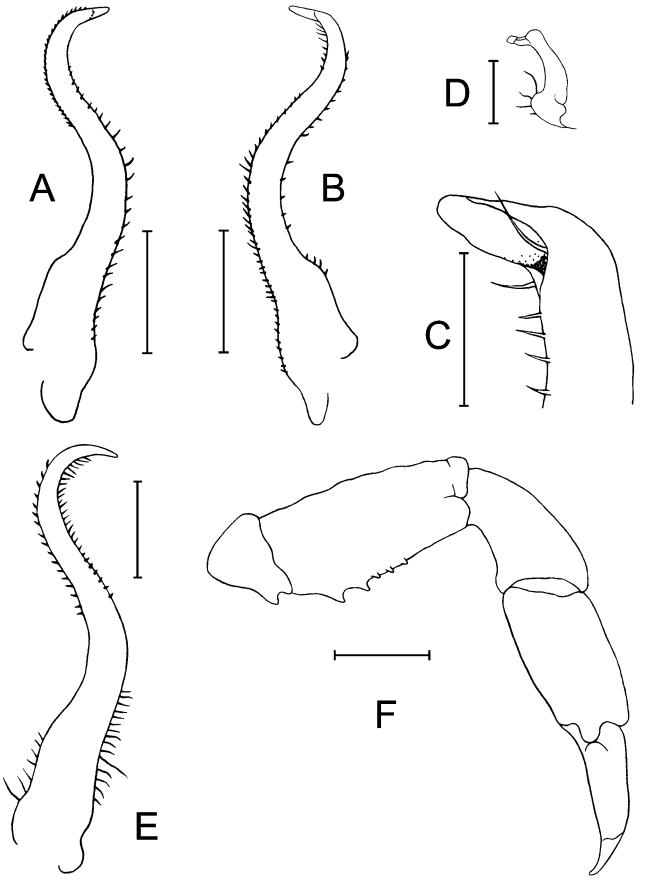

Figure 5. (A–D) *Cryptopilumnus taiwanensis* gen. nov., sp. nov. Holotype male (4.5 by 3.0 mm) (NMNS5771-001). (E, F) *Cryptopilumnus changensis*, male (4.6 by 3.3 mm) (ZRC 1970.1.20.32). (A, B, E) left G1; (C) distal part of left G1; (D) left G2; (F) right fourth ambulatory leg. Scale bars: A, B, D, E, 0.2 mm; C, 0.1 mm; F, 0.5 mm.

granular; setae scattered on poorly defined frontal, epigastric, protogastric, hepatic and branchial regions; front broadly bilobed, median lobes separated by median cleft, margins gently convex to almost straight; lateral lobule low but visibly demarcated from median lobes by small notch, margins uneven but unarmed, about half carapace width (Figures 3A, 4A); eye moveable, suborbital margin lined with small rounded granules, without tooth, spine or fissure; orbital hiatus distinct, basal antennal segment mobile, antennae lodged inside orbit; supraorbital margin lined with scattered very small granules, without fissure; anterolateral margin arcuate, convex, with three very low lobes (excluding low external orbital tooth), which may be almost indiscernible, first lobe barely separated from external orbital tooth by depression, third lobe lowest and smallest, margins lined with small granules but not spinules; posterolateral margins distinctly converging towards gently sinuous posterior carapace margin, lined with minute granules (Figure 3A). Pterygostomial, subhepatic, suborbital regions covered with minute granules and dense short setae. Endostomial ridges distinct. Third maxilliped quadrate; merus

about 1.6 times broader than long, distinctly smaller than ischium; ischium rectangular, without median sulcus, inner margin gently denticulate, about 1.2 times longer than broad; palp (dactylus, propodus and carpus) short, articulates at inner corner of merus; exopod stout, with distinct flagellum (Figure 4C).

Both male and female chelipeds asymmetrical (Figure 3A,B); ischium short, inner margin granular; merus with granular inner margin, without obvious distal tooth; outer surface of carpus granular, with low, rounded inner-distal tooth; chela prominent teeth present at base of fingers, prominent teeth of mobile and immobile fingers interlocking when closed; palms swollen medially, outer surface of palm with numerous small and large granules, dense setae present on outer surface of palms and carpus (Figures 3B,C, 4E).

P2–P5 slender; P3 longest; dorsal surface of merus and propodus of the P2–P5 with scattered setae, carpus and dactylus covered with dense setae all around (Figure 3A,B); dorsodistal angle of merus of P2–P5 rounded, not prominently produced; dorsodistal margin of merus of P2–P4 with low granules; ventral margin of ischium of P4 with seven to nine comb-like tubercles, three or four anterior spines larger, posterior ones smaller, proximal part of ventral margin of merus denticulate; P5 less setose, ischium with five to seven small comb-like tubercles distally on ventral margin, ventral margin of merus with three or four larger tubercles proximally, followed by seven to nine smaller tubercles on both left and right margins, becoming gradually reduced in size toward the distal end, tubercles on outer margin stronger than those along inner margin; carpus short, unarmed; dactylo-propodal lock present; dactylus gently curving inwards, tip corneous (Figure 3D).

Thoracic sternites smooth; sternites 1 to 3 completely fused without trace of sutures, sternites 3 and 4 separated by incomplete sutures, with only lateral parts visible; male sterno-abdominal cavity extending to about half the length of sternite 4 (Figures 3B, 4B). Male abdomen with all somites (including telson) freely articulating; somite 3 laterally expanded, completely covering sternite 8 when closed; telson triangular, longer than broad, tip rounded (Figures 3B, 4F). G1 slender, S-shaped; distally pointed, curving outwards (Figure 5A–C); G2 very short, sigmoid (Figure 5D).

Etymology

The species is named after the island where it was found.

Type locality

It is known only from northwestern, southern and eastern coasts of Taiwan.

Habitat

The species has only been found in cracks within sediment rocks in the lower part of the intertidal zone.

Colour of fresh specimen

In life, the dorsal surfaces are dark greenish-black. The meri of the ambulatory legs are generally paler. The ventral surfaces are dirty-white. The setae on the carapace and legs are brown.

Remarks

Cryptopilumnus taiwanensis can easily be separated from *C. pereiodontus* by its smoother carapace (Figures 3A, 4A) (versus distinctly granular, cf. Davie and Ghani 1993, figure 1A), less well-defined and lower anterolateral teeth (Figures 3A, 4A) (versus relatively more prominent, cf. Davie and Ghani 1993, figure 1A,B); granules on the outer surface of the chela being relatively larger (Figures 3C, 4E) (versus larger, cf. Davie and Ghani 1993, figure 2C); more strongly armed P4 and P5 which have more tubercles (Figures 3A, 4D) (versus with only two or three tubercles on P5 while P4 is apparently unarmed, cf. Davie and Ghani 1993, figure 1D); and distal part of the G1 gently curving upwards and more tapering (Figure 5A–C) (versus relatively shorter and not bent, cf. Davie and Ghani 1993, figure 2E). *Cryptopilumnus taiwanensis* can be separated from *C. changensis* by its relatively more setose carapace (Figure 3A versus Figure 2A), indistinct lobes on the anterolateral margin (Figures 3A, 4A) (versus low teeth, Figure 1A, 2A), slightly narrower frontal median lobes (Figures 3A, 4A versus Figures 1A, 2A), denser setae on the outer surface of the chela (Figures 3C, 4E versus Figures 1B,C, 2C), relatively shorter ambulatory legs (Figures 3A, 4D versus Figures 1A, 2A, 5F), ischium of P5 has comb-like tubercles on the ventral margin (Figure 4D) (versus simple tubercles, Figure 5F), weaker armature on the ischium and merus of the P4 and P5 with fewer tubercles (Figure 4D versus Figure 5F), and distal part of the G1 gently curving upwards (Figure 5A–C) (versus gently hooked downwards, Figure 5E). The colour of the two species in life are also different; with the dorsal surfaces of *C. taiwanensis* a uniform dark greenish-black compared with brownish-green with clear patches of light green between the regions and ambulatory legs in *C. changensis*.

Acknowledgements

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