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Burrowing lobsters mostly from shallow coastal environments in Papua New Guinea (Crustacea: Axiidea: Axiidae, Micheleidae)

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Abstract

Poore, G.C.B. 2018. Burrowing lobsters from shallow coastal environments in Papua New Guinea (Crustacea: Axiidea: Axiidae, Micheleidae). *Memoirs of Museum Victoria* 77: 1–14.

Surveys of coral reefs and associated habitats have discovered nine species of Axiidae and one of Micheleidae in Papua New Guinea. Only the micheleid is new to science. The collection provides an opportunity to provide colour photographs of some and to revisit their taxonomy. Two species are synonymised with others: *Alienaxiopsis lizardensis* Sakai, 2011 with *A. clypeata* (De Man, 1905) and *Allaxiopsis bougainvillensis* Sakai, 2011 with *Axiopsis Picteti* var. *spinimana* De Man, 1905, now *Allaxiopsis spinimana* (De Man, 1905). *Axiopsis pica* Kensley, 2003 is recognised as distinct from *A. serratifrons*, with which it co-occurs. *Michelea papua* sp. nov. is described as new.

Keywords

Crustacea, Axiidae, Micheleidae, *Alienaxiopsis*, *Allaxiopsis*, *Axiopsis*, *Parascytoleptus*, *Paraxiopsis*, *Ralumcaris*, *Michelea*, Papua New Guinea, taxonomy

Introduction

The Our Planet Reviewed (La Planète révisitée) expeditions in Papua New Guinea in 2012 and 2014, coordinated by Phillipe Bouchet for the Muséum nationale d'Histoire naturelle, Paris, discovered a diverse fauna of axiidean ghost shrimps and burrowing lobsters in shallow water. Ghost shrimps of the family Callianassidae are being studied separately, but here burrowing lobsters belonging to Axiidae and Micheleidae are dealt with.

While only one of the ten species recorded is new, four are first records for Papua New Guinea and provide new morphological information that illuminates the complicated and sometimes confusing taxonomy of some species. Seven species were photographed in colour. The discoveries have provided information for a reassessment of genera of Axiidea (work in progress) that were most recently reviewed (as Axioidea) by Sakai (2011).

The material comes from two sampling series in shallow water environments in Papua New Guinea using a variety of methods, including divers in shallow water brushing coral rubble under water (PB and KB prefixes), hand-dredging (PD and KD prefixes) or sampling individually by hand (PR, KR and KZ prefixes). The expedition in November–December 2012 near Madang, Madang Province, provided samples in the PAPUA NIUGINI series. The expedition in April 2014 based in Kavieng, New Ireland, provided samples in the KAVIENG 2014 series. These collections were augmented for comparative purposes with others from shallow waters of Papua New Guinea in other museums, and by material from the Kimberley region of Western Australia.

Material and methods

Material is deposited in the Muséum national d'Histoire naturelle, Paris (MNHN, IU-prefixes), Museum für Naturkunde, Berlin (ZMB), Zoological Museum, Hamburg (ZMH), Museums Victoria, Melbourne (NMV), the Australian Museum, Sydney (AM), Western Australian Museum, Perth (WAM) and Northern Territory Museum and Art Gallery, Darwin (NTMAG). All measurements are of carapace length (cl.) including rostrum. Photographs of fresh specimens that were taken in the lab shortly after collection were made by Tin-Yam Chan (TYC) and Arthur Anker (AA).

Results

Four of the ten species recorded, *Alienaxiopsis clypeata* (De Man, 1888), *Allaxiopsis spinimana* (De Man, 1905), *Axiopsis pica* Kensley, 2003, and *Paraxiopsis austrinus* Sakai, 1994, have been recorded from Papua New Guinea for the first time. *Axiopsis* (*Axiopsis*) *pitatucensis* De Man, 1925 (= *Calaxius pitatucensis*), described from Papua New Guinea, was not collected but is probably a higher water species. It is surprising that, despite hundreds of dredge and diving samples targeting axiidean habitats in shallow water, more species were not captured. Most of the species found are widespread in the Indo West-Pacific; in particular, *Axiopsis serratifrons* and *Paraxiopsis brocki* have been recorded numerous times from many places. The possibility that these last two are species complexes cannot be discounted.

Infraorder Axiidea de Saint Laurent, 1979

Axiidae Huxley, 1879

***Alienaxiopsis* Sakai, 2011**

Alienaxiopsis Sakai, 2011: 32–33.

Type species. *Alienaxiopsis lizardensis* Sakai, 2011, by original designation.

Remarks. *Alienaxiopsis* was erected to include two species, *Alienaxiopsis lizardensis* Sakai, 2011 (type species) and *A. clypeata* (De Man, 1888). Sakai's (2011) key differentiated the two species but, as explained below, the two are synonymous.

***Alienaxiopsis clypeata* (De Man, 1888)**

Figs 1a, b, 3

Axius clypeatus De Man, 1888: 470, pl. 20 fig. 2.
Axiopsis (Axiopsis) clypeata.—De Man, 1925: 70.
Allaxius clypeatus.—Sakai and de Saint Laurent, 1989: 73–74.—Poore and Collins, 2009: 237.
Alienaxiopsis lizardensis Sakai, 2011: 34–36, fig. 2. Syn. nov.

Material examined. Papua New Guinea. Madang Province. PAPUA NIUGINI stations. Tab I., 05° 09.9' S, 145° 50.4' E, 20 m (stn PB06), IU-2013-7096 (ovigerous female, 3.4 mm).

New Ireland Province, Kavieng lagoon, KAVIENG 2014 stations. E side of Ral I., 02°36.7'S, 150° 42.6' E, 3–10 m (KZ22), IU-2014-1142 (ovigerous female, 2.5 mm; male, 4.2 mm). Mouth of Albatross Passage, E side, 02° 35.2' S, 150° 43.1' E, 13 m (KB72), NMV J71641 (female, 4.2 mm). New Ireland mainland, N coast, 02° 35.2' S, 150° 50.3' E, 17 m (KB66), IU-2016-8134 (female, 3.5 mm).

Australia. Queensland, Great Barrier Reef, Yonge Reef, near Lizard I., 14° 38' S, 145° 38' E, AM P.25014 (holotype of *Alienaxiopsis lizardensis*, male, 4.7 mm).

Photographed specimens not seen. Papua New Guinea. Madang Province. PAPUA NIUGINI stations: location not specified, 15 m (stn PR89), 1 specimen. Kranket I., 05° 12' S, 145° 48.8' E (stn PR86), 2 ovigerous females.

Type locality. Ambon, Indonesia.

Supplementary description. Rostrum acute, depressed, 0.3 length of rostral base–cervical groove, with pair of erect lateral spines at midpoint and larger pair at base. Median gastric carina obsolete, with 1 tooth, ending in broad triangular plate; submedian gastric carina obsolete, with 2 erect teeth; supraocular spine oblique, not marginal; lateral gastric carina obsolete, with 1 erect tooth. Eyestalk reaching end of rostrum. Antenna article 2 with broadly triangular distal spine; scaphocerite 5 times as long as greatest height (lateral view), reaching to midpoint of article 5. Major cheliped ischium, merus and carpus each with minute distal tooth on lower margin; propodus swollen, upper margin 1.35 times greatest height, carinate, with distal tooth; fixed finger 0.5 times length of upper margin of propodus, with blunt distal tooth near tip of cutting edge; dactylus 2.3 times as long as wide, cutting edge with 2 low rounded teeth in proximal half. Minor cheliped as long as major cheliped, propodus about 0.75 times as high as on major cheliped; ischium and merus each with minute distal tooth on lower margin; propodus swollen, upper margin 1.2 times greatest height, carinate, with distal tooth; fixed finger as long as upper margin of propodus, with distal tooth on cutting edge; dactylus 3.2 times as long as wide, cutting edge smooth. Telson 1.1 times as wide as long at level of most anterior lateral teeth; distal margin 0.5 times telson greatest width; lateral margin with 4 teeth; distal margin convex, with 1 or 2 lateral articulating robust setae, with median spine; face with 2 pairs of spines. Uropodal endopod twice as long as wide; anterior margin strongly lobed proximally (as rounded shoulder), otherwise concave with strong tooth at midpoint and elevated distal spine; posterior margin convex, unarmed; distal margin straight, oblique, with strong elevated spine at anterior end, smaller spine at posterior end; facial rib with 3 spines. Uropodal exopod oval, twice as long as wide; anterior margin of article 1 with 4 teeth; posterior margin convex; distal margin irregular, 3 marginal spines, stronger spine defining posterior corner, strong articulating spine near anterior corner; article 2 oval, with distal spine almost as long as body of article.

Colour. Translucent with bright red band anteriorly and dorsolaterally on carapace, dorsolaterally on pleon, and on upper margins of cheliped carpus and propodus; maxilliped 3 bright red; cheliped fingers white.

Distribution. Indo-West Pacific (Guam, Papua New Guinea, Indonesia, Fiji); to 20 m depth.

Remarks. De Man's (1888) description was extensive but his drawings few. Here, colour photographs and figures of the carapace, pereopods 1 and tail fan are included.

Sakai (2011) based a new species *Alienaxiopsis lizardensis* on the specimen from Lizard I., Great Barrier Reef, Australia (AM P.25014) that was examined and identified by Poore and Collins (2009) as *Allaxius clypeatus*. Sakai listed Poore and Collins' record under the synonymy and distribution of both species. This specimen has been re-examined and redrawn; no differences in the gastric ornamentation (characters alleged to differentiate the two) could be detected between it, material from Papua New Guinea or De Man's (1888) figures. Sakai's (2011: fig. 2B) figure of the dorsal carapace is quite misleading. *Alienaxiopsis lizardensis* is here synonymised with *A. clypeata*.

Until now, *Alienaxiopsis clypeata* was known only from Ambon, Indonesia (type locality), Guam and Fiji (Kensley, 2003), but is here recorded from Papua New Guinea. The record from Fiji is based on unpublished data from the USNM online database http://collections.nmnh.si.edu/search/iz/).

***Allaxiopsis* Sakai, 2011**

Allaxiopsis Sakai, 2011: 34–35.

Remarks. Sakai (2011) included three species in *Allaxiopsis* but confused their records. The type species, *Paraxius picteti* Zehntner, 1894, was described from a single female (cl. 10 mm) collected at Ambon, Indonesia. Two males (the larger cl. 8.5 mm) were recorded from *Siboga* station 209 at Kabaena I., Indonesia, by De Man (1905) and then re-illustrated (De Man, 1925). More specimens were recorded from Guam, Marshall Islands, and Fiji by Kensley (2003). *Allaxiopsis spinimana* (De

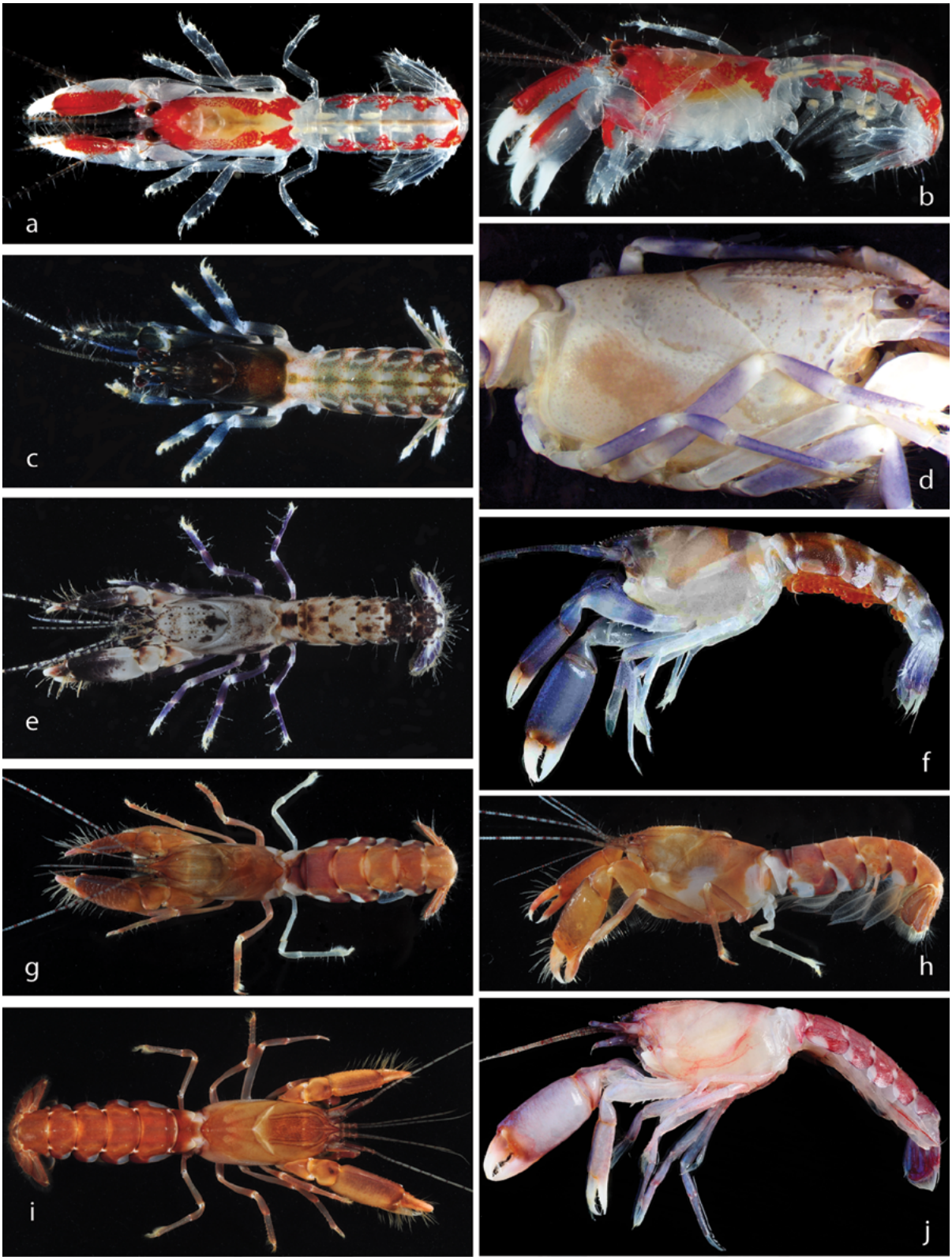

Figure 1. *Alienaxiopsis clypeata* (De Man, 1888): a, b, MNHN unregistered (stn PR86). *Allaxiopsis picteti* (Zehntner, 1894): c, MNHN IU-2013-1209. *Axiopsis pica* Kensley, 2003, MNHN IU-2013-7048: d, preserved; e, living. *Axiopsis serratifrons* A. Milne-Edwards, 1873: f, MNHN IU-2013-638; g, h, MNHN IU-2013-7052; i, MNHN IU-2013-7046; j, MNHN IU-2013-302. Photo credits: AA, a–c, e, g–j; TYC, f; GCBP, d.

Figure 2. *Parascytoleptus papua* Poore and Collins, 2010: a, MNHN IU-2014-2735; b, MNHN IU-2013-7128. *Paraxiopsis brocki* (De Man, 1888): c, MNHN IU-2013-7108; d, MNHN IU-2014-2736. *Ralumcaris bisquamosa* (De Man, 1905): e, MNHN IU-2013-7120. Photo credits: AA, b, c, e; TYC, a, d.

Man, 1905) was originally described as a variety of *A. picteti* from *Siboga* station 209 based on a 9.25 mm female and a smaller male. The variety was treated at the species level by Sakai and de Saint Laurent (1989) and has been rediscovered (see below). *Allaxiopsis bougainvillensis* Sakai, 2011 (type species of the genus) was described from much smaller specimens (4.5 mm and 4.9 mm) from Bougainville, Papua New Guinea and is treated here as a synonym of *A. spinimana*. Sakai included Kabaena I., Sulawesi, Indonesia, in the distribution of all three species and as type locality of the last two, contradicting the data provided with his type specimens. Each of the two species is diagnosed here with a minimal character suite.

Allaxiopsis picteti (Zehntner, 1894)

Figs 1c, 4

Paraxius picteti Zehntner, 1894: 196–199, pl. 9 fig. 25.
?*Axiopsis picteti*.—Borradaile, 1903: 539.

Axiopsis (*Axiopsis*) *picteti*.—De Man, 1925: 6, 70, 92–96, pl. 7 fig. 16.

Allaxius picteti .—Sakai and de Saint Laurent, 1989: 75.—Kensley, 2003: 361, pls 5, 6.

Allaxiopsis picteti.—Sakai, 2011: 39–40.

Material examined. Papua New Guinea. Madang Province. PAPUA NIUGINI stations. S of Urembo I., outer slope, 05° 15.9' S, 145° 47.1' E, 3 m (stn PB43), IU-2013-1209 (male, 8.3 mm). N of Bil Bil I., 05° 17.7' S, 145° 46.9' E, 5 m (stn PB51), IU-2013-7014 (male, 2.5 mm).

New Ireland Province, Kavieng lagoon, KAVIENG 2014 stations. S side of Patio I., 02° 36.2' S, 150° 31.6' E, 6–8 m (stn KB38), IU-2014-2526 (male, 6.8 mm). NW point of Nusa I., 02° 33.9' S, 150° 46.7' E, 8–10 m (stn KS3), IU-2014-2041 (female, 2.0 mm).

Australia. Western Australia, Kimberleys, Echuca Shoal, <23 m, 13° 53.781' S, 123° 53.686' E (Woodside Kimberley Survey stn 107/K12), WAM C50773 (female, 5.5 mm).

Type locality. Ambon, Indonesia.

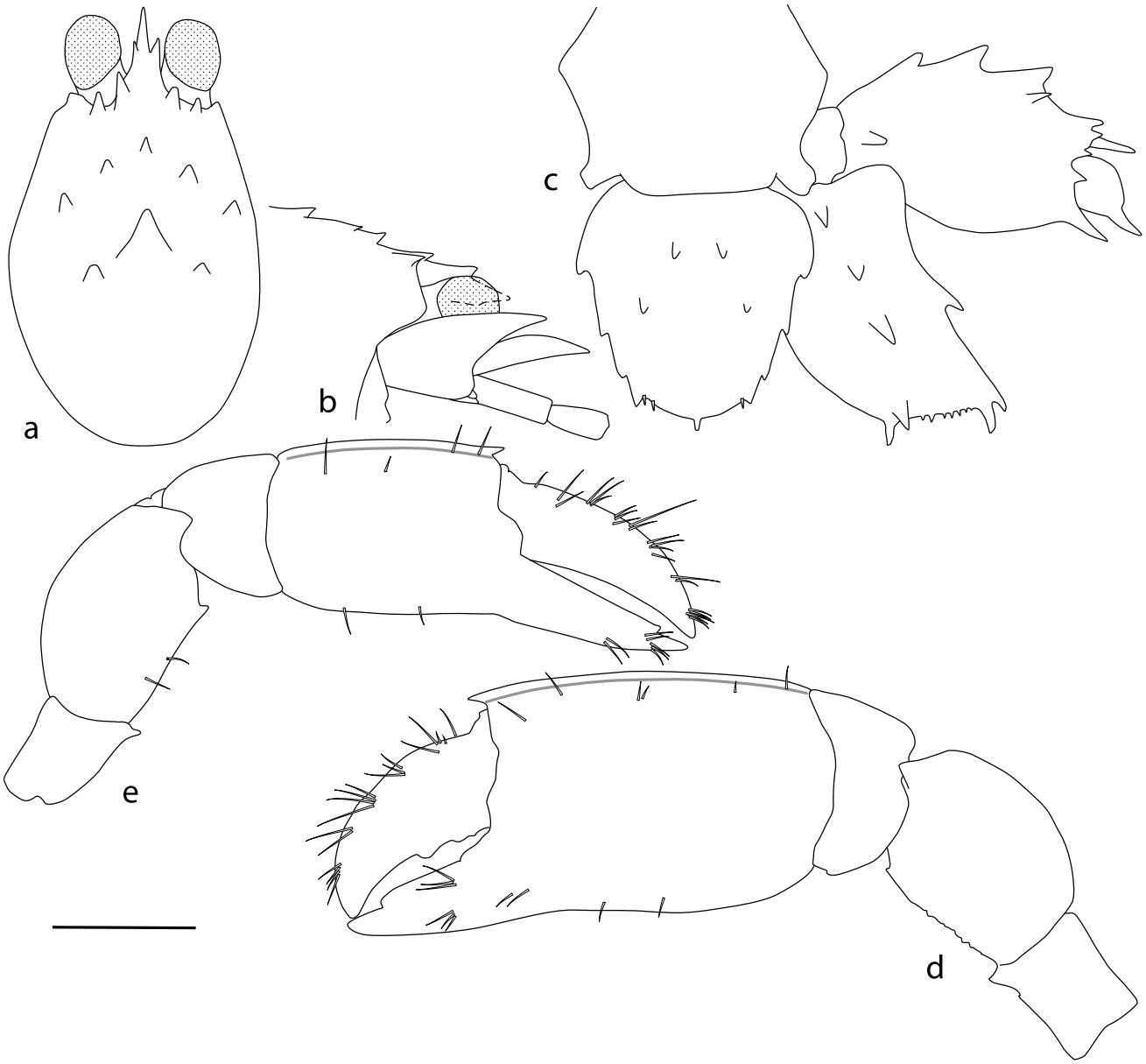

Figure 3. *Alienaxiopsis clypeata* (De Man, 1888), male, MNHN IU-2016-8134: a, b, anterior carapace, dorsal and lateral views; c, telson and uropod; d, major left cheliped; e, minor right cheliped. Scale bar = 1 mm.

Diagnosis. Major cheliped, propodus with blunt tubercles on lateral and mesial faces, more prominent nearer upper margin. Minor cheliped, propodus tuberculate on lateral and mesial faces.

Supplementary description. Rostrum acute, depressed, 0.3 length of rostral base–cervical groove, with pair of erect lateral spines near apex and larger pair at base. Gastric carina difficult to differentiate; median gastric carina obsolete except near base of rostrum, with sequence of 1, 1, 2, 2, 2 teeth; submedian gastric carina obsolete, with 1 tooth anteriorly and 2 or 3 teeth posteriorly; supraocular spine oblique, not marginal; lateral gastric carina with 2 or 3 blunt teeth. Eyestalk reaching beyond end of rostrum. Antenna article 2 with small distal spine; scaphocerite 4 times as long as greatest height (lateral view), reaching third length of article 4. Major cheliped coxa–carpus unarmed; propodus upper margin 1.4 times greatest height, carinate, with 5 spines, lateral face tuberculate proximally near upper margin; fixed finger 0.5 times length of upper margin of propodus, cutting edge with 2 blunt distal teeth; dactylus cutting edge with 3 low rounded teeth in proximal half. Minor cheliped coxa–carpus unarmed; propodus upper margin 1.5 times greatest height, carinate, with 2 distal spines, lateral face with few proximal tubercles; fixed finger almost as long as upper margin of propodus, with distal teeth near

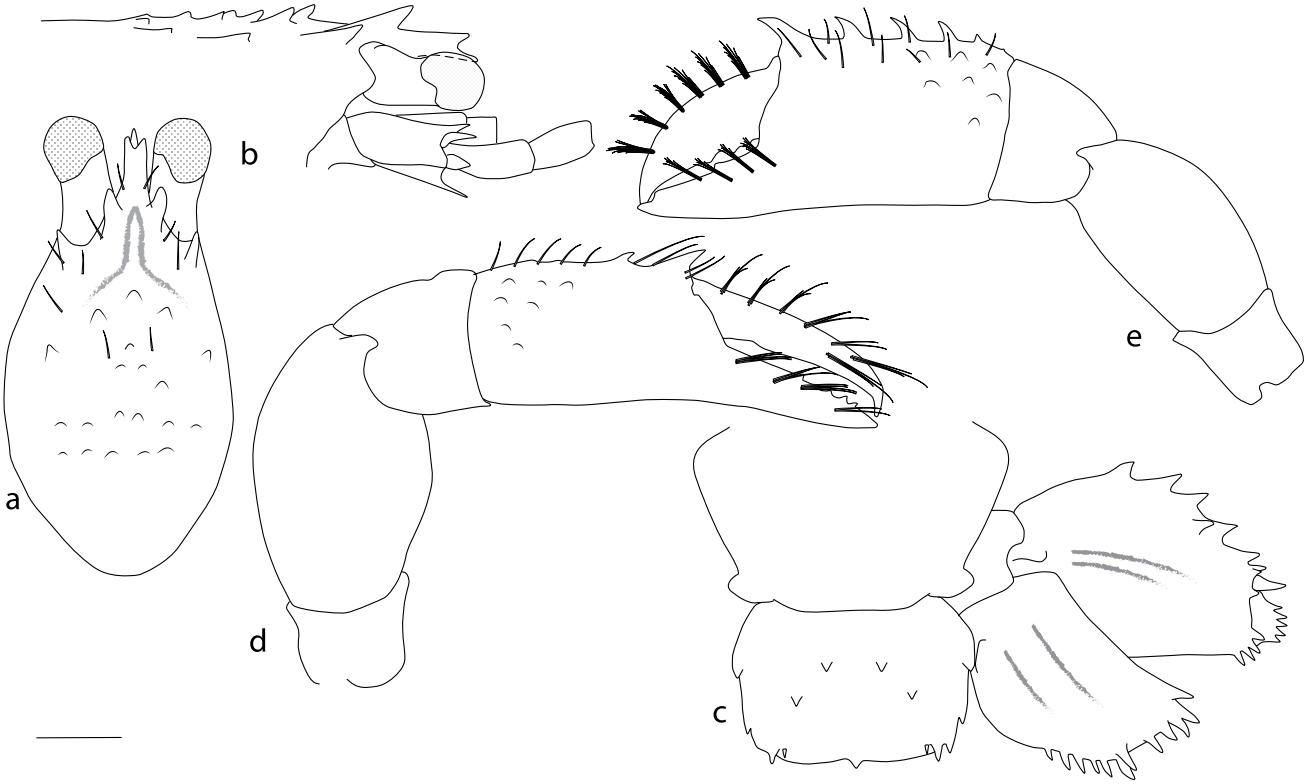

Figure 4. *Allaxiopsis picteti* (Zehntner, 1894), males, MNHN IU-2013-1209: a, b, anterior carapace, dorsal and lateral views; c, telson and uropod; d, minor right cheliped. MNHN IU-2013-2526: e, major left cheliped. Scale bar = 1 mm.

tip of cutting edge; dactylus cutting edge smooth. Telson 1.4 times as wide as long at level of most anterior lateral teeth; distal margin 0.8 times telson greatest width; lateral margin with 3 teeth; distal margin straight, with 1 lateral articulating robust seta, lateral fixed spine, with median spine; face with 2 pairs of spines. Uropodal endopod 1.6 times as long as wide; anterior margin strongly lobed proximally (as rounded shoulder), otherwise concave with or without spine at midpoint, with subdistal and distal spine; posterior margin convex, with 5 spines along distal third; distal margin straight, transverse, with depressed spine at anterior end, 2 marginal spines, 1 stronger spine and another superior, at posterior end; facial rib unarmed. Uropodal exopod semicircular, 1.5 times as long as wide; anterior margin of article 1 convex, with 5 or 6 marginal teeth, 1 submarginal; posterior margin straight, with 3 distal spines set obliquely; distal margin transverse, 3 marginal spines, strong articulating spine near anterior corner; article 2 with 5 teeth along distal margin.

Colour. Carapace high red-brown; pleon with patches of green-brown and scattered red chromatophores; antennal flagellum with alternating white and brown stripes; cheliped high blue; pereopods with transverse blue bands on major articles, otherwise white.

Distribution. Indonesia: Ambon (type locality), Kabaena I., Sulawesi (De Man, 1925); Guam; Marshall Islands; Fiji (Kensley, 2003); Papua New Guinea: Madang, Bougainville, New Ireland; Australia, N Western Australia; 3–20 m depth.

Remarks. Kensley (2003) reported on material from Guam and included a photograph with colours similar to the one here. Kensley also reported on unpublished records of the species from Papua New Guinea, Fiji and the Marshall Islands identified by him (see USNM online database http://collections.nmnh.si.edu/search/iz/). Kensley's record of the species from Malaysia is not on the database. The carapace, tail fan and the never-before-illustrated chelipeds are figured here.

Allaxiopsis spinimana (De Man, 1905)

Fig. 5

Axiopsis Picteti var. *spinimana* De Man, 1905: 597.

Axiopsis (*Axiopsis*) *Picteti* var. *spinimana*.—De Man, 1925: 6, 70, 96, pl. 7 fig. 17.

Allaxius spinimanus.—Sakai and de Saint Laurent, 1989: 75.

Allaxiopsis spinimana.—Sakai, 2011: 40.

Allaxiopsis bougainvillensis Sakai, 2011: 37–39, fig. 3. **Syn. nov.**

Material examined. Papua New Guinea. Bougainville, Teop I., 05° 34.3' S, 155° 4.7' E, (as 'Tiop Bougainville, German New Guinea', H. Schoede, ZMB 14440 (holotype female, 4.9 mm; paratype female, 4.5 mm of *Allaxiopsis bougainvillensis* Sakai, 2011) (both photographed by C.O. Coleman).

Madang Province, Channel between Pik I. and Kranket I., 05° 09.6' S, 145° 49.7' E, 3–8 m, coll. R. Hanley, NMV J67992 (2 ovigerous females, 7.5, 7.8 mm; 3 males, 3.2–5.0 mm; part of larger collection, NTMAG Cr.0100212).

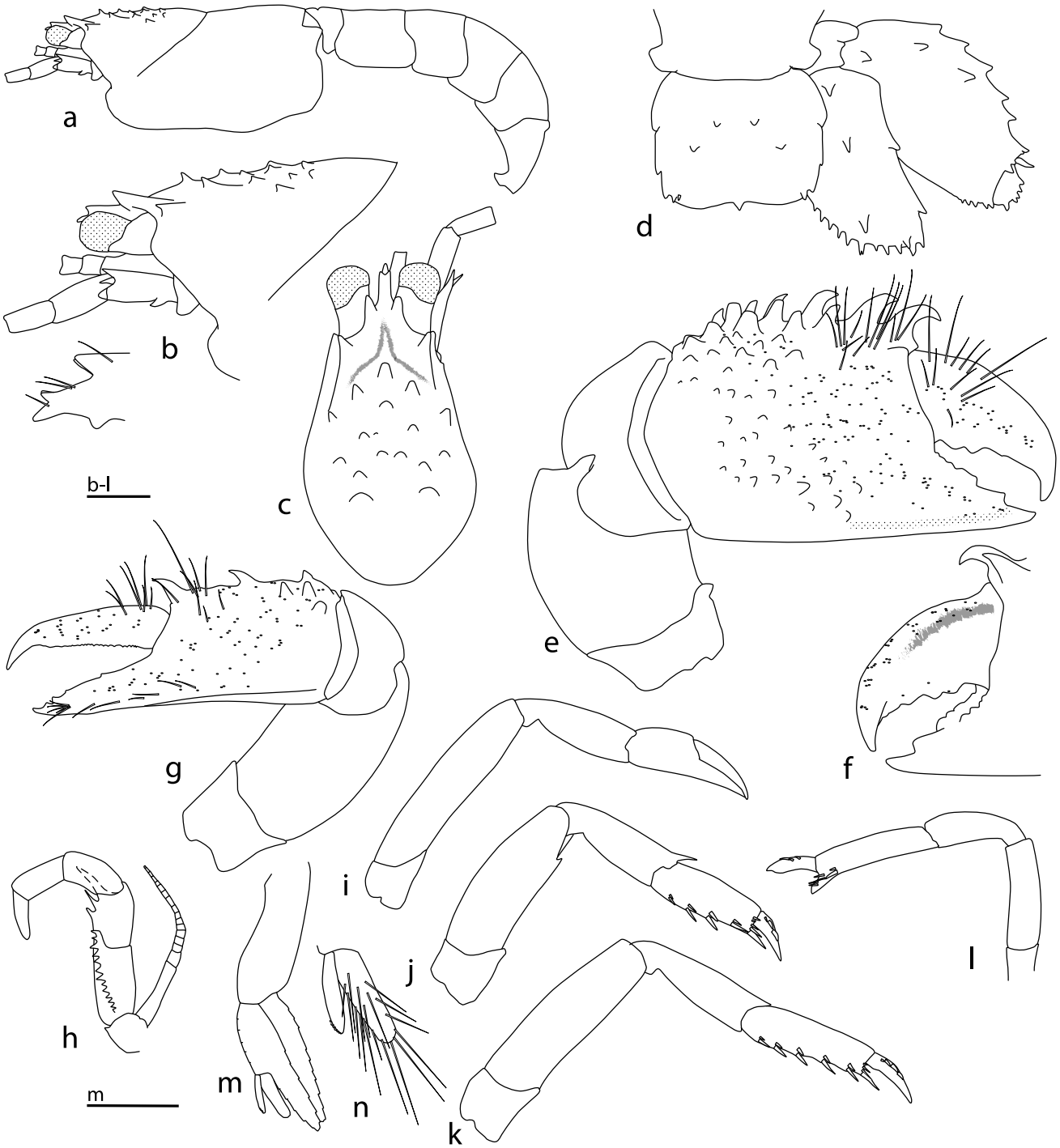

Figure 5. *Allaxiopsis spinimana* (De Man, 1905) male, NMV J67992: a, habitus; b, c, anterior carapace, dorsal and lateral views, with detail of rostrum; d, telson and uropod; e, major right cheliped, lateral; f, major right cheliped, fingers, mesial; g, minor left cheliped; h, maxilliped 3; i–l, pereopods 2–5; m, n, pleopod 2, with details of appendices interna and masculina. Scale bars = 1 mm. Bases of many setae indicated by small ovals.

Type locality. Indonesia, off south point of Kabaena I., 22 m (*Siboga* stn 209).

Diagnosis. Major cheliped, propodus with blunt tubercles on proximal lateral face, more prominent nearer upper margin becoming spine-like and more hooked towards distal upper margin. Minor cheliped, propodus with few tubercles on proximal lateral face, upper margin with 3 spines.

Supplementary description. Rostrum acute, depressed, 0.3 length of rostral base–cervical groove, with pair of erect lateral spines near apex, larger pair at midpoint, and ventral tubercle. Gastric carina difficult to differentiate; median gastric carina obsolete except near base of rostrum, with sequence of 1, 1, 2 teeth; submedian gastric carina obsolete, with 1 tooth anteriorly and 2 or 3 teeth posteriorly; supraocular spine oblique, not marginal; lateral gastric carina, with 2 blunt teeth. Eyestalk reaching beyond end of rostrum. Antenna article 2 with small distal spine; scaphocerite 4 times as long as greatest height (lateral view), reaching sixth length of article 4. Major cheliped ischium, merus and carpus each smooth on lower margin; propodus swollen, lateral face tuberculate over proximal half, tubercles larger closer to upper margin, upper margin about equal to greatest height, with 2 rows each of 6 spines, the larger ones sharper and more hooked distally; fixed finger 0.45 times length of upper margin of propodus, with 2 blunt distal teeth along cutting edge, with short tuberculate mesial ridge; dactylus 2.1 times as long as wide, with lateral carina near upper margin, cutting edge with 2 low rounded teeth in proximal half. Minor cheliped as long as major cheliped, propodus about 0.5 times as high as on major cheliped; ischium and merus smooth on lower margin; propodus swollen, propodus upper margin 1.5 times greatest height, lateral face with 3 tubercles on proximal lateral face, upper margin with 3 teeth, second and third sharp; fixed finger almost as long as upper margin of propodus, with 2 distal teeth on cutting edge; dactylus 4 times as long as wide, cutting edge smooth. Telson 1.4 times as wide as long at level of most anterior lateral teeth; distal margin 0.8 times telson greatest width; lateral margin with 3 teeth; distal margin excavate, with 1 lateral articulating robust seta, lateral fixed spine, with median spine; face with 2 pairs of spines. Male pleopod 2 appendix masculina 1,3 times as long as appendix interna, stiff setae on posterior face. Uropodal endopod 1.8 times as long as wide; anterior margin strong lobed proximally (as rounded shoulder), otherwise concave with spine at midpoint, with subdistal and distal spine; posterior distal margin curved, with 10 spines, the most distal 2 submarginal, anterodistal angle marked by 2 spines; facial rib with 3 spines. Uropodal exopod semicircular, 1.8 times as long as wide; anterior margin of article 1 convex, with 6 marginal teeth; posterior margin straight, with 5 distal spines set obliquely; distal margin transverse, 2 marginal spines, strong articulating spine near anterior corner, facial rib with 3 spines; article 2 with 5 teeth along distal margin.

Colour. Traces of purple on pereopod 1 propodus and dactylus on preserved material. De Man (1925) described the colour as being similar to *A. picteti* but more violet in parts. Juveniles and adults of *A. picteti* appear to differ so this species may also differ.

Distribution. Indonesia, S Sulawesi; Papua New Guinea, Central Province, Bougainville; shallow heights.

Remarks. De Man (1905) based *Axiopsis picteti* var. *spinimana* on two syntypes from the 'Anchorage off the south point of Kabaena-island', Indonesia (*Siboga* stn 209), the same locality at which he also recorded *A. picteti*. De Man (1925) described his two syntypes in moderate detail but illustrated only the distinctive cheliped.

Allaxiopsis bougainvillensis Sakai, 2011, is based on two female specimens (ZMB 14440) from Papua New Guinea, which Sakai referred to as the holotype with both chelipeds ('lectotype' in fig. 3 caption) and a paratype without chelipeds. They are correctly identified on the ZMB label as '*Axiopsis* (*Axiopsis*) *picteti* var. *spinimana* De Man, 1905', possibly by H. Schoede. In describing his new taxon, Sakai (2011) correctly stated that these specimens are not types but used this observation to justify a new species without stating how it differed from *A.* (*A.*) *picteti spinimana*. He did not illustrate or describe the distinctive spinose chelipeds of the holotype (photographs of which were provided to me by C.O. Coleman), which are clearly identical to those in De Man's (1925) figure of *A. spinimana* and to those figured here from other material. The supposed differences in gastric sculpture between *A. bougainvillensis* and *A. picteti* are small and not relevant.

The type locality of *A. bougainvillensis* was given by Sakai (2011) as 'Triop Bougainville, German New Guinea', a mistranscription of Tiop written on the label, which is now spelled Teop.

The species shares the trifid rostrum, regular pattern of blunt gastric spines, short scaphocerite, broad telson, uropodal endopod with shouldered anterior margin, and spinose uropodal rami with *A. picteti*. The most significant difference is the presence of chelipeds with spinose palms, the distal spines on the upper margin of the palm having a characteristic hooked form, characters that formed the basis of the identification of the Papua New Guinea specimens. Most of the characters of Sakai's (2011) diagnosis of this species are of generic value only.

Axiopsis Borradaile, 1903

Axiopsis pica Kensley, 2003

Figure 1d, e

Axiopsis pica Kensley, 2003: 363, figs 1, 2, pl. 1.—Ngoc-Ho, 2005: 51–55, fig. 2.

Axiopsis serratifrons.—Sakai, 2011: 56–63 (part).

Material examined. Papua New Guinea. Madang Province, PAPUA NIUGINI stations. Kranket I., outer slope, 05° 11.3' S, 145° 49.5' E, 1–24 m (stn PR129), IU-2013-7048 (female, 14.4 mm).

Mariana Islands. Guam Island, Apra Harbour, Middle Shoal, among coral rubble and rocks, 1 m, IU-2016-8007 (UF 2782), (1 ovigerous female, 16 mm); near Harbour entrance, among rocks, 8–12 m, IU-2016-8008 (UF 3021) (female, 13.5 mm).

Distribution. Guam (type locality), Papua New Guinea, French Polynesia; to 24 m depth.

Remarks. The single female from Papua New Guinea was first identified by its striking colour pattern, similar to that published

by Kensley (2003: pl. 1). Kensley (2003) noted that, as well as a distinctive colour, *Axiopsis pica* has 'a broader and more robust larger cheliped of pereopod 1 bearing flattened scale-like tubercles' than *A. serratifrons* with which it co-occurred. The upper margin of the propodus of the holotype and of the Papua New Guinea female is 1.5 times its greatest height. Kensley (2003) also compared his new species with material identified as *A. serratifrons* from Hawaii which has more slender chelipeds.

Ngoc-Ho (2005) compared specimens that she identified as *A. pica* from French Polynesia with a syntype of *A. serratifrons* also from Hawaii. The major cheliped of this syntype is twice as long as wide and smooth. Following Sakai's (2011) selection of the other syntype from Tonga as the lectotype (see below), comparison with Hawaiian specimens may be irrelevant.

Axiopsis pica co-occurs with *A. serratifrons* in both French Polynesia and Papua New Guinea. The major cheliped of the largest specimen is similarly proportioned, 1.5 times as long as wide, as of similarly-sized *A. serratifrons*. The most reliable morphological distinction between the two species can be found in the carapace. The carapace and pleon of *A. serratifrons* is smooth and flexible, with few scattered long setae, while that of *A. pica* is sclerotised, almost calcified and pitted with short stiff setae associated with the pits (Fig. 1d).

Axiopsis serratifrons (A. Milne-Edwards, 1873)

Figs 1f–i, 6a

Axia serratifrons A. Milne-Edwards, 1873: 263, pl. 13 figs 6, 6a.

Axiopsis serratifrons.—Sendler, 1923: 44, pl. 21 fig. 10.—Sakai and de Saint Laurent, 1989: 76.—Sakai, 2011: 56–63, fig. 9 (extended synonymy).

Material examined. Paralectotype. Hawaii, IU-2016-8115 (Th147) (male, 10 mm).

Papua New Guinea. Madang Province, PAPUA NIUGINI stations. Kranket I., outer slope, 05° 12.1' S, 145° 49.3' E, 17 m (stn PB02), IU-2013-302 (female, 9.3 mm); 05° 11.3' S, 145° 49.5' E, 1–11 m (stn PR225), IU-2013-7051 (male, 22 mm), NMV J71638 (ovigerous female, 22 mm); 05° 12' S, 145° 49' E, 10 m (stn PR99), IU-2013-7033 (ovigerous female, 9.5 mm). Rempi Area, S of Barag I., 05° 01.3' S, 145° 47.9' E, 2–13 m (stn PR61), IU-2013-638 (ovigerous female, 9.3 mm); S of lagoon inside bay, 05° 01.6' S, 145° 48.1' E, 2–15 m (stn PR69), IU-2013-7116 (male, 4.3 mm); outer slope, 05° 01.6' S, 145° 48.1' E (stn PR65), IU-2013-637 (male, 11.5 mm). Alexishafen, 05° 05.3' S, 145° 48.1' E, 1–6 m (stn PD31, IU-2013-7019 (male, 6.3 mm). W of Panab I., 05° 10.3' S, 145° 48.5' E, 1–18 m (stn PR147), IU-2013-7052 (female, 15.8 mm). Riwo waters, 3–15 m (stn PR109), IU-2013-7061 (male, 11.9 mm). S of Yabob I., 05° 15.5' S, 145° 47.3' E, 2–6 m (stn PD66), IU-2013-7098 (male, 5.8 mm). Ulimal I., 05° 05.6' S, 145° 48.7' E, 6 m (stn PS16), IU-2013-15308 (male, 10.0 mm).

New Ireland Province, Kavieng region, KAVIENG 2014 stations. Edmago I., 02° 36.9' S, 150° 44.4' E, 9 m (KZ2), IU-2014-826 (male, 8.6 mm); IU-2014-2685 (male, 9.3 mm). New Ireland mainland near N Cape, 02° 33.3' S, 150° 47.7' E, 1–20 m (stn KZ18), IU-2016-1011 (female, 12.5 mm). W side of Edmago I., 02° 37.1' S, 150° 44.2' E, 5–6 m (stn KZ20), NMV J71639 (ovigerous female, 10.5 mm). E side of Ral I., 02° 36.7' S, 150° 42.6' E, 3–10 m (stn KZ22), IU-2014-1090 (female, 10.6 mm). Byron Channel, SE Patio I., 02° 36.6' S, 150° 32.9' E, 2–7 m (stn KB40), IU-2014-2577 (ovigerous female, 10.9 mm). NE of Big Nusa I., entrance to Kavieng Harbour, 02° 33.7' S, 150° 49.1' E, 10 m (stn KZ11), IU-2014-2625 (ovigerous female, 10.6 mm). Mouth of Albatross Passage, E side, 02° 35.2' S, 150° 43.1' E, 13 m (KB72), IU-2016-8136 (juv., 5.0 mm). Between Big Nusa and Little Nusa Islands, 02° 34.6' S, 150° 46.3' E, 13-14 m (KB16), IU-2014-17688 (female, 6.9 mm). Eickstedt Passage W of Usien I., 02° 40.3' S, 150° 39.1' E, 9–11 m (KR70), IU-2014-17691 (male, 13.6 mm). Albatross Passage, 02° 44.6' S, 150° 42.8' E, 12–15 m (KD12), IU-2014-17692 (juv., 3.6 mm).

Colour. Variable. Generally reddish-orange, stronger colour on gastric carina; pleonal pleura with white patch anteroventrally; chelipeds similar or steel-blue, colour stronger at base of fingers (see figs 1f–i and Kensley [1981]).

Distribution. Widespread in the Indo West-Pacific, eastern Pacific (Hendrickx, 2008), south-west Atlantic (Sakai, 2011, 2015) and south-east Atlantic (Wirtz, 2009); subtidal.

Remarks. Of the two syntypic specimens from Samoa and Hawaii recorded by A. Milne-Edwards (1873), Sakai (2011) selected that from Samoa as the lectotype, not the one from Hawaii erroneously applied to the 'type locality' by Kensley (2003) and called 'holotype' by Ngoc-Ho (2005). This confusion was discussed by Komai and Tachikawa (2008). Sakai's (2011: figs 8A, B, 9) illustrations of the Samoan lectotype (ZMB K8405: checked for me by A. Brandt) are indistinguishable from Ngoc-Ho's (2005: fig. 3) of the Hawaiian paralectotype (MNHN IU-2016-8115 [Th147]). Sakai's (2011: fig. 8C) illustration of the Hawaiian paralectotype differs from both in appearing to have larger rostral teeth, the rostrum less evenly tapering, more teeth on the median carina (shown by my re-examination to have two on the rostrum, c. 15 on gastric region; fig. 6a), almost no spines on the lateral gastric carina (actually 13, 15), and fewer intermediate gastric tubercles (actually c. 20). The cheliped of the paralectotype lacks tuberculation on the propodal faces and the spine on the upper border of the merus, but these absences are common in juveniles of this size.

In an extensive synonymy, Sakai (2011) synonymised four species with *A. serratifrons*. The synonymy of *Axius affinis* De Man, 1888 (type locality, Ambon, Indonesia), *Axiopsis sculptimana* Ward, 1942 (type locality, Diego Garcia, Chagos Archipelago) and *Axiopsis brasiliensis* Coelho and Ramos-Porto, 1991, has not been disputed although a species with such a wide distribution suggests further examination is warranted as Komai and Tachikawa (2008) suspected. Kensley (1981) discussed the species in the Americas but his synonymy was limited. Ngoc-Ho (2005) recognised *A. pica* Kensley, 2003 (type locality, Guam), the fourth species synonymised by Sakai (2011), following a detailed justification and recorded it from French Polynesia. This synonymy is not recognised here (see *A. pica* above for discussion of differences).

Sakai's (2011) key to species of *Axiopsis* relied on the presence of a tooth on the upper margin of the merus and a smooth propodus of the cheliped to distinguish *A. consobrina* from *A. serratifrons* (without a tooth, with squamose propodus). Many smaller individuals, including ovigerous females, identifiable as *A. serratifrons* based on colour resemble *A. consobrina* De Man, 1905 in these features. De

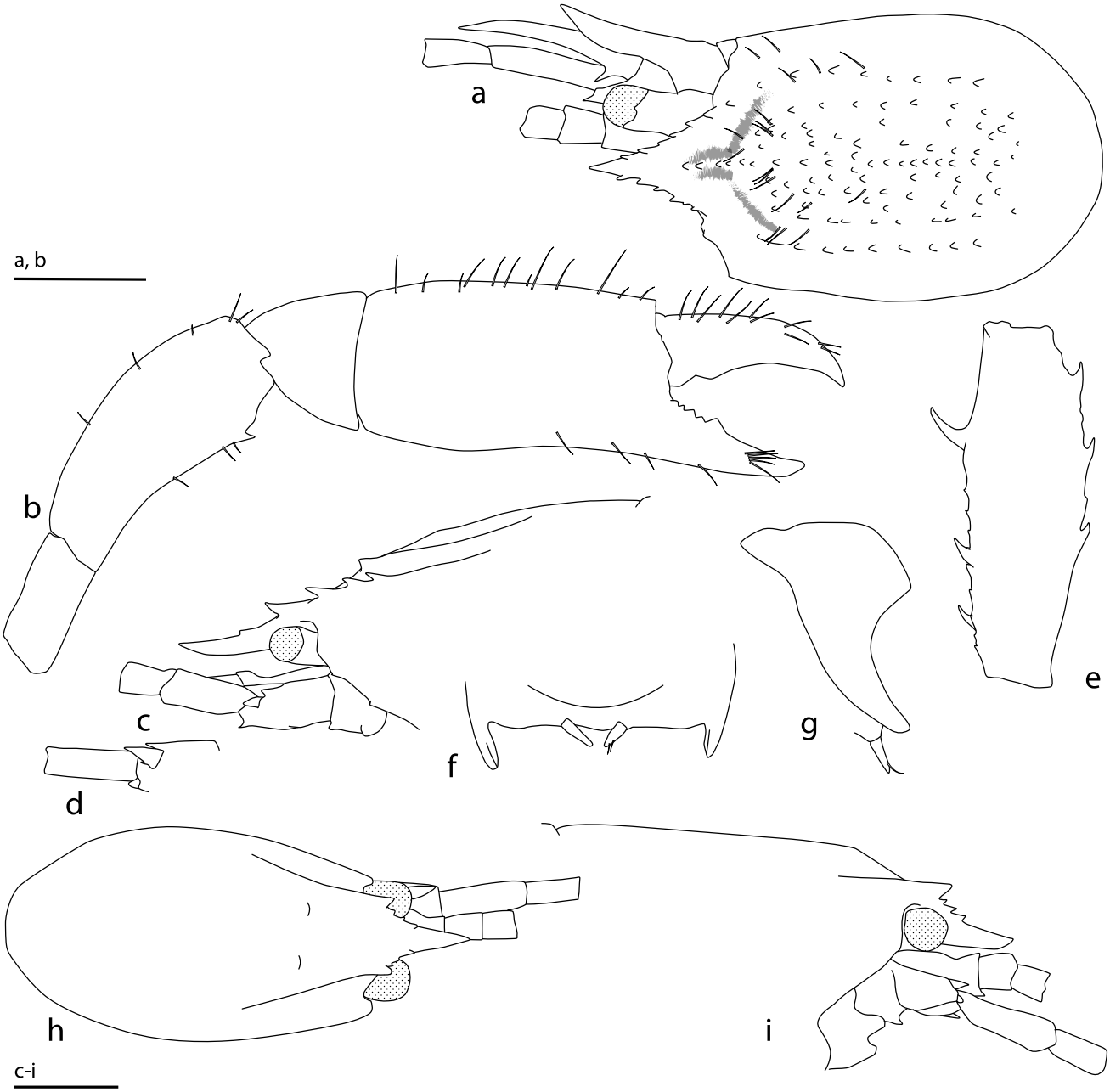

Figure 6. *Axiopsis serratifrons* A. Milne-Edwards, 1873: a, male, MNHN IU-2013-637, anterior carapace, dorsal view. *Parascytoleptus papua* Poore and Collins, 2010, male, MNHN IU-2013-7128: b, major right cheliped. *Paraxiopsis brocki* (De Man, 1888), male, MNHN IU-2013-7108: c, anterior carapace, lateral view; d, antenna with scaphocerite; e, cheliped, merus; male, MNHN IU-2014-2736; f, g, pleopods 1, ventral and lateral views. *Ralumcaris bisquamosa* (De Man, 1905), male, MNHN IU-2013-7120: h, i, anterior carapace, dorsal and lateral views. Scale bars = 1 mm.

Man (1905) distinguished *A. consobrina* on the absence of intermediate gastric teeth between the carinae and the palm of the smaller cheliped as long as the fingers but this is true only for the type. *Axiopsis consobrina* occurs usually from 75 m to a maximum of 310 m depth (Sakai, 2011; Vaitheeswaran, 2014) but Ngoc-Ho (2005) recorded one individual from 2.5 m depth. *Axiopsis serratifrons* is more immediately subtidal.

Parascytoleptus Sakai and de Saint Laurent, 1989

Parascytoleptus papua Poore and Collins, 2010

Figs 2a, b, 6b

Parascytoleptus papua Poore and Collins, 2010: 614–618, figs 1, 2.

Material examined. Papua New Guinea. Madang Province, PAPUA NIUGINI stations. N of Riwo mangrove and seagrass, 05°08.7'S,

145°48.2'E, 2 m (stn PB48), IU-2013-7100 (male, 2.6 mm). N of Sek I., inner slope, 05°04.7'S, 145°48.9'E, 3 m (stn PB50), NMV J71642 (2 males, 2.8, 3.1 mm).

New Ireland Province, Kavieng region, KAVIENG 2014 station. NW side of Ral I., coral wall, 19 m, 02° 36.4' S, 150° 42.4' E (stn KB62), IU-2014-2735 (female, 3.0 mm); IU-2014-17694 (male, 3.6 mm).

Distribution. Papua New Guinea, Madang and New Ireland provinces; 2–19 m depth.

Remarks. The types were collected not far from the new material. The major cheliped of the adult male figured here is longer and more elongate than that of the female figured by Poore and Collins (2010). Sakai (2011) diagnosed the genus with the male pleopod 1 'a small unsegmented protrusion' based on its presence on two males of 4.2 mm and 5.3 mm length. This has not been observed on the holotype of *P. papua* (4.2 mm) or the smaller males reported here. The pleopod 1 may appear only in larger specimens.

Paraxiopsis De Man, 1905

Remarks. Two of the 16 known species were found in Papua New Guinea and are diagnosed here with a minimal character suite.

Paraxiopsis austrinus **(Sakai, 1994)**

Eutrichocheles austrinus Sakai, 1994: 185, figs. 6, 7.—Sakai 2011: 111.

Paraxiopsis austrinus.—Kensley 2003, 373.—Poore and Collins 2009: 266, fig. 29.

Material examined. Papua New Guinea. New Ireland Province, Kavieng region, KAVIENG 2014 stations. Mouth of Albatross Passage, E side, 02° 35.2' S, 150° 43.1' E, 13 m (stn KB72), IU-2014-1046 (male, 6.1 mm). S coast of Baudison I., 02° 45.2' S, 150° 41.7' E, 22–27 m (stn KB68), IU-2014-1153 (male, 7.6 mm; ovigerous female, 6.3 mm). E of Albatross Passage, 02° 45.2' S, 150° 43.4' E, 13–17 m (stn KB24), IU-2014-2364 (male, 9.0 mm).

Diagnosis. Carapace smooth, with tomentum of short and longer setae. Rostrum with 0–3 small lateral teeth; lateral gastric carina with supraorbital spine plus 2 teeth; submedian gastric carina with 6–8 teeth; median gastric carina without spines. Telson with 3 or 4 pairs of dorsal spines. Cheliped merus with 2 spines on upper margin, palm unornamented. Male pleopod 1 absent in small specimens, single article in adults.

Distribution. Northern Australia; New Ireland Province, Papua New Guinea; to 27 m depth.

Remarks. The new material extends the range of this species from Darwin, northern Australia, to Papua New Guinea. The species differs from the original description only in having no rostral spines (three small spines in Australian specimens) and in having one (rather than two) post-supraocular spine on the lateral gastric carina. All of the males lack pleopod 1 but possess a minute tubercle in its place. Kensley (2003) and Poore and Collins (2009) justified the generic placement of this species.

Paraxiopsis brocki **(De Man, 1888)**

Figs 2c, d, 6c–g

Axius brocki De Man, 1888: 475, pl. 20 fig. 3.

Axiopsis (*Paraxiopsis*) *brocki*.—De Man, 1905: 597.—Tirmizi, 1983: 88–90, fig. 3.

Eutrichocheles brocki.—Sakai and de Saint Laurent ,1989: 52, fig. 4B.—Ngoc-Ho, 1998: 365–368, fig. 1.

Paraxiopsis brocki.—Kensley, 1996.—Poore and Collins, 2009: 266.—Sakai, 2011: 158–161, fig. 27C (full synonymy).

Material examined. Papua New Guinea. Madang Province, PAPUA NIUGINI stations. W of Panab I., 05° 10.3' S, 145° 48.5' E, 1–18 m (stn PR147), IU-2013-7108 (male, 6.8 mm). Riwo, mangrove, 05° 09' S, 145° 48.2' E, 1–2 m (stn PR235), IU-2013-7118 (ovigerous female, 5.5 mm). Kranket I., Cape Jantzen, 05° 12.5' S, 145° 49.1' E, 13 m (stn PB11), IU-2013-7126 (male, 3.1 mm).

New Ireland Province, Kavieng region, KAVIENG 2014 stations. S coast of Baudison I., 02° 45.2' S, 150° 41.7' E, 22–27 m (stn KB68), IU-2014-990 (female, 5.5 mm); IU-2014-1032 (female, 5.9 mm). NW point of Nusa I., 02° 33.9' S, 150° 46.7' E, 15–17 m (stn KB04), IU-2014-2054 (juvenile, 3.1 mm). Marthas Shoal, sand and coarse rubble in gutter, 20 m, 02° 32.5' S, 150° 35.3' E (stn KB60), NMV J71640 (male, 7.5 mm; 2 ovigerous females, 6.8 mm); IU-2014-2736 (male, 6.8 mm). NW point of Nubis I., 02° 37.2' S, 150° 31.8' E, 20 m (stn KB39), IU-2014-17693 (juvenile, damaged).

Indonesia. Maluku Province, Pulau Wuliaru, 7° 27' S, 131° 3.7' E, IU-2014-12081 (female, 9.5 mm).

Diagnosis. Carapace smooth, without tomentum of setae. Rostrum with 4–6 lateral teeth; lateral gastric carina with supraorbital spine plus 2 teeth; submedian gastric carina with 1 or 2 teeth; median gastric carina without spines. Telson with 3 or 4 pairs of dorsal spines. Cheliped merus with 1–3 spines on upper margin, palm unornamented. Male pleopod 1 absent in small specimens, single article in adults.

Distribution. Widespread in the Indo West-Pacific, from eastern Africa, Western Australia, northern Australia, to southern Japan and French Polynesia; to 91 m depth (Sakai, 2011).

Remarks. The new material contributes little to knowledge of this widespread and frequently taken species. The species was well illustrated by Ngoc-Ho (1998). Sakai (2011: fig. 27C) figured a simple male pleopod 1 on a male from Darwin, Australia; pleopod 1 is absent in the smallest male and minute in the larger ones from this collection. Most of the specimens at hand have a minute anterior tooth on pleonal pleura 2–5. Sakai (2011) himself discussed variation in this character and in the presence or absence of the male pleopod 1 after presenting an extensive diagnosis.

Ralumcaris **Sakai, 2011**

Ralumcaris Sakai, 2011: 182–183.

Ralumcaris bisquamosa **(De Man, 1905)**

Figs 2e, 6h, i

Axiopsis (*Paraxiopsis*) *bisquamosa* De Man, 1905: 597.—De Man, 1925: 7, 72, 109, pl. 8 fig. 20–20c, pl. 9 fig. 20d–m.—Holthuis, 1953: 51.

Eutrichocheles bisquamosa.—Sakai and de Saint Laurent, 1989: 53, fig. 15.—Kensley, 1994: 822.

Paraxiopsis bisquamosa.—Kensley, 1996: 711, 712.—Kensley, 2003: 372, table 2.

Ralumcaris bisquamosa.—Sakai, 2011: 183–185, figs 33, 34.

Material examined. Papua New Guinea. Madang Province, PAPUA NIUGINI stations. Rempi Area, W of Barag I., 05° 01.2' S, 145° 47.9' E, 5–10 m (stn PD45), IU-2013-7130 (male, 2.6 mm). N of Kranket I., 05° 11.3' S, 145° 49.6' E, 5 m (stn PB47), IU-2013-7037 (ovigerous female, 3.6 mm). Cape Barschtch, 05° 03.9' S, 145° 48.8' E, 12 m (stn PB27), IU-2013-7119 (male, 3.2 mm). Tab I., inner slope, 05° 10.1' S, 145° 50.2' E, 1–4 m (stn PR162), IU-2013-7120 (male, 4.1 mm).

New Ireland Province, Kavieng region, KAVIENG 2014 stations. Steffen Strait, W side of Wadei I., 02° 39.5' S, 150° 37.7' E, 15 m (stn KS31), IU-2014-2451 (juvenile damaged), IU-2016-8135 (juvenile, 2.9 mm). W side of Tsoilaunung I., 02° 32.8' S, 150° 30.8' E, 6 m stn KB48), IU-2014-2619 (ovigerous female, 5.9 mm). Tab I., N.L. Bruce, 05° 10' S, 145° 51' E, NMV J34090 (ovigerous female, 4.2 mm).

Distribution. Indonesia, Papua New Guinea, Mariana Is; 1–36 m depth.

Remarks. Kensley (1996) pointed out the differences between *Paraxiopsis bisquamosa* and the remaining species of this genus and excluded the species from *Paraxiopsis* as redefined by him. Sakai (2011) described and figured De Man's holotype (ZMA Crust. De. 102.674) but labelled it as 'lectotype'.

Micheleidae Sakai, 1992

***Michelea* Kensley & Heard, 1991**

***Michelea papua* sp. nov.**

http://zoobank.org/urn:lsid:zoobank.org:act:37FAF4C1-2B8E-44AA-B357-783EDE48B9FD

Figure 7

Material examined. Holotype. Papua New Guinea. New Ireland Province, N of Kobotteron I., 02° 36.4' S, 150° 42.4' E, 2–3 m, reef wall and rubble, (KAVIENG 2014 stn KB62), IU-2013-2781 (male, 3.2 mm).

Diagnosis. Gills fully developed. Pleopods 2, 3, 5 with 18/6, 18/8 and 25/13 marginal lamellae on endopods/exopods, respectively (pleopod 4 unknown). Telson tapering to rounded apex, length 1.15 width. Maxilliped 3 ischium with obsolete crista dentata; merus with mesial tooth.

Description. Cephalothorax 0.4 total length, about 1.65 times as long as greatest height; rostrum triangular, about half as long as basal width, slightly depressed distally, about 0.4 as long as eyestalks; cervical groove weakly defined, reaching 0.6 length of cephalothorax; longitudinal setal-row level with lateral margin of eyestalk, of 5 setae; vertical setal-row of 5 setae below horizontal row and 2 setae near cervical groove.

Pleomere 1 with dorsolateral longitudinal setal-row of 10 setae. Pleomeres 2–6 each with transverse setal-rows of 6–7 setae near midpoint; all somites also with groups of long simple setae, none with marginal setal-rows.

Antennule with elongate waisted article 1, 0.6 length of cephalothorax; articles 2 and 3 subequal, each about 0.25 length of article 1; flagella with 11 and 9 articles, longer than peduncle. Antenna with distinct articulating scaphocerite, about half length of article 2; article 4 reaching to middle of article 3 of antennule; article 5 short; flagellum missing.

Mandible, maxillules, maxillae, maxillipeds 1 and 2 typical of genus. Maxilliped 3 ischium with obsolete crista dentata; merus with strong mesial tooth on right of pair only (absent on left); exopod 1.6 times ischium length.

Chelipeds equal; ischium with weak lower tooth; merus with weak tooth on slightly convex lower margin, upper margin more convex proximally than distally, 1.8 times as long as high; carpus unarmed; propodus almost cylindrical, 3.6 times as long as high; fixed finger 0.35 total length of propodus, its cutting edge with long obsoletely bicuspid tooth at midpoint; dactylus cutting edge straight, curved distally, equal to fixed finger.

Pereopod 2 unknown. Pereopod 3 propodus 2.5 times as long as wide, with 2 spiniform setae on distal-upper mesial face, 6 on distal-lower face; and 2 transverse setal-rows of 1 and 2 setae; dactylus with 2 spiniform setae on upper margin. Pereopod 4 propodus 3.8 times as long as wide, with 7 spiniform setae on upper margin, 5 on lower margin; with 2 transverse setal-rows each of 2 setae; dactylus with 5 spiniform setae on upper-mesial margin. Pereopod 5 subchelate; fixed finger with 4 distal spiniform setae; dactylus without spiniform setae.

Pleopod 1 of male lobed mesially, expanded distally, with c. 8 minute hooks, setose around midpoint and laterally, and with 5 simple seta laterally. Pleopod 2 with appendix interna sac-like, 2.5 times as long as wide; appendix masculina narrow, about third long as endopod; with 18 lamellae on lateral margin of endopod, 6 on distolateral margin of exopod. Pleopod 3 with 18 lamellae on lateral and distomesial margin of endopod, 8 on lateral margin of exopod; pleopod 4 unknown; pleopod 5 with 25 lamellae on endopod, 13 on exopod.

Telson tapering to rounded apex from one-third length; 1.15 times as long as wide. Uropodal endopod ovate, 1.5 times as long as wide, anterior margin straight, distal margin semicircular, without distal tooth, posterior margin convex; exopod ovate, 1.7 times as long as wide, anterodistal margin with 16 short spiniform setae, posterior margin with 6 blade-like setae.

Branchial formula as in *M. kalbarri* Poore and Collins, 2015.

Distribution. Papua New Guinea. New Ireland Province (03° S, 151° E), 2–3 m. depth (known only from type locality).

*Etymology***.** From Papua New Guinea; noun in apposition.

*Remarks***.** *Michelea papua* resembles *M. imperieusae* Poore and Collins, 2015, from north-western Australia in having similar numbers of pleopodal lamellae but differs in the short broad rostrum (not spine like), longer antennae, and more elongate maxilliped 3 and pereopodal articles.

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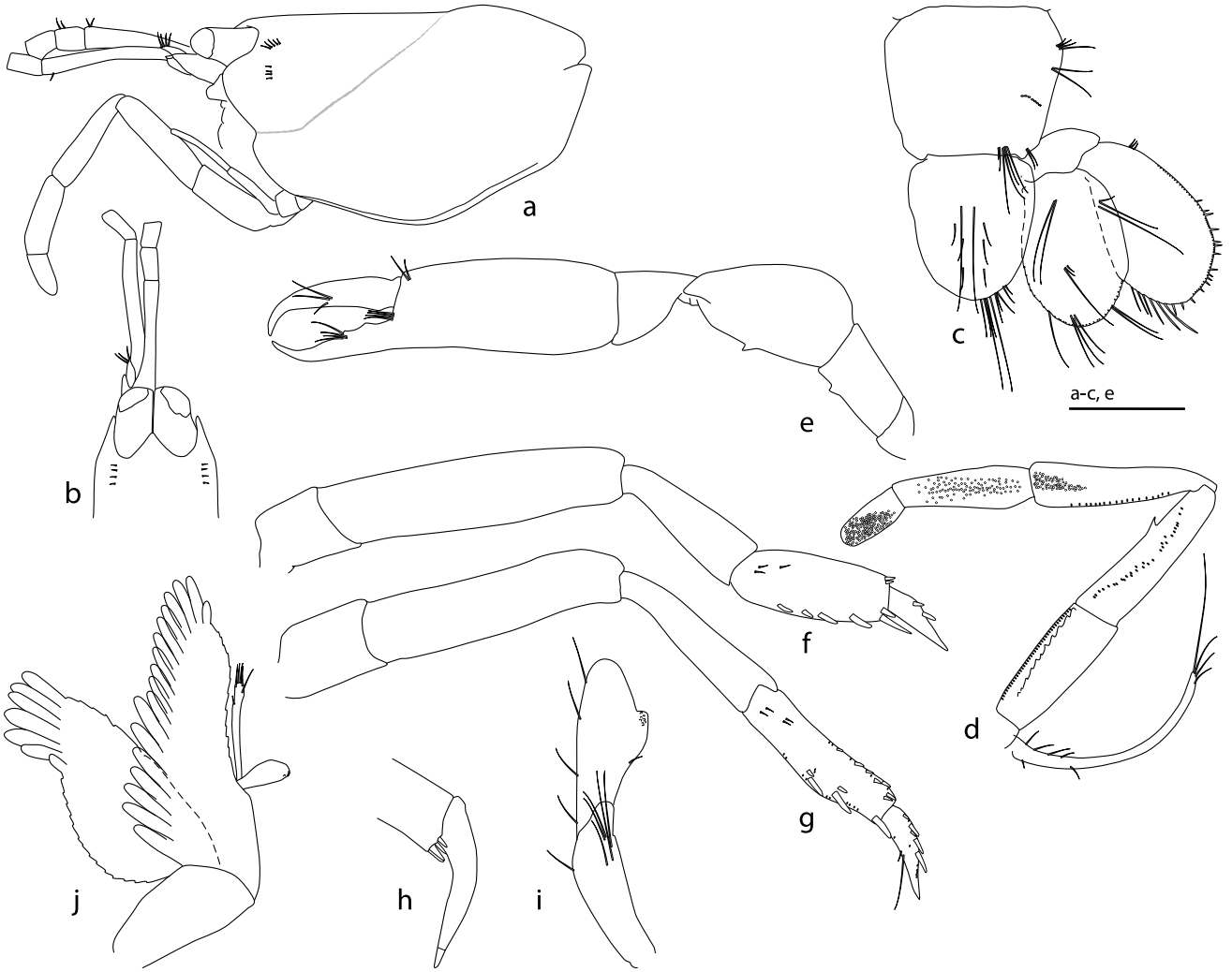

Figure 7. *Michelea papua* sp. nov., holotype: a, lateral carapace, antenna, antennule, maxilliped 3; b, carapace, antenna, antennule; c, pleomere 6, telson, uropod; d, maxilliped 3; e, f, g, pereopods 1, 3, 4; h, pereopod 5 dactylus; i, j, pleopods 1, 2. Scale bar = 1 mm.

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References

Borradaile, L.A. 1903. On the classification of the Thalassinidea. *Annals and Magazine of Natural History (ser. 7)* 12: 534–551 + Addendum on p. 638. http://biodiversitylibrary.org/page/29993300

Coelho, P.A., and Ramos-Porto, M. 1991. Sínopse dos crustáceos decápodos brasilieros (famílias Scyllaridae, Palinuridae, Nephropidae, Parastacidae e Axiidae). *Anais da Universidade Federal Rural de Pernambuco – Ciências biologicas* 8/10 [1983–85]: 47–88.

Holthuis, L.B. 1953. Enumeration of the decapod and stomatopod Crustacea from Pacific coral islands. *Atoll Research Bulletin* 24: 1–66. http://www.sil.si.edu/DigitalCollections/atollresearchbulletin/issues/00024.pdf

Hendrickx, M.E. 2008 New records of and notes on decapod crustaceans in the east Pacific. *Crustaceana* 81 999–1006. http://dx.doi.org/10.1163/156854008X354957

Huxley, T.H. 1879. On the classification and the distribution of the crayfishes. *Proceedings of the Zoological Society of London* 1878: 752–788. http://biodiversitylibrary.org/page/28519446

Kensley, B. 1981. Notes on *Axiopsis* (*Axiopsis*) *serratifrons* (A. Milne Edwards) (Crustacea: Decapoda: Thalassinidea). *Proceedings of the Biological Society of Washington* 93: 1253–1263. http://biodiversitylibrary.org/page/34600140

Kensley, B. 1994. The genus *Coralaxius* redefined, with descriptions of two new species (Crustacea: Decapoda: Axiidae). Journal of Natural History 28: 813–828. http://dx.doi.org/10.1080/00222939400770421

Kensley, B. 1996. The genus *Paraxiopsis* De Man, with descriptions of new species from the Western Atlantic (Crustacea: Decapoda: Axiidae). *Bulletin of Marine Science* 58: 709–729. https://repository.si.edu/handle/10088/10979

Kensley, B. 2003. Axioid shrimps from Guam (Crustacea, Decapoda, Thalassinidea). *Micronesica* 35-36: 359–384. https://repository.si.edu/handle/10088/10970

Kensley, B., and Heard, R.W. 1991. An examination of the shrimp family Callianideidae (Crustacea: Decapoda: Thalassinidea). *Proceedings of the Biological Society of Washington* 104: 493–537. https://biodiversitylibrary.org/page/34809191

Komai, T., and Tachikawa, H. 2008. Thalassinidean shrimps (Crustacea: Decapoda) from the Ogasawara Islands, Japan. *Natural History Research* 10: 19–52.

Man, J.G. de 1888. Bericht über die von Herrn Dr. J. Brock im indischen Archipel gesammelten Decapoden und Stomatopoden. *Archiv für Naturgeschichte* 53: 215–600, pls 7–22. http://biodiversitylibrary.org/page/6379410

Man, J.G. de 1905. Diagnoses of new species of macrurous decapod Crustacea from the "Siboga-Expedition". *Tijdschrift der Nederlandsche Dierkundige Vereeniging* 9: 587–614. http://biodiversitylibrary.org/page/9779712

Man, J.G. de 1925. The Decapoda of the Siboga-Expedition. Part VI. The Axiidae collected by the *Siboga-Expedition*. *Siboga Expéditie Monographie* 39a5: 1–127. http://decapoda.nhm.org/pdfs/15372/15372.pdf

Milne-Edwards, A. 1873. Descriptions de quelques Crustacés nouveaux ou peu connus provenant du Musée de M. C. Godeffroy. *Journal du Muséum Godeffroy* 1: 253–264 [Heft 4: 77–88], pls 1, 2. https://biodiversitylibrary.org/page/35399250

Ngoc-Ho, N. 1998. Le genre *Eutrichocheles* Wood-Mason, 1876 (Crustacea, Decapoda, Thalassinidea) en Polynésie française et au Vietnam avec description de deux espèces nouvelles. *Zoosystema* 20: 363–378.

Ngoc-Ho, N. 2005. Thalassinidea (Crustacea, Decapoda) from French Polynesia. *Zoosystema* 27: 47–83. http://sciencepress.mnhn.fr/sites/default/files/articles/pdf/z2005n1a4.pdf

Poore, G.C.B., and Collins, D.J. 2009. Australian Axiidae (Crustacea: Decapoda: Axiidea). *Memoirs of Museum Victoria* 66: 221–287. http://doi.org/10.24199/j.mmv.2009.66.20

Poore, G.C.B., and Collins, D.J. 2010. *Parascytoleptus* and *Spongiaxius* redefined with two new species from the southwestern Pacific (Decapoda: Axiidea: Axiidae). Pp. 611–625 in: Fransen, C., De Grave, S. and Ng, P. (eds), *Studies on Malacostraca: Lipke Bijdeley Holthuis Memorial Volume*. *Crustaceana Monographs 14*. Brill: Leiden.

Poore, G.C.B., and Collins, D.J. 2015. Micheleidae (Crustacea: Decapoda: Axiidea): new family and generic synonymies, three new Australian species, and new records. *Memoirs of Museum Victoria* 73: 95–105. http://doi.org/10.24199/j.mmv.2015.73.08

Saint Laurent, M. de 1979. Vers une nouvelle classification des Crustacés Décapodes Reptantia. *Bulletin de l'Office Nationale de Pêche de Tunisie* 3: 15–31.

Sakai, K. 1992. The families Callianideidae and Thalassinidae, with the description of two new subfamilies, one new genus and two new species (Decapoda, Thalassinidea). *Naturalists, Publications of Tokushima Biological Laboratory, Shikoku University* 4: 1–33.

Sakai, K. 1994. Eleven species of Australian Axiidae (Crustacea: Decapoda: Thalassinidea) with descriptions of one new genus and five new species. *The Beagle, Occasional Papers of the Northern Territory Museum of Arts and Sciences* 11: 175–202. http://hdl.handle.net/10070/256995

Sakai, K. 2011. Axioidea of the world and a reconsideration of the Callianassoidea (Decapoda, Thalassinidea, Callianassida). *Crustaceana Monographs* 13: 1–616.

Sakai, K. 2015. A revised list of all ghost shrimps (Callianassidea and Thalassinidea) (Decapoda, Pleocyemata) from the Red Sea area, with a new genus, *Lepidophthalminus* gen. nov. and two new species in the genera *Gilvossius* and *Neocallichirus*. *Crustaceana* 88: 422–448. http://dx.doi.org/10.1163/15685403-00003420

Sakai, K., and de Saint Laurent, M. 1989. A check list of Axiidae (Decapoda, Crustacea, Thalassinidea, Anomula), with remarks and in addition descriptions of one new subfamily, eleven new genera and two new species. Naturalists, *Publications of Tokushima Biological Laboratory, Shikoku University* 3: 1–104.

Sendler, A. 1923. Die Dekapoden und Stomatopoden der Hanseatischen Sudsee-Expedition. *Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft* 38: 21–47, pls 5, 6.

Tirmizi, N.M. 1983. Four axiids (Decapoda, Thalassinidea) from Indonesia. *Researches on Crustacea, Carcinological Society of Japan* 12: 85–95. http://doi.org/10.18353/rcustacea.12.0_85

Vaitheeswaran, T. 2014. A new record of *Axiopsis consobrina* (De Man, 1905) (Family: Axiidae : Borradaile, 1903) (Crustacea : Decapoda : Thalassinidea) off Thoothukudi, southeast coast of India (08°53.6'N 78°16'E and 08°53.8'N 78°32'E). *Indian Journal of Veterinary and Animal Science Research* 43: 49–57. http://www.tanuvas.tn.nic.in/ijvasr/vol10(1)/57-65.pdf

Ward, M. 1942. Notes on the Crustacea of the Desjardins Museum, Mauritius Institute, with descriptions of new genera and species. *Mauritius Institute Bulletin* 2: 49–109.

Wirtz, P. 2009. The Gulf of Guinea goby-shrimp symbiosis and a review of goby-thalassinidean associations. *Arquipélago*. *Life and Marine Sciences* 25: 71–76. http://www.horta.uac.pt/intradop/images/stories/arquipelago/25/Arquipelago_25_71-76_Wirtz.pdf

Zehntner, L. 1894. Voyage de M.M. Bedot et C. Pictet dans l'Archipel Malais. Crustacés de l'Archipel Malais. *Revue Suisse de Zoologie* 2: 135–214. http://biodiversitylibrary.org/page/9970404