

ON THE IDENTITY OF *PINNIXA BREVIPES* H. MILNE EDWARDS, 1853, AND A NEW SPECIES OF *APHANODACTYLUS* TESCH, 1918 (CRUSTACEA: DECAPODA: BRACHYURA: PINNOTHEROIDEA) FROM THE PHILIPPINES

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ABSTRACT. – A new species of *Aphanodactylus* is described from Panglao Island, the Philippines. This new species can be distinguished from other species of *Aphanodactylus* by the characters of the carapace, the form of the ambulatory legs, and the structure of the male first gonopod. The photograph of the holotype of poorly known *Pinnixa brevipes* H. Milne Edwards, 1853, is compared with species of *Aphanodactylus* sensu stricto and the allied genus *Gandoa* Kammerer, 2006. Its distinctly punctate and rectangular carapace suggest that *A. brevipes* belongs in *Gandoa*. A lectotype for *Pinnixa brevipes* is designated.

KEY WORDS. – Pinnotheridae, *Aphanodactylus*, new species, Philippines, taxonomy.

INTRODUCTION

Species of pinnotheroid crabs of the genus *Aphanodactylus* Tesch, 1918, are known commensals of tube-dwelling terebellid polychaetes of the genus *Loimia*. *Aphanodactylus* is currently represented by four species: *A. sibogae* Tesch, 1918 [type species; Lesser Sunda Islands], *A. brevipes* (H. Milne Edwards, 1853) [Madagascar], *A. edmondsoni* Rathbun, 1932 [Hawaii], and *A. loimiae* Konishi & Noda, 1999 [Ryukyu Islands] (Ng et al., 2008). The genus has traditionally been placed in the pinnotherid Asthenognathinae, but Ng et al. (2008) recently transferred Asthenognathinae to Varunidae and argued that *Aphanodactylus* and *Gandoa* Kammerer, 2006, a senior homonym of *Voeltzkowia* Lenz, 1905, will probably need to be transferred to their own family at a later date. A new genus and new species from Japan, closely allied to these two genera has also been described by Naruse et al. (2009). The establishment of this new family is now being done by S. T. Ahyong and P. K. L. Ng, together with the description of a new genus from Guam.

The PANGLAO 2004 and PANGLAO 2005 Expeditions in the central Philippines have yielded a bonanza of interesting

and rare species of decapod Crustacea, with dozens of new genera and species reported thus far (see Bouchet et al., 2009; Ng et al., 2009; Richer de Forges et al., 2009). During the PANGLAO 2004 expedition, one ovigerous female of an unidentified species of *Aphanodactylus* was collected from Panglao Island. In addition to this material, Johann Hinterkircher and Arthur Anker kindly passed us a male specimen of *Aphanodactylus* collected from a terebellid worm at Panglao Island. In this paper, we report on a new species of *Aphanodactylus* from Panglao Island.

The measurements provided, in millimetres, are carapace width (CW) and length (CL) respectively. The abbreviations P2–P5, G1 and G2 are used for pereopods 2–5, male first and second gonopods, respectively. Specimens examined are deposited in the Zoological Reference Collection (ZRC) of the Raffles Museum of Biodiversity Research, National University of Singapore; Natural History Museum and Institute, Chiba, Japan (CBM); Muséum national d’Histoire naturelle (MNHN), Paris, France; Bernice P. Bishop Museum (BPBM), Honolulu, Hawaii; and The Naturalis (ex Rijksmuseum van Natuurlijke Historie, RMNH), Leiden, The Netherlands.

TAXONOMY

Pinnotheridae De Haan, 1833

***Aphanodactylus* Tesch, 1918**

***Aphanodactylus panglao*, new species
(Figs. 1–4)**

Aphanodactylus sibogae – Cases & Storch, 1981: 24, Fig. 9 (not *Aphanodactylus sibogae* Tesch, 1918)

Material examined. – Holotype: ovigerous female (8.8 × 5.0 mm) (NMCR), Napaling, Panglao Island, Bohol Sea, Philippines, Panglao Marine Biodiversity Project, PANGLAO 2004, stn. B8, 3 m deep, 9°37.1N 123°46.1E, by subtidal brushing of coral rock and debris, 7 Jun.2004. Paratype: 1 male (4.2 × 3.1 mm) (ZRC), Panglao Island, Bohol Sea, the Philippines, associated with an unidentified terebellid worm, coll. J. Hinterkircher, early 2000s.

Comparative material. – *Aphanodactylus sibogae* Tesch, 1918: 1 lectotype female (8.8 × 5.4 mm) (RMNH 2162), in tubes of terebellid worm (*Loimia*), east of Dangar Besar, Sapeh Bay, north coast of Sumbawa, Lesser Sunda Islands, Indonesia, up to 36 m depth, coll. SIBOGA Expedition, 14–16 Feb.1900; 1 male (7.8 × 5.3 mm) (ZRC), Sekotong, West Lombok, Indonesia, coll. D. L. Rahayu, 16 May 2007. *Aphanodactylus edmondsoni* Rathbun, 1932: 1 holotype female (16.1 × 9.5 mm) (BPBM 3576), Oahu, Hawaii, coll. C. H. Edmondson, 27 Nov.1931; 1 male (11.6 × 8.0 mm) (BPBM 3577), Oahu, Waimanalo, Hawaii, coll. C. H. Edmondson, 27 Nov.1931; 1 male (11.5 × 8.2 mm), 1 female (16.9 × 10.2 mm) (ZRC 2000.0542), Oahu, Hawaii, coll. C. H. Edmondson, 1930s. *Aphanodactylus loimiae* Konishi & Noda, 1999: 1 male (10.3 × 7.4 mm), 1 ovigerous female (13.9 × 8.6 mm) (CBM-ZC 5341), Kyan, Kuroshima Island, Yaeyama Islands, Ryukyus, Japan, 10 m deep, coral reef, in tube of *Loimia ingens*, 10 Oct.1999, coll. K. Nomura on SCUBA; 1 ovigerous female (15.3 × 9.1 mm) (CBM-ZC 5443), Ahra Beach, Kume-jima Island, Okinawa Islands, Ryukyus, Japan, 10 m deep, coral reef, inhabited in tube of *Loimia ingens*, 15 Jun.1995, coll. K. Nomura on SCUBA.

Description of female holotype (ovigerous). – Carapace (Fig. 1a) oval, distinctly broader than long, carapace width to length ratio 1.76; dorsal surface smooth, regions poorly demarcated, pits absent from gastric region. Front (Fig. 1a) deflexed, medially concave in dorsal view, gently convex in anterior view. Orbital margins entire, slightly narrowed subdistally with infraorbital and suborbital margins continuing laterally beyond cornea to form relatively long gap; infraorbital margin mesially ending as triangular inner orbital tooth; infraorbital margin lining low suborbital crista, suborbital crista mesially reaching basal antennal articles. Anterolateral margin entire, convex laterally, not cristate, continuous with posterolateral margin. Epistome (Fig. 1b) very short, medially sunken. Antennule folding transversely in fossa. Antennae with stout basal antennal article, not reaching distolateral angle of carapace; antenna enters orbit. Eyes (Fig. 1b) subconical, eyestalk short, cornea distinct.

Third maxillipeds covering approximately three-quarters of buccal cavern when closed; ischium longer than merus, extended proximo-laterally, with small protrusion on distomesial angle; merus smaller than ischium, mid-length

about two-thirds of ischium, concave distally; palp attached to distolateral angle of merus, each segment not enlarged, segments joined end to end; exopod slender, reaching proximal half of merus; flagellum long, reaching mesial margin of merus.

Thoracic sternites 1/2 completely fused, 2/3 and 3/4 each demarcated by shallow ridge; sternites 4–8 laterally demarcated by shallow sutures, each medially interrupted; sutures between sternites 4/5 and 6/7 longer than others, vulva on distal two-thirds of sternite 5, between mesial ends of suture 5/6 and 6/7.

Chelipeds equal. Merus triangular in cross section, dorsal margin rugose, dorsal margin and outer surface setose. Carpus smooth, inner angle absent. Chela with smooth surfaces, palm about 2.5 times longer than immovable finger; immovable finger with weakly sinuous cutting edge, cutting edge convex medially, lined with small teeth; movable finger with cutting edge concave on distal half. Ambulatory legs (P2-P5) relatively short, P3 longest, fourth leg shortest, upper surface glabrous, setose on margins and lower surfaces of carpi and propodi. Merus as long as or slightly longer than combined length of respective propodus and dactylus, extensor margin unarmed, flexor margin with 0–2 small denticles (Table 1). All propodi with 2 and 1 short, sharp claws on upper and lower sides of distoflexor angle. Dactyli very short, claw-like.

Abdomen (Fig. 3h) with all somites and telson distinct, mobile; somites wide, exopods of third to fifth pleopods protruding from lateral margins of abdomen in ventral view.

Description of male paratype. – Carapace (Fig. 2) subquadrate, broader than long, carapace width to length ratio 1.35; dorsal surface smooth, regions poorly demarcated,

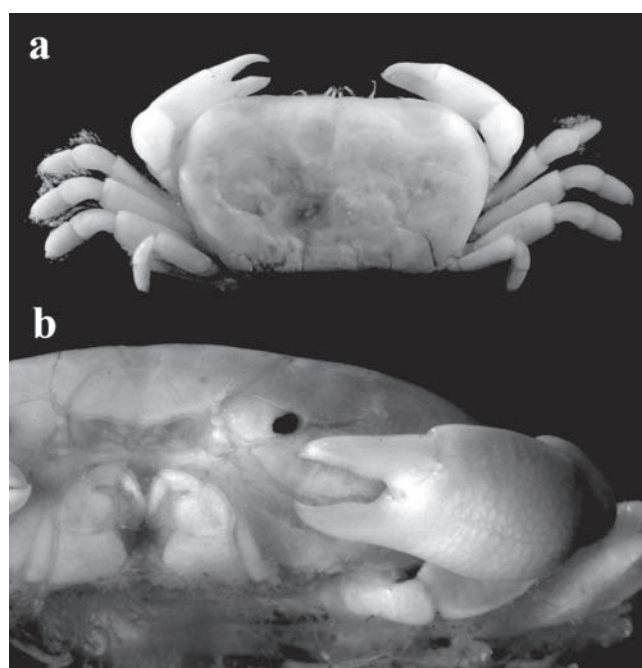


Fig. 1. *Aphanodactylus panglao*, new species. Holotype, ovigerous female (8.8 × 5.0 mm) (NMCR): a, dorsal view; b, anterior view.

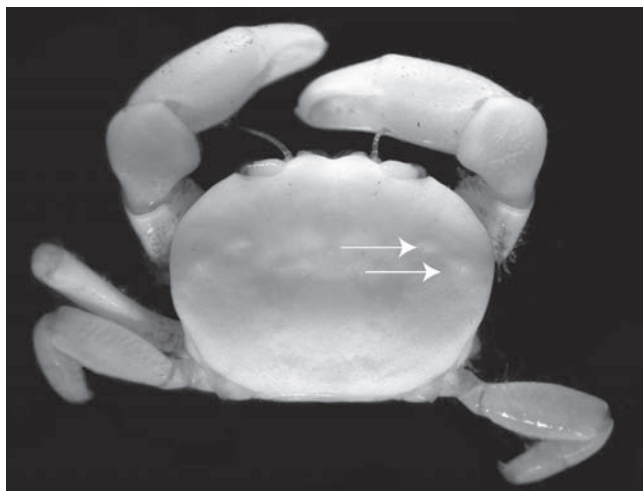


Fig. 2. *Aphanodactylus panglao*, new species. Paratype male (4.2 × 3.1 mm) (ZRC). Arrows indicate low swellings on hepatic regions.

with 2 pairs of small rounded swellings on hepatic regions. Front (Fig. 3a) deflexed, produced triangularly in frontal view, medially concave in dorsal view. Orbital margins (Fig. 3a) entire, oval, no gap between cornea and external orbital angle, infraorbital margin mesially ending as triangular inner orbital tooth, infraorbital margin lining low suborbital crista, suborbital crista mesially reaching basal antennal articles. External orbital angle directed anteriorly, cristate from behind angle, anterolateral margin entire, continuous to posterolateral margin. Epistome (Fig. 3h) longer than that of female, posterior margin straight. Antennule and antennae as

Table 1. Dentition on extensor and flexor margins of meri of P2–P5 of female holotype of *Aphanodactylus panglao*, new species.

	Left	Right
P2 extensor margin	0	0
P2 flexor margin	1 large tooth	0
P3 extensor margin	0	0
P3 flexor margin	2 large teeth	2 large teeth
P4 extensor margin	0	0
P4 flexor margin	2 large teeth	2 large teeth
P5 extensor margin	0	0
P5 flexor margin	0	0

Table 2. Dentition on extensor and flexor margins of meri of P2–P5 of male paratype of *Aphanodactylus panglao*, new species.

	Left	Right
P2 extensor margin	7 large teeth with small denticles on proximal 1/2	~6 large teeth with small denticles on proximal 3/5
P2 flexor margin	~3 large and small teeth on distal 2/3	2 large and some small teeth on distal 3/5
P3 extensor margin	With denticles, but very small	5 large and many small teeth on proximal 3/5
P3 flexor margin	4 large teeth	3 large teeth
P4 extensor margin	Very small denticles	Very small denticles
P4 flexor margin	3 large teeth	2 large with smaller ones
P5 extensor margin*	0 or small denticles only	0 or small denticles only
P5 flexor margin*	0 or small denticles only	0 or small denticles only

*Many of male legs are detached, but on the basis of relative sizes, they are from both sides of P2 and right P3. Both P5 are missing, but on the basis of the photograph of the fresh specimen (Fig. 4), both margins appear to be unarmed or only with denticles.

in female. Eyes (Fig. 3a) short, stout, with distinct cornea.

Third maxillipeds (Fig. 3b) covering almost whole buccal cavern when closed; basically similar to female third maxilliped except for more rounded distomesial angle.

Thoracic sternites 1/2 fused, sternites 2/3 demarcated by distinct suture, 3/4 demarcated by low ridge, sternites 4–8 laterally demarcated by shallow, narrow sutures, sutures medially interrupted, no medial longitudinal suture, press button of abdominal locking mechanism present on distal quarter of sternite 5; penis emerging from near anterior border of sternite 8 (Fig. 3e).

Chelipeds relatively strong, slightly unequal in size. Merus triangular in cross section, ventro-outer margin granulated, dorsal margin rugose, dorsal margin and outer surface setose. Carpus smooth, inner angle rounded. Chelae (Fig. 3c) and ambulatory legs as in female, except for armature of extensor and flexor margins of ambulatory meri (Table 2).

Abdomen (Fig. 3f) with all somites and telson distinct, mobile, relatively narrow, first and second somites short, third somite to telson forming straight lateral margins. G1 simple, proximal four-fifths straight, distal one-fifth bent inwards towards median part of sternum.

Colouration. – Male dirty white; female pinkish-white.

Ecological note. – The holotype female was obtained from corals that were hand-collected by SCUBA divers. In this collecting method, divers brush coral rocks and debris, collecting the dislodged material in trays. Many of the rocks are encrusted with terebellid worm tubes and these were probably destroyed during the brushing. The paratype male was obtained from a terebellid worm collected by a diver (Fig. 4).

Etymology. – The species is named after the island from which it was collected, Panglao. The name is used as a noun in apposition.

Remarks. – Species of *Aphanodactylus* sensu stricto bear a strong superficial resemblance to each other but can be distinguished by a combination of characters. *Aphanodactylus*

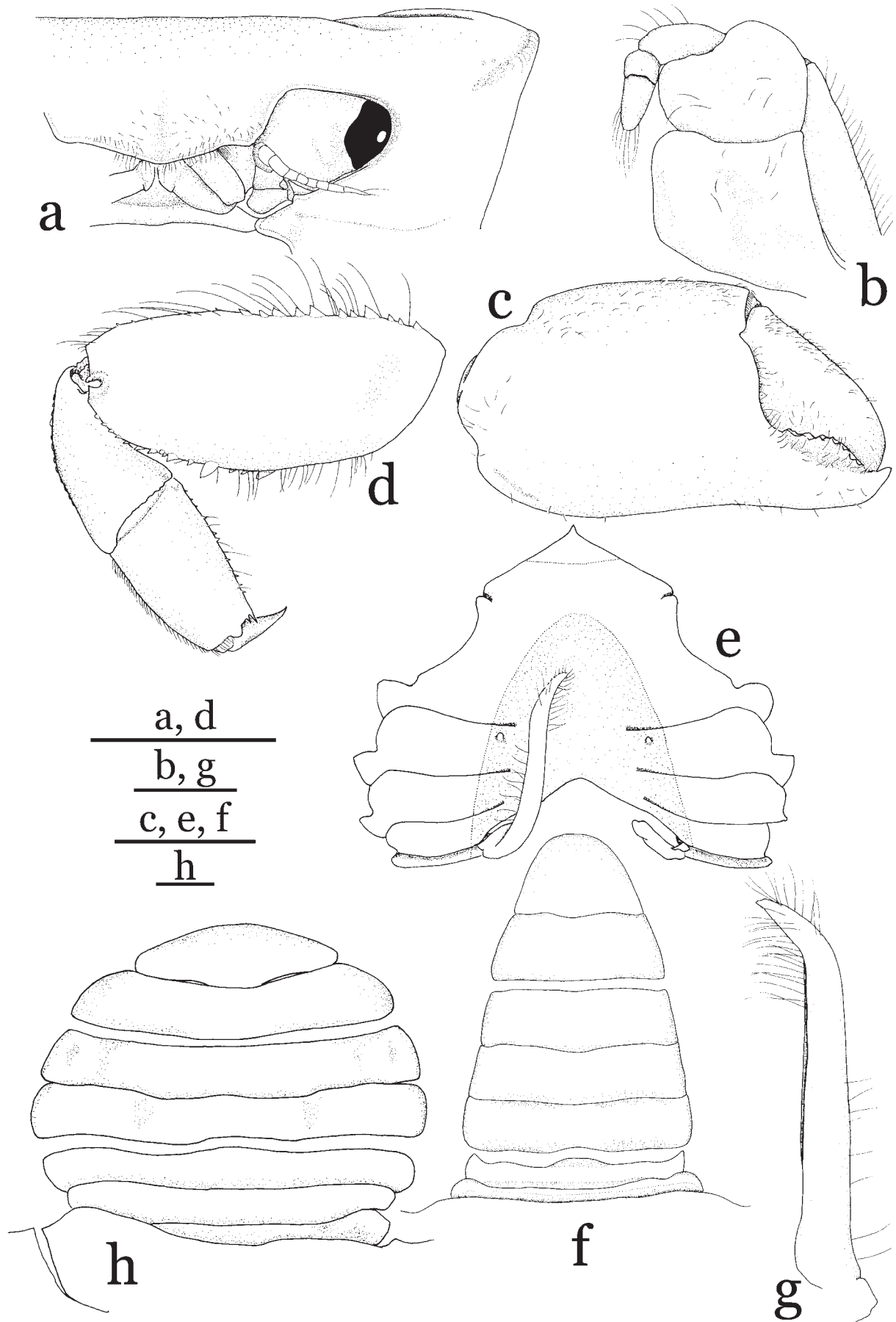


Fig. 3. *Aphanodactylus panglao*, new species: a, cephalothorax, anterior view; b, left third maxilliped; c, right chela; d, left first ambulatory leg; e, thoracic sternum; f, abdomen and telson; g, left G1, ventral view; h, abdomen and telson. a–g, paratype male (4.2 × 3.1 mm) (ZRC); h, holotype, ovigerous female (8.8 × 5.0 mm) (NMCR). Scales bars: a, c–f, h = 1 mm; b, g = 0.5 mm.

panglao, new species, is distinct in the female possessing relatively more slender ambulatory legs and the male having a relatively narrower carapace (CW to CL ratio 1.35 versus 1.39–1.47 in the other species). In addition, the orbit of the female holotype of *A. panglao* is laterally long and slightly narrowed sublaterally, and a relatively long gape is present between external orbital angle and the tip of cornea (Fig. 1b). In *A. sibogae* and *A. loimiae*, the orbit is gradually narrowed laterally, and the gape between external orbital angle and the tip of cornea is proportionately shorter (Fig. 5b; Konishi & Noda, 1999: Fig. 2c). The extensor margins of the meri of P2 to P5 of *A. panglao* are armed with small denticles or teeth, with that on the first ambulatory leg (P2) very strong, consisting of six or seven prominent teeth (Fig. 3d). These teeth are absent on *A. edmondsoni* and *A. loimiae*. They are also likely to be absent or at best very small on type male *A. sibogae*, with the detailed description and figures by Tesch (1918) showing an unarmed extensor margin of the merus of the third ambulatory leg. There are certainly no teeth or distinct denticles on the extensor margins of the P2 to P5 meri of the present male of *A. sibogae* from Lombok. The differences in the dentition observed in the ambulatory meral flexor margins of the male and both margins in the case of the female, do not appear to be significant. In addition, the hepatic region of the carapace of *A. sibogae* has two pairs of elongated pits whereas in *A. panglao*, the pits are replaced by small swellings instead. *Aphanodactylus panglao* can also be distinguished from *A. loimiae* and *A. edmondsoni* by its distally bent male G1 (Fig. 3g) (versus gently incurved in

A. edmondsoni and *A. loimiae*) (Edmondson, 1962: Fig. 2d; Ng et al., 2009).

Cases & Storch (1981) recorded *A. sibogae* from *Loimia medusa* in the Camotes Islands, Philippines. The number of specimens and sexes examined were not listed, and the size and sex of the specimen figured was not specified; although its appearance suggests it was a male. The figure of this male, however, differs from males of other *Aphanodactylus* species in having the anterolateral margins apparently more laterally produced, relatively more convergent posterolateral margins, and the fourth ambulatory leg being proportionately stouter (Fig. 2; Cases & Storch, 1981: Fig. 9; Tesch, 1918: Pl. 18 fig. 2, 2a; Ng et al., 2009: Fig. 1a). However, most of the figures of decapod shrimps and crabs in Cases & Storch (1981) are rather schematic and not very accurate, even for several well known species. This suggests that their figure of “*A. sibogae*” may also be inaccurate and the differences observed may be real. Our attempts to find the specimen(s) of “*A. sibogae*”, which are supposed to be in the biological collections of the University of San Carlos, were unsuccessful. The specimens are not in the university. Since Camotes is geographically very close to Panglao Island (type locality of *A. panglao*), their record is provisionally also referred to *A. panglao*.

Fransen et al. (1997) listed a syntype female of *A. sibogae* in RMNH and this specimen was examined and photographed (Fig. 5). Tesch (1918: 285) stated that the size of the ovigerous female is 11.3×6.0 mm, but the specimen on hand, however, measured 8.8×5.4 mm. It would appear that the original measurements are in error. In any case, only two specimens of *A. sibogae* are known, one male, one ovigerous female, with the latter clearly a type (Fransen et al., 1997: 130). The specimen agrees very well with Tesch’s (1918) original



Fig. 4. *Aphanodactylus panglao*, new species, paratype male (4.2×3.1 mm) (ZRC), on unidentified host terebellid worm. Inset: freshly collected male. (Photograph: J. Hinterkircher).

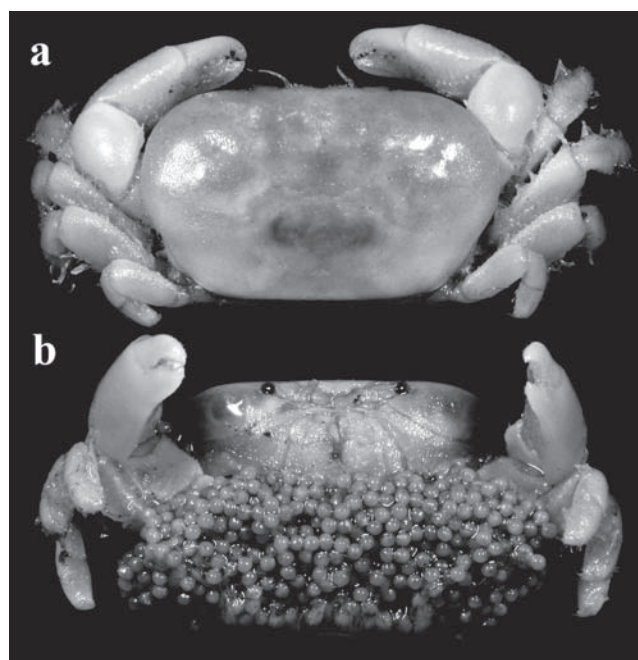


Fig. 5. *Aphanodactylus sibogae* Tesch, 1918, lectotype, ovigerous female (8.8×5.4 mm) (RMNH 2162): a, dorsal view; b, ventral view.

description and figures. The only other type specimen, the male, is still in the Zoological Museum, University of Amsterdam. The female specimen in RMNH is here designated the lectotype of *A. sibogae* Tesch, 1918.

Gandoa Kammerer, 2006

***Gandoa brevipes* (H. Milne Edwards, 1853)**

(Figs. 6, 7)

Pinnixa brevipes H. Milne Edwards, 1853: 220; A. Milne-Edwards, 1873: 320; Tesch, 1918: 284 (footnote).

Aphanodactylus brevipes – Serène, 1964: 277, 278; Ng et al., 2008: 247.

Material examined. – Lectotype female (ca. 8.5 × 5.1 mm, carapace soft) (MNHN B-10616), Mayotte, coll. Cloué.

Remarks. – The taxonomy of this species is problematic. In describing this species, all H. Milne Edwards wrote was “Carapace piquetée et sans crête transversale droite mais présentant vers le tiers postérieur un sillon courbe. Pattes courtes et paraissant obtuses au bout, les dactylopodites étant rudimentaires. Madagascar.” (H. Milne Edwards, 1853: 220). No figure was provided and he also did not indicate the number, sexes or sizes of the specimen(s) he had. Alphonse Milne-Edwards (1873), in naming the pinnotherid *Pinnixa fischeri* (now in *Tetrias*) noted that in *P. brevipes*, “... sa carapace finement ponctuée et les pinces moins comprimées et moins granuleuses.” (A. Milne-Edwards, 1873: 320). Tesch (1918: 284) also briefly discussed *P. brevipes*, noting that its very short ambulatory dactylus was very similar to that of *Aphanodactylus* and alluding to their close relationship. Serène (1964) examined the type specimen of *P. brevipes* and commented “Un examen du type femelle ovigère de 4 × 5 environ, confirme la supposition de Tesch (1918) au sujet de son appartenance au genre *Aphanodactylus*. En particulier les mxp 3 sont sur *P. brevipes* comme décrits sur *Aphanodactylus sibogae* : ischium trapezoïde plus long que le merus, la suture

entre eux transverse, le palpe à 3 articles bout à bout, etc. ... de nombreux autres caractères concordent sur les deux espèces. Cependant *brevipes* a les pattes ambulatories beaucoup plus longipes comparativement à celles de *A. sibogae* et c’est une espèce différente qui justifie une nouvelle description avec figure d’après le type.” (Serène, 1964: 278). No photograph or figure was provided. Serène (1964) clearly considered it to be a species of *Aphanodactylus*, an action followed by Ng et al. (2008).

Danièle Guinot was kind enough to check the type specimen of *Pinnixa brevipes* for us. She notes that the type is a dried ovigerous female in poor condition, being soft and very fragile. The label associated with it reads “Type. Mayotte, Cloué” and appears to have been written by R. Serène. The locality data, Mayotte, contradicts that stated by H. Milne Edwards (1853), Madagascar, but this may not be significant. The island of Mayotte is part of the Comoros, and like Madagascar, used to be French territory. Mayotte lies just off the northwest coast of Madagascar in the Mozambique Channel. The identity of the supposed collector, Cloué, is not known. As H. Milne Edwards (1853) did not select a holotype (or even indicate how many specimens he had), the female specimen in MNHN is here designated the lectotype of *Pinnixa brevipes*.

The present photographs of the type of *P. brevipes* (Figs. 6, 7) are the first of the species. As H. Milne Edwards (1853: 220) originally had described, the dorsal surface of the carapace is clearly punctate, a feature not observed in the



Fig. 6. *Gandoa brevipes* (H. Milne Edwards, 1853), lectotype female (ca. 8.5 × 5.1 mm, carapace soft) (MNHN B-10616): a, dorsal view; b, anterior view. (Photograph: J.-F. Dejouannet)

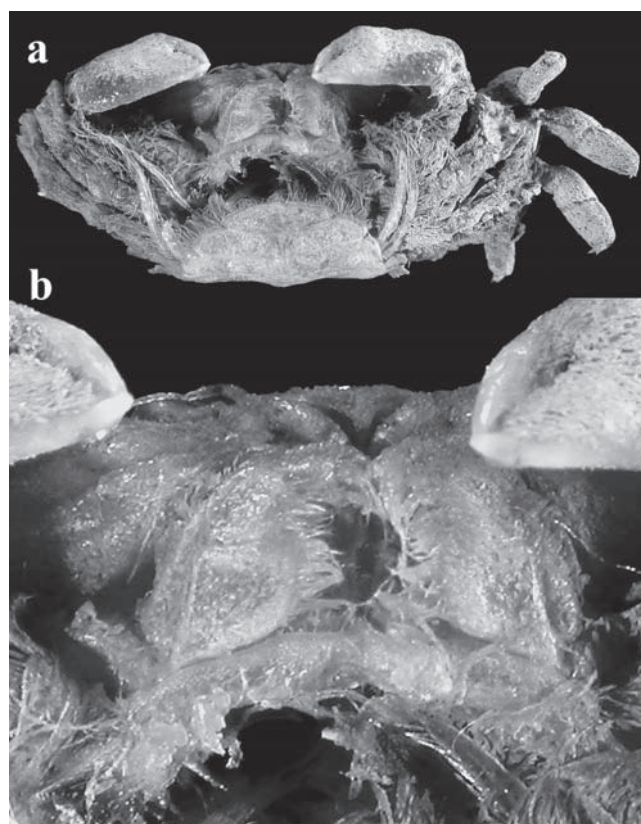


Fig. 7. *Gandoa brevipes* (H. Milne Edwards, 1853), lectotype female (ca. 8.5 × 5.1 mm, carapace soft) (MNHN B-10616): a, ventral view; b, third maxillipeds. (Photograph: J.-F. Dejouannet)

other three known *Aphanodactylus* species or the new species here. In addition, *Pinnixa brevipes* has a characteristically more rectangular carapace (versus distinctly ovate in other *Aphanodactylus* species; Figs. 1a, 5; Tesch, 1918: Pl. 18: Fig. 2; Edmondson, 1962: Fig. 3; Konishi & Noda, 1999: Figs. 1a, 2a) and a laterally more elongate orbit (versus less elongated in other *Aphanodactylus* species; Fig. 1b). These features suggest that *Pinnixa brevipes* is closer to the monotypic *Gandoa* Kammerer, 2006. Although *Gandoa zanzibarensis* (Lenz, 1905) [type locality: Zanzibar] is also a poorly known species, with no additional record since the original description, Lenz's (1905: Fig. 9, 9a–c) drawings of the 8 × 5 mm female clearly show the punctate dorsal surface of the carapace and the laterally elongate orbit. Interestingly, both species are from the east coast of Africa in the western Indian Ocean, while *Aphanodactylus* is only known from the western Pacific. The available evidence thus strongly indicates that *Pinnixa brevipes* H. Milne Edwards, 1853, is not a species of *Aphanodactylus* but should instead be transferred to *Gandoa*. This action is taken here. *Gandoa brevipes* also appears to be a different species from *G. zanzibarensis*, with the front less well developed and the carapace proportionately much broader (cf. Figs. 6, 7; Lenz, 1905: Fig. 9). We also note that the presently observed differences between *Aphanodactylus* and *Gandoa* are not substantial, and more specimens from the Indian Ocean may well result in the synonymy of the two genera. In view of the carapace differences and disjunct distribution, we prefer to recognize *Gandoa* as a separate genus for now.

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