

Micheleidae (Crustacea: Decapoda: Axiidea): new family, generic and species synonymies, three new Australian species, and new records

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Abstract

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The Micheleidae are shown to include all taxa previously separated as Meticonaxiidae. A revised key to genera, *Marcusiaxius*, *Meticonaxius*, *Tethisea* and *Michelea* is presented. *Meteoraxius* Sakai and Türkay, 2012 is synonymised with *Meticonaxius* de Man, 1905. *Micheleopsis* Sakai, 2010 is synonymised with *Michelea* Kensley and Heard, 1991; among other quite trivial differences, the genus had been differentiated on a simple form of the male pleopod 1, suspected to be a juvenile feature and/or lacking merit as a generic character. Three new species, *Michelea kalbarri*, *M. imperieusae* and *Tethisea alanwilliamsi* are described. *Michelea kalbarri* is unique in its genus in lacking pleopodal lamellae. *Michelea novaecaledoniae* Poore, 1997 is added to the Australian fauna. *Michelea paraleura* is synonymised with *M. leura*.

Keywords

Crustacea, Decapoda, Axiidea, Meticonaxiidae, Micheleidae, *Meticonaxius*, *Tethisea*, *Michelea*, new species

Introduction

The family Micheleidae Sakai, 1992 sensu lato was reviewed globally by Poore (1997) who recognised 26 species in four genera. Two genera and five species have been added since (Lin, 2006; Liu and Liu, 2012; Poore, 2008; Sakai, 2010). Poore (1994, 1997) treated two subfamilies, Meticonaxiinae Sakai, 1992 and Micheleinae Sakai, 1992, as synonymous but they were revived at the family level by Sakai (2011). Here, this disagreement is reviewed in the light of a reappraisal of morphological characters with support from molecular analyses. The two recent genera are assessed and found to be synonymous with others of long standing. Finally, three new Australian species are described while making their generic diagnoses more flexible.

With most species represented by few specimens growth changes are poorly understood. Here, we present evidence that the fully-formed male pleopod 1, a stalked triangular blade, may not be present in juvenile males, and then develops through bud-like forms over more than one instar. This variability needs to be taken into taxonomic account at the species and genus level.

This is the second of two papers dealing in part with collections of Axiidea made as part of a project mounted by CSIRO Marine and Atmospheric Research (CMAR) and Museum Victoria entitled “Mapping benthic ecosystems on the deep continental shelf and slope in Australia’s South West Region” (Poore and Collins, 2009). The project has shown the

decapod crustacean fauna to be rich and diverse (Poore et al., 2008). The material collected in the south-west is supplemented by more taken along the north-western Australian slope and by collections from the Northern Territory.

Material is deposited in Museum Victoria, Melbourne (NMV), the Northern Territory Museum and Art Gallery, Darwin (NTMAG) and the US National Museum of Natural History, Washington (USNM). Measurements are of carapace length (cl.) including rostrum.

One family or two?

Kensley and Heard (1991) reviewed the Callianideidae Kossmann, 1880, including seven genera. Their PAUP analysis of morphological characters resulted in three clades comprising: (1) *Callianidea* H. Milne Edwards, 1837; (2) *Mictaxius* Kensley and Heard, 1991, *Crosniera* Kensley and Heard, 1991 and *Thomassinia* de Saint Laurent, 1973; and (3) *Marcusiaxius* Rodrigues and de Carvalho, 1972, *Meticonaxius* de Man, 1905 and *Michelea* Kensley and Heard, 1991. The three clades were united by absence of a suture on the uropodal endopod, flattened pereopods 3 and 4, setal rows on pleomeres and pereopods 2–4. The first two of these clade are now treated as Callianideidae s.s., with Thomassiniidae treated as a junior synonym (Dworschak et al., 2012; Poore, 2015).

It is a moot point whether one or two families should be recognised for the genera of Kensley and Heard’s (1991) third clade. Sakai (1992) introduced two subfamilies of

Callianideidae, Micheleinae for *Michelea* and Meticonaxiinae for the others. Poore (1994) synonymised the two subfamilies relying on the paraphyly of three meticonaxiine genera, *Marcusiaxius*, *Meticonaxius* and *Tethisea* Poore, 1994. While he found numerous synapomorphies for *Michelea*, none supported grouping of the others. This argument was followed by Poore (1997) who stated that numerous synapomorphies united all taxa. This analysis was criticised by Sakai (2011) in support of retention of his original taxa at family level. He believed the characters used were of “no significance” compared to others relying instead on the rostrum being obsolete in *Michelea* and produced in the other genera and differences in pleopods, propodi of pereopods 3 and 4, pleurobranchs, the telson and uropodal endopod. Of these characters only the rostrum, pleopods and pereopodal propodi were listed in his family diagnoses; other characters in his diagnoses are essentially identical in the two families. He erroneously contrasted pereopod 5 in the two families – it is subchelate in both. Sakai’s (2014) amended key to axiidean families separated the two families Micheleidae and Meticonaxiidae on the size of the rostrum, ‘small’ in the former and ‘distinct’ in the latter. The two lines of his couplet 6 are virtually identical and would not separate Micheleidae (*Michelea*) from Callianideidae as they are intended to do.

The difference of opinion is not so much about whether *Michelea* differs from the others or not but on whether ‘Meticonaxiidae’ can be defined as a monophyletic taxon. No morphological evidence supports their monophyly. Robles et al.’s (2009: fig. 1) Bayesian analysis of 16S and 18S data contained just two sister species, *Michelea* sp. and *Tethisea mindoro* Poore, 1994, so contributed nothing to the Meticonaxiidae/Micheleidae question. A more complete analysis of basal axiidean taxa by the same authors is available as part of an ongoing analysis aimed principally at elaborating the relationships of Callianassoidea first explored by Felder and Robles (2009). This as yet unpublished cladogram shows *T. mindoro* to be sister taxon to a clade containing three species of *Meticonaxius* on one branch and two species of *Michelea* on another (R. Robles, pers. comm., Jan 2014). This result accords with the conclusion of Poore (1994, 1997).

Micheleidae Sakai, 1992

Micheleinae Sakai, 1992: 18.

Meticonaxiinae Sakai, 1992: 19.

Micheleidae.—Poore, 1994: 99.—Poore, 1997: 354–357.—Poore, 2004: 176.—Poore, 2008: 174.—Sakai, 2011: 311.—Dworschak et al., 2012: 190.—Sakai, 2014: 611 (key).

Meticonaxiidae.—Sakai, 2011: 297–301.—Sakai and Türkay, 2014: 161.—Sakai, 2014: 611 (key) **Syn. nov.**

Diagnosis. Cephalothorax, rostrum, pleon, telson and uropod unarmed. Rostrum obsolete or a flat triangular plate with sublateral carinae extending almost to cervical groove. Linea thalassinica absent. Posterior margin of carapace curved medially, with lateral lobes interacting with pleomere 1. Thoracic sternite 7 broad, flattened posteriorly, narrow anteriorly. Setal-rows present usually on anterolateral carapace,

on lateral face of propodi of pereopods 2–4, and on pleomeres 1 and 6 and sometimes others. Eyestalks cylindrical, tapering; sometimes without pigmented eyes. Antenna with articulating scaphocerite. Maxilla scaphognathite with 1 or 2 long setae on posterior lobe extending into branchial chamber. Maxilliped 3 pediform. Pereopod 1 (cheliped) merus lower margin straight, sometimes with spine. Pereopod 2 chelate. Pereopod 3 propodus ovate or subrectangular; pereopods 3 and 4 propodi with or without distal spiniform seta on lower margin (facial spiniform setae in *Michelea*). Male pleopod 1 with triangular second article, appendix interna represented by hooks. Pleopods 2–5 similar, with elongate rami, each with elongate appendix interna, with or without marginal plates. Uropod endopod ovate; exopod without dorsal plate.

Remarks. The family contains four genera of which *Marcusiaxius* Rodrigues and de Carvalho, 1972 has not been reported from Australia. The genus and its type species *M. lemoscastrói* were validly published by Rodrigues and Carvalho (1972) and redescribed by Carvalho and Rodrigues (1973) both in another journal later. Sakai (2011) erroneously maintained without explanation that the latter were first authors. The other genera are discussed below.

Key to genera of Micheleidae

Remarks. Poore’s (1997) review included four genera. Two have been added since, *Micheleopsis* Sakai, 2010 which can not be clearly distinguished from *Michelea*, and *Meteoraxius* Sakai and Türkay, 2012 which can not be distinguished from *Meticonaxius* de Man, 1905 (see discussions below). These and the discovery of species that are atypical of their genera necessitates redrafting and correcting Poore’s (1997) key to genera. Sakai’s (2011: 298–300) key to ‘Meticonaxiidae’ is simpler but less reliable.

1. Rostrum minute, triangular; usually without pleurobranchs above pereopod 2–4; usually with pleopodal lamellae; pereopods 3 and 4 with lateral spiniform setae *Michelea*
 - Rostrum prominent, flat; usually with pleurobranchs above pereopod 2–4; without pleopodal lamellae; pereopods 3 and 4 without lateral spiniform setae 2
2. Uropodal endopod with anterior margin convex, ending by curving to rounded posterior margin; maxilliped 1 exopod with second linear article; pleomeres 3–5 without setal-rows *Tethisea*
 - Uropodal endopod with straight anterior margin ending sharply; maxilliped 1 exopod without second article; pleomeres 3–5 with setal-rows 3
3. Eyes visible in dorsal view, rostrum narrowly rounded or acute; cheliped fixed finger with major tooth two-thirds way along; uropodal endopod at most 1.5 times as long as wide *Meticonaxius*
 - Eyes not visible in dorsal view, rostrum broadly rounded, bullet-shaped; cheliped fixed finger with major tooth one-third way along; uropodal endopod about twice as long as wide *Marcusiaxius*

***Meticonaxius* de Man, 1905**

Meticonaxius de Man, 1905: 592.—Poore, 1997: 364–365 (for synonymy).—Sakai, 2011: 305–306.

Meteoraxius Sakai and Türkay, 2012: 731–732 (type species *Meteoraxius meteor* Sakai and Türkay, 2012, by original designation).

Syn. nov.

Remarks. *Meticonaxius* has a long synonymy (see Poore, 1997). Sakai and Türkay (2012) compared their new genus and species, *Meteoraxius meteor*, with *Marcusiarius* from which it differs in several features. Unfortunately, they did not compare it with *Meticonaxius* from which it can not be distinguished. Both genera vary in few characters that might be considered of generic value. The rostrum of species of *Meticonaxius* is narrower than that of species of *Marcusiarius*; in some the apex is rounded and others acute but the eyes are always visible dorsally, unlike in *Marcusiarius* where the broadly rounded rostrum covers the eyes. *Meteoraxius meteor* lacks setal rows on the carapace; the number recorded throughout the 15 species of both genera ranges from one to three so absence could not be considered of generic value. The species has a moderately developed crista dentata on maxilliped 3; it is absent in *Marcusiarius* but variably developed in *Meticonaxius* species. *Meteoraxius meteor* has a long maxilliped 3 exopod; is usually rudimentary in these genera but can be as long as half the ischium. *Meteoraxius meteor* has the same shaped telson, longer than wide, as in all other species of *Meticonaxius*, different from the short telson of *Marcusiarius* species. The uropodal endopod of *M. meteor* has a triangular apex and the exopod rounded. Similar uropods are seen in some species of *Meticonaxius* but in others the exopod ends more squarely. *Meteoraxius* post-dates and was not included in the review of Sakai (2011). The genus is here synonymised with *Meticonaxius*.

Sakai (2011) excluded *Meticonaxius longispina* (Stebbing, 1920) and *M. microps* (Bouvier, 1905) from this genus, placing them in *Marcusiarius* instead. He argued that the rostrum in both species 'is not so acutely triangular as in *Meticonaxius*, but obtusely triangular as in *Marcusiarius*.' While the rostrums of these two species are more rounded than in other species of *Meticonaxius* both have dorsally visible eyes, broad uropodal endopod and more distally placed tooth on the fixed finger, all characteristic of this genus. The rostrum of species of *Marcusiarius* can not be referred to as 'obtusely triangular'.

Poore (1997) provided a key to eight species of *Meticonaxius*. Lin (2006) added another and tabulated characters of nine species. Sakai and Türkay (2014) redescribed and illustrated *M. coeca* (Balss, 1921) from Tanzania and removed it from synonymy of *M. monodon* de Man, 1905 from Indonesia. Species now number ten.

Meticonaxius is represented in Australia only by *M. soela* Sakai, 1992 at 300 m in the Coral Sea.

***Michelea* Kensley and Heard, 1991**

Michelea Kensley and Heard, 1991: 519.—Poore, 1997: 373–375.—Poore, 2008: 175.—Poore, 2004: 176–177.—Sakai, 2011: 311–312.

Micheleopsis Sakai, 2010: 1462 (type species *Micheleopsis orlik* Sakai, 2010, by original designation) **Syn. nov.**

Remarks. Poore (1997) diagnosed the genus and provided a key to the ten species known. *Michelea dampieri* Poore, 2008, *Michelea takeda* Liu and Liu, 2012, *Michelea orlik* (Sakai, 2010) transferred from *Micheleopsis*, and the two new species described below can be added to his list. Members of the genus can usually be recognised by the presence of lamellae on the edges of the pleopodal rami but one of the new species described below lacks these lamellae. Otherwise, the extremely short rostrum, laterally compressed carapace, pereopodal setation, ovate uropodal rami, cylindrical eyestalks and the elongate first article of the antennule characterise the genus.

Sakai (2010) erected the new genus *Micheleopsis* that he said looks superficially similar to *Michelea*. For the important generic characters listed above the two do not differ. He noted that the carapace of the new genus (represented by a single individual of one species, *M. orlik*) bears a dorsolateral carina running from each side of the rostrum to the posterior third of the gastric region – a similar carina has been illustrated for *M. microphylla* Poore, 1997 and is hinted at in other illustrations. The character would seem to rely on authors' interpretations and illustrations. He noted that the maxilliped 3 exopod is rudimentary – it exceeds the ischium in all other species. This is one of several variable features of the genus, notably the number of gills and pleopodal lamellae, treated as being of specific value. Neither difference warrants separating a new genus from *Michelea* and it is here synonymised.

Sakai (2010) also stated that the specimen of *M. orlik* was a male with uniramous pleopods 1, with distal patches of hooks, and 2-articulate pleopod 2 endopods without an appendix masculina. His illustration seems of a somewhat distorted, damaged or teratological ramus – nothing like it appears elsewhere in axioids. Adult males of seven species of *Michelea* are known: *M. abbranchiata* Poore, 1997, *M. dampieri*, *M. devanyi* Poore, 1997, *M. imperiusae* sp. nov., *M. leura* (Poore and Griffin, 1979), *Michelea takeda* and *M. vandoverae* (Gore, 1987) – all have a male pleopod 1 typical of species in all micheleid genera, a stalked triangular blade with mesial hooks, and an appendix masculina on pleopod 2. Other species are known only from females or males in which pleopod 1 is absent or bud-like. The male holotype of *M. lepta* (Sakai, 1987) lacks pleopod 1 and an appendix masculina on pleopod 2; *M. microphylla* Poore, 1997 has an obsolete simple pleopod 1 and lacks an appendix masculina. Representatives of all species being so few, growth-related change in micheleids has not been reported. Seven males of *M. vandoverae* (cl. 4.1–6.2 mm, USNM collections) all possess a typical pleopod 1 (C.C. Tudge, pers. comm. 9 Mar 2013). In this paper we report a male of *M. leura* without a male pleopod 1, of which a male, previously identified as its synonym *M. paraleura* Poore, 1997, possesses a fully-formed pleopod.

The same variation occurs in *Tethisea* (see below). Dworschak (2008) documented similar changes in pleopod 1 in a somewhat related species, *Neocallichirus karumba* (Poore and Griffin, 1979). We conclude that full formation of the male pleopod 1 may occur over more than one instar (absence to bud-like to triangular). Genera based on what could be juvenile features, such as a less than fully formed male pleopod 1, can not be justified while uncertainty remains over allometric changes.

Micheleopsis is treated here as a junior synonym of *Michelea*. Neither the genus nor its only species was mentioned by Sakai (2011) in his otherwise comprehensive summary of *Michelea* and its included taxa.

About half of the 13 species of *Michelea* are Australian: *M. dampieri* Poore, 2008, *M. microphylla* Poore, 1997, *M. hortus* Poore, 1997, *M. leura* (Poore and Griffin, 1979), *M. novaecaledoniae* Poore, 1997 newly recorded, and two newly erected here.

***Michelea imperieuseae* sp. nov.**

Figure 1

Michelea sp. MoV5530.—McCallum, 2012: 57.

Material examined. Holotype. Western Australia, *RV Southern Surveyor* Imperieuse L23 transect (18°27.37'S–18°27.43'S, 120°08.41'E–120°08.41'E), 80–81 m, 19 Jun 2007 (stn SS05/2007/082), NMV J55702 (male, cl 3.5 mm, fixed in 96% ethanol).

Diagnosis. Gills fully developed. Pleopods 2–5 with 20/5, 19/10, 20/15 and 20/15 marginal lamellae on endopods/exopods respectively. Telson tapering, length 1.1 width. Maxilliped 3 ischium with obsolete crista dentata, exopod longer than ischium; merus with mesial tooth.

Description. Cephalothorax 0.25 total length, about 1.8 times as long as greatest depth; rostrum acute, sharply narrowing from broad base, slightly depressed distally, about 0.7 as long as eyestalks; cervical groove weakly defined, reaching 0.65 length of cephalothorax; longitudinal setal-row level with lateral margin of eyestalk, of 6 setae; marginal setal-row of 2 setae at base of eyestalk.

Pleomere 1 with dorsolateral longitudinal setal-row of 6 setae. Pleomeres 2–4 with transverse setal-row of about 6 setae near lateral posterior margin; pleomere 5 with transverse setal-row of 8 setae; all somites also with groups of long simple setae, none with marginal setal-rows. Pleomere 6 with 2 transverse setal-rows of 3 setae.

Antennule with elongate waisted article 1, 0.4 times length of cephalothorax; articles 2 and 3 subequal, each about 0.25 length of article 1; flagella each of 10 articles, longer than peduncle. Antenna with distinct articulating scaphocerite, about third length of article 2; article 4 reaching to middle of article 2 of antenna 1; article 5 short; flagellum of 20 articles, more than twice as long as peduncle.

Mandible, maxillules, maxillae, maxillipeds 1 and 2 typical of genus. Maxilliped 3 ischium with obsolete crista dentata; merus with strong mesial tooth; exopod 1.7 times ischium length.

Chelipeds unknown.

Pereopod 2 merus–propodus with lower marginal rows of long setae; carpus 0.55 length of merus; propodus little longer than carpus with setal-row of 7 short setae; fixed finger cutting edge with 4 short spiniform setae; dactylus longer than fixed finger, with 3 short spiniform setae on distal half of cutting edge; each finger with corneous tip. Pereopod 3 propodus twice as long as wide, with 4 spiniform setae on lower margin, plus 2 on distal-lower and 2 on distal-upper mesial face; and 2 transverse setal-rows of 3 and 2 setae; dactylus with 2

spiniform setae on upper-mesial margin. Pereopod 4 propodus 3 times as long as wide, 9 spiniform setae, some in pairs, on lower mesial face, and 6 on upper margin, and transverse setal-row of 4 setae; dactylus with 3 spiniform setae on upper-mesial margin. Pereopod 5 subchelate; propodus with setae on lower margin; fixed finger with 5 spiniform setae.

Pleopods 1 of male curved mesially, expanded distally, with c. 8 minute hooks, setose around midpoint and laterally, and with 1 simple seta at apex. Pleopod 2 with 20/5 marginal lamellae on endopod/exopod respectively; appendix masculina third length of endopod; appendix interna half length of appendix masculina. Pleopod 3 with appendix interna sac-like, 3 times as long as wide; with 19 lamellae on endopod, 10 on exopod; pleopods 4 and 5 each with 20 lamellae on endopod, 15 on exopod.

Uropodal endopod ovate, 1.6 times as long as wide, with a minute distal tooth; exopod ovate, 1.8 times as long as wide, mesiodistal margin oblique, lateral margin with 5 short spiniform setae. Telson tapering to rounded apex from one-quarter length; 1.15 times as long as wide.

Gills fully developed.

Distribution. Western Australia, 18°S, 120°E, 80 m.

Etymology. *Imperieuseae*, from Imperieuse Reef, near the type locality, noun in genitive case.

Remarks. Although the chelipeds are missing we are confident that this is a new species closest to *M. hortus*. It differs in having more pleopodal lamellae (*M. hortus* has only four or five marginal lamellae on the pleopodal endopods and none on the exopods), and more elongate uropodal rami (endopod and exopod 1.4 and 1.6 times as long as wide respectively) and telson (as wide as long).

***Michelea kalbarri* sp. nov.**

Figure 2

Michelea sp. MoV4969.—Poore et al., 2008: 95.

Material examined. Holotype. Western Australia, off Kalbarri (27°48.29'S–28°29.22'S, 113°17.49'E–113°25.08'E), 123–112 m, 04 Dec 2005 (stn SS10/2005/096), NMV J53462 (female, cl 3.4 mm).

Diagnosis. Gills fully developed. Pleopods 2–5 without marginal lamellae. Telson tapering to rounded apex, length 1.2 width. Maxilliped 3 ischium with obsolete crista dentata; merus with mesial tooth.

Description. Cephalothorax 0.37 total length, about 1.7 times as long as greatest depth; rostrum acute, sharply narrowing from broad base, slightly depressed distally, about 0.7 as long as eyestalks; cervical groove weakly defined, reaching 0.7 length of cephalothorax; longitudinal setal-row level with lateral margin of eyestalk, of 5 setae; marginal setal-row of 5 setae at base of eyestalk.

Pleomere 1 without dorsolateral longitudinal setal-row. Pleomeres 3–5 with transverse setal-rows of 6–7 setae near midpoint; all somites also with groups of long simple setae, none with marginal setal-rows. Pleomere 6 with transverse setal-row of 4 setae.



Figure 1. *Michelea imperieusae* sp. nov. Holotype, NMV J55702. a, habitus. b, anterior carapace, with antennules, antennae, lateral view. c, telson and uropods. d, maxilliped 3. e–f, pereopods 2–5. i–l, male pleopods 1–3. Scale bar applies to habitus only.



Figure 2. *Michelea kalbarri* sp. nov. Holotype, NMV J53462. a, habitus. b, c, anterior carapace, antennules and antennae, lateral and dorsal views. d, telson and uropods. e, maxilliped 3. f–j, cheliped, pereopods 2–5, with detail of dactyli. k, pleopod 3. Scale bar applies to habitus only.

Antennule with elongate waisted article 1, 0.4 length of cephalothorax; articles 2 and 3 subequal, each about 0.25 length of article 1; flagella each of 14 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 of 17 articles, more than twice as long as peduncle.

Mandible, maxillules, maxillae, maxillipeds 1 and 2 typical of genus. Maxilliped 3 ischium with obsolete crista dentata; merus with strong mesial tooth; exopod 1.7 times ischium length.

Chelipeds equal; ischium with weak lower tooth; merus twice as long as deep, upper margin convex, with weak tooth on slightly convex lower margin; carpus unarmed; propodus almost cylindrical, 3.5 times as long as deep; fixed finger 0.37 total length of propodus, its cutting edge with 1 obsolete tooth at midpoint; dactylus cutting edge straight, curved distally, equal to fixed finger.

Pereopod 2 merus-propodus with lower marginal rows of long setae; carpus 0.5 length of merus; propodus 1.3 times as long as carpus, with setal-row of 5 short setae; fixed finger cutting edge with 5 short spiniform setae; dactylus longer than fixed finger, with 4 short spiniform setae on distal half of cutting edge; each finger with corneous tip. Pereopod 3 propodus 2.5 times as long as wide, with 2 spiniform setae on distal-upper mesial face, 7 on distal-lower face; and 2 transverse setal-rows of 3 and 4 setae; dactylus with 3 spiniform setae on upper margin. Pereopod 4 propodus 3.5 times as long as wide, with 3 spiniform setae on lower margin, 3 spiniform setae and numerous pectinate distally; with transverse setal-row of 3 setae; dactylus with 4 spiniform setae on upper-mesial margin. Pereopod 5 semichelate; propodus with setae on lower margin transforming to strongly pectinate distally; fixed finger with 4 distal spiniform setae; dactylus without spiniform setae.

Pleopods 2–5 without marginal lamellae; appendix interna sac-like, 3 times as long as wide.

Uropodal endopod ovate, 1.65 times as long as wide, with a minute distal tooth; exopod ovate, almost twice as long as wide, lateral margin with about 20 short spiniform setae. Telson tapering to rounded apex from one-third length; 1.2 times as long as wide.

Branchial formula (f = filamentous; r = rudimentary):

Thoracomere	1	2	3	4	5	6	7	8
Arthrobranch	–	r	1	2	2	2	2	–
Epipod	1	1	1	1	1	1	1	–
Podobranch	–	–	f	f	f	f	–	–

Distribution. Western Australia, 27°S, 113°E, 112–123 m.

Etymology. The specific name is that of a town near the type locality; noun in apposition.

Remarks. *Michelea kalbarri* is notable for the absence of pleopodal lamellae on both rami, present on at least one ramus in all other species. While this feature has been treated as a key generic character the numbers of lamellae are highly variable, being absent on exopods of three species (Sakai, 2011) while the maximum is almost 100 on both rami in *M. lamellosa* Kensley and Heard, 1991. In all other respects, general habitus and pereopods, the species is a typical member of *Michelea*.

Michelea novaecaledoniae Poore, 1997

Michelea novaecaledoniae Poore, 1997: 388–390, fig. 22.—Sakai, 2011: 316.

Material examined. Coral Sea, Chesterfield Reef (19°06'S, 158°53'E), 32–60 m, R. Hanley, 27 Jul 1988 (NTMAG Cr013049, female; NTMAG Cr013052, ovigerous female with 10 embryos, cl 4.3 mm).

Distribution. New Caledonia, 22°S, 166°E, and Chesterfield Reef, Coral Sea, 19°S, 158°E, 32–60 m.

Remarks. The pleopods and tailfan are consistent with the description of the type specimen from New Caledonia. The endopods of pleopods 3 and 4 have three and four lateral lamellae plus one mesially. This is the first record of an ovigerous female of *Michelea*. It is striking for the paucity of embryos (ten only) and their large oval size, 1.8 x 1.1 mm, 0.4 of the carapace length. This second record extends the species' distribution.

Michelea leura (Poore and Griffin, 1979)

Callianidea leura Poore and Griffin, 1979: 281–284, figs 40, 41.—Sakai, 1984: 104.

Michelea leura.—Kensley and Heard 1991: 519.—Poore, 1997: 381–386, figs 17–19.—Sakai, 2011: 315.

Michelea paraleura Poore, 1997: 390–393, figs 23, 24.—Sakai, 2011: 316. **Syn. nov.**

Material examined. Australia, NT, Port Essington, Mangrove Point Reef (11°24.0'S, 132°11.0'E), LWS, R. Hanley, 15 Sep 1985 (NTMAG Cr013206, juvenile male, cl 2.5 mm).

Distribution. NT, Qld, 11°–19°S, reef, 1–2 m.

Remarks. Poore's (1997) arguments separating *M. paraleura* from *M. leura* seem now unconvincing. The new juvenile male, three-quarters the size of the figured paratype male from NT, lacks a first pleopod. The appendix masculina carries fewer setae than in the paratype. The numbers of lamellae on the endopod and exopod of pleopod 2 are fewer (17, 13) than those of the larger paratype (26, 15) but more are evident on more posterior pleopods. The species was previously recorded from the Great Barrier Reef, Qld, and Oxley Island, NT. This record takes the species to mainland Australia.

Tethisea Poore, 1994

Tethisea Poore, 1994: 99–100.—Poore, 1997: 393–394.—Sakai, 2011: 309.

Remarks. The rostrum, tapering truncate telson and ovate uropodal endopod of the new species described here are of the same form as those of the two species of *Tethisea* Poore, 1994 (Poore, 1997). The new species differs significantly in the absence of strong spiniform setae in the gape of the cheliped and the blunt, rather than attenuating and acute cheliped fingers. As in *Michelea* discussed above, the male pleopod 1 varies within and possibly between species. The male pleopod 1 of the new species is of the triangular form typical of adult micheleids. Of seven males of *T. mindoro* Poore, 1997 in Museum Victoria the two larger specimens (cl, 5.0, 6.5 mm) possess bud-like pleopods 1 and in five specimens (cl, 2.2–5.0

mm) pleopod 1 is absent. None has a triangular pleopod 1 but might be anticipated in a larger male. The appendix masculina is present on all pleopods 2.

Besides the new species described below, *Tethisea mindoro* occurs in Western Australia, the only Australian state in which the genus occurs.

***Tethisea alanwilliamsi* sp. nov.**

Figures 3, 4

Tethisea sp. MoV5472.—Poore et al., 2008: 95.

Material examined. Holotype. Western Australia, off Pt Hillier (35°22.53'S–35°22.56'S, 117°12.11'E–117°11.31'E), 419–460 m, 22 Nov 2005 (stn SS10/2005/096), NMV J55604 (male, cl 9.7 mm).

Diagnosis. Rostrum with convex lateral margins meeting at subacute tip. Maxilliped 3 without exopod. Cheliped without strong spiniform setae in gape; fingers moderately stout, not finely attenuating. Uropodal exopod 1.3 times as long as wide.

Description. Cephalothorax 0.35 total length, about 1.1 times as deep as wide; rostrum with convex lateral margins, obscuring eyes from dorsal view, meeting at subacute tip, slightly depressed distally, with dorsal setae along lateral carinae, 1.6 times as long as broad at base of eyes, almost 3 times as long as eyestalks; lateral carinae extending on to cephalothorax, without median carina; cervical groove weakly defined; dorsoposterior margin a convex medial lobe, separated from posterolateral margins; without setal-row.

Pleomere 1 narrower than pleomere 2, with anterolateral lobes overlying posterolateral margins of cephalothorax; pleuron without marginal spine; dorsolateral setal-row of 7 setae. Pleomere 2 1.5 times as long as first, pleuron broadly overlapping first somite. Pleomeres 2–5 without setal-rows. Pleomere 6 with longitudinal setal-row of about 10 setae.

Eyestalks acute distally, cornea pale, distal.

Antennule with article 1 shorter than rostrum; articles 2 and 3 subequal, each about 0.4 length of article 1; flagella each of c. 14 articles, longer than peduncle. Antenna with long acute articulating scaphocerite, 0.85 length of article 4; article 4 reaching to near end of article 3 of antenna 1; article 5 short.

Mandible, maxillae, maxillipeds 1 and 2 typical of genus. Maxilliped 3 ischium with crista dentata of 7 blunt teeth; merus without mesial tooth; ischium–merus with dense mesial rows of long setae; carpus–dactylus longer than ischium–merus; exopod almost semicircular, length about half width of ischium.

Chelipeds equal in size but with slight variation in spination; ischium with distal spine on lower margin; merus with 3 (right) and 2 (left) spines on lower margin, upper margin strongly convex; carpus unarmed, carinate on upper margin; propodus 2.8 times as long as deep, deepest at midpoint, with carinate upper and lower margins, almost folded over on upper; fixed finger 0.3 length of propodus, with proximal blunt tooth on cutting edge, more prominent on left; gape slight, without long spiniform setae laterally; dactylus cutting edge concave proximally, blunt. Pereopod 2 merus–propodus with lower marginal rows of long setae; carpus 0.6 length of merus; propodus as long as carpus, without setal-row; fixed finger cutting edge with numerous contiguous spiniform setae;

dactylus longer than fixed finger, straight. Pereopod 3 propodus 1.3 times as long as wide, upper and lower margins convex, posterior face densely setose, the whole forming a shallow oval dish-like surface, without setal-row; dactylus broad. Pereopod 4 propodus 1.8 times as long as wide, without setal-row; dactylus broad. Pereopod 5 propodus with short fixed finger; dactylus curved, about 3 times as long as fixed finger, distally rounded.

Pleopods 1 of male 2-articled, second article 4 times as long as wide, with medial lobe bearing minute hooks. Pleopod 2 missing. Pleopod 3 endopod 3.8 times as long as wide; appendix interna 10 times as long as wide; exopod twice as long as wide, ovate. Pleopods 4 and 5 essentially similar to pleopod 3.

Uropodal endopod with anterior margin weakly convex, ending by curving to rounded posterior margin, 1.3 times as long as wide; exopod with shallow concave anterior margin, apically rounded, posterior margin broadly lobed, 1.3 times as long as wide; with uneven robust setae among many plumose setae. Telson 1.1 times as long as wide, tapering to truncate apex beyond constriction one-third way along.

Distribution. Western Australia, 35°S, 117°E, 419–460 m.

Etymology. For Alan Williams, CSIRO Marine Laboratories, Hobart, promoter and organiser of the much-appreciated Voyages of Discovery research program, especially in Western Australia.

Remarks. *Tethisea alanwilliamsi* differs from *T. indica* Poore, 1994 and *T. mindoro* Poore, 1997 in the absence of strong spiniform setae in the gape of the cheliped. The outline of the rostrum in dorsal view is intermediate between that of the described species; the cheliped is more robust and its fingers not of their attenuating acute form.

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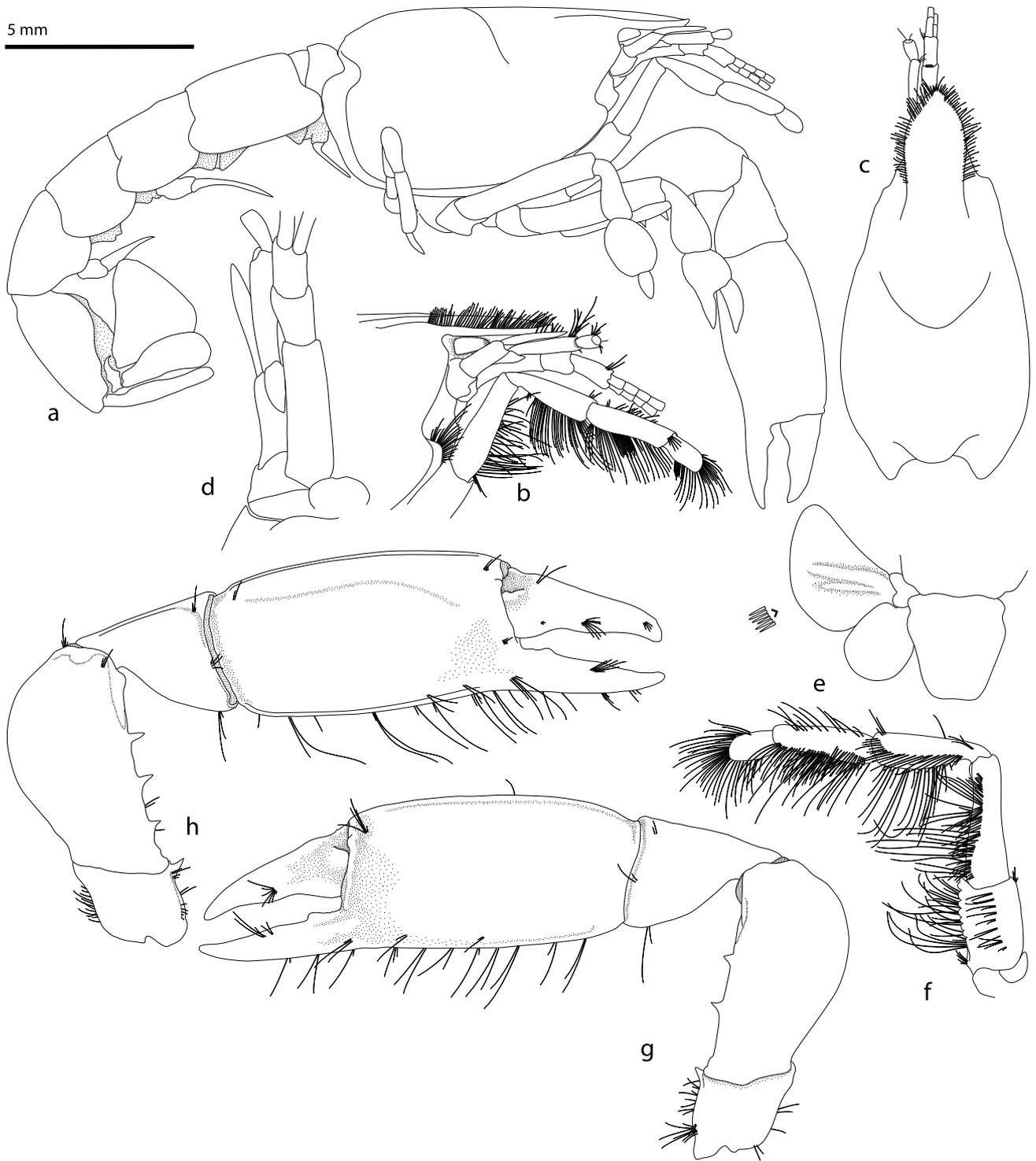


Figure 3. *Tethisea alanwilliamsi* sp. nov. Holotype, NMV J55604. a, habitus. b, c, anterior carapace, antennules, antennae, in lateral and dorsal views. d, antennules, antennae, in ventral view. e, telson (long marginal setae not shown, marginal robust setae in detail) and uropods (marginal setae not shown). f, maxilliped 3. g, h, left and right chelipeds. Scale bar applies to habitus only.

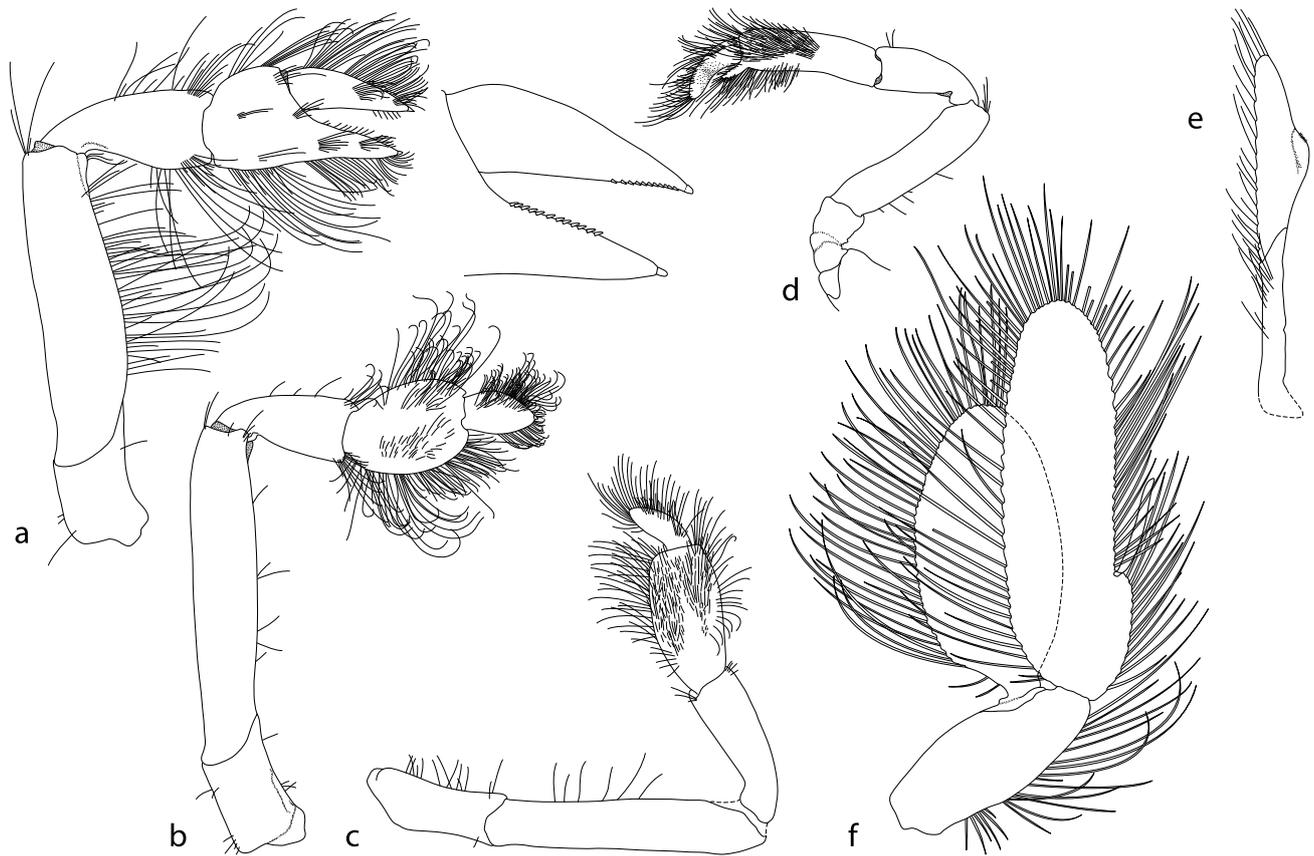


Figure 4. *Tethisea alanwilliamsi* sp. nov. Holotype, NMV J55604. a–d, pereopods 2–5. e, f, male pleopods 1, 3.

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