



Six closely related species of the *Copidognathus gibbus* group (Acarina: Halacaridae) from north-eastern Australia

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Abstract: During a survey of the halacarid fauna of the Great Barrier Reef and reefs of the Coral Sea 70 species of *Copidognathus* were collected, among them 31 species of the *gibbus* group. Five new and closely related species in this group, namely *C. aenigmatus* sp. nov., *C. asketus* sp. nov., *C. seductus* sp. nov., *C. squarrosus* sp. nov. and *C. thompsoni* sp. nov., are described. *C. canaliculifer* is also recorded from the Great Barrier Reef. The holotype and paratype of this species are found to differ and the consequences of this observation are discussed. *C. canaliculifer* plus the five new and three previously described species are found to form an easily recognizable group that is characterized by wide and densely punctate idiosomal plates and a series of arched dorsolateral striae.

Résumé : Six espèces étroitement apparentées du groupe *Copidognathus gibbus* (Acarina : Halacaridae) du nord-est de l'Australie. Durant notre étude de la faune des Halacariens de la Grande Barrière de Corail ainsi que des récifs coralliens de la Mer de Corail, 70 espèces de *Copidognathus* ont été récoltées, dont 31 espèces du groupe *gibbus*. Cinq nouvelles espèces très voisines de ce groupe, à savoir, *C. aenigmatus* sp. nov., *C. asketus* sp. nov., *C. seductus* sp. nov., *C. squarrosus* sp. nov. et *C. thompsoni* sp. nov., sont décrites. *C. canaliculifer* est aussi signalée dans les récifs coralliens de la Grande Barrière de Corail. Les holotype et paratype chez cette espèce sont différents et les conséquences de ceci sont discutées. *C. canaliculifer* avec les cinq nouvelles espèces ainsi que trois espèces décrites précédemment forment un groupe facilement reconnaissable, caractérisé par des lamelles idiosomales larges et ponctuées et une série de stries dorso-latérales arquées.

Keywords : Acarina, Halacaridae, *Copidognathus gibbus* group, Great Barrier Reef, Coral Sea, new species description

Introduction

With approximately 300 described species, *Copidognathus* is the largest known genus of the predominantly marine mite family Halacaridae. Many species can be assigned to clearly defined species groups, of which the *gibbus* group with 42 described species (Bartsch, 1997) is among the most

diverse. Although the *gibbus* group is known world-wide, from polar to tropical regions, it appears to have reached a particular high diversity in the southern hemisphere (Bartsch, 1997), perhaps best exemplified by the occurrence of twelve species on the small Western Australian Island of 'Rottneest' (Bartsch, 1994).

A survey of the halacarid fauna of the Great Barrier Reef and reefs of the Coral Sea, from where previously only a single species of *Copidognathus* had been described (Bartsch, 1996), is currently under way and has so far

revealed 70 species of *Copidognathus*, 31 belonging to the *gibbus* group (Otto, unpublished). The present paper, part of a series of publications on the northeastern Australian halacarid fauna which resulted from this survey (Otto, 1999a-c, 2000a-h; Otto & Bartsch, 2000), reports on six closely related species in this group.

Material and methods

All material was collected by the author except where stated otherwise. Mites were cleared in lactic acid and mounted in PVA or glycerol. Drawings were made with the aid of a camera lucida from compressed specimens. In the accounts of each species only one sex is described in detail, the opposite sex is described only in characters that differ. All characters were seen on all specimens except for the shape of the ocular plate which is usually obscured by other idiosomal plates and can be clearly seen only in a few specimens.

Abbreviations in descriptions: AD, anterior dorsal plate; AE, anterior epimeral plate; ds-1 to ds-6, dorsal idiosomal setae (excluding those on posterior epimeral plate) numbered in sequence from anterior to posterior; GA, genitoanal plate; glp-1 to glp-4, dorsal gland pores numbered in sequence from anterior to posterior; GO, genital opening; OC, ocular plate; pas, parambulacral seta; PD, posterior dorsal plate; PE, posterior epimeral plate; pgs, perigenital seta(e); P-2, P-3, P-4, second, third and fourth palp segments, respectively, counted from base of palp; sgs, subgenital seta(e); I-IV, leg I to leg IV. Additional abbreviations used in the illustrations are explained in the captions. Great Barrier Reef Marine Park is abbreviated GBR.

All specimens with an accession number prefix QMS are deposited in the Queensland Museum (QM), at the branch Museum of Tropical Queensland in Townsville. Other depositories: ANIC, Australian National Insect Collection, Canberra (Australia); ZMH, Zoologisches Museum Hamburg (Germany).

Systematics

Copidognathus Trouessart, 1888

Diagnosis

Dorsal and ventral plates well developed (Fig. 1 A,C), occasionally fused (Figs 3A, 8A). AE with pair of epimeral pores (Fig. 1C). Female GA with three pairs pgs and one pair sgs (Fig. 1C). Male

GA with at least four pairs pgs and with three or four pairs sgs (Fig. 5E).

Rostrum more or less triangular (Fig. 1D). Tectum with small spine or huge crest. Majority of species with one pair of maxillary setae on gnathosomal base and one pair on rostrum (Fig. 1D). Palp four-segmented, slender (Fig. 1E); P-2 with one dorsal seta (Fig. 1E, 6D); P-3 lacking seta; P-4 with three setae in basal whorl and minute apical seta.

Tibiae I and II each with three and tibiae III and IV each with two ventral or medioventral setae (Fig. 4B,D,G), usually two of these on tibiae I and II and one of these on tibiae III and IV bipectinate, the other glabrous or serrated. Tarsus I with three dorsal and three ventral setae (Fig. 4F),

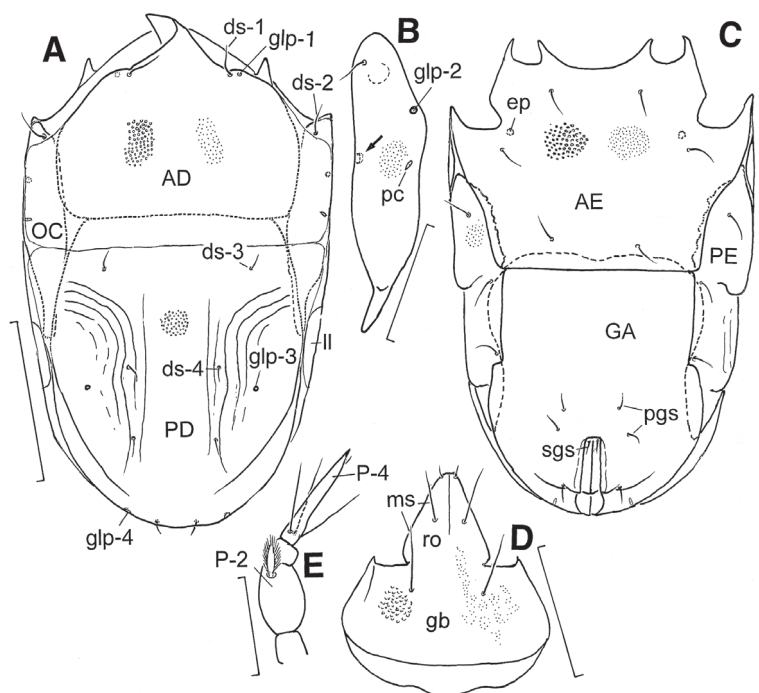


Figure 1. *Copidognathus aenigmatus* sp. nov., female. **A** idiosoma, dorsal view. **B** ocular plate. **C** idiosoma, ventral view. **D** gnathosomal base and rostrum, ventral view. **E** palp, dorsal view. (AD) anterior dorsal plate; (AE) anterior epimeral plate; (ds-1) to (ds-4) dorsal idiosomal setae; (ep) epimeral pore; (GA) genitoanal plate; (gb) gnathosomal base; (glp-1) to (glp-4) gland pores 1-4; (ll) lateral lamella; (ms) maxillary setae; (OC) ocular plate; (pc) pore canaliculus; (PD) posterior dorsal plate; (PE) posterior epimeral plate; (P-2, P-4) palp segments 2 and 4; (pgs) perigenital setae; (ro) rostrum; (sgs) subgenital setae. Scale bars: A, C 100 µm; B, D 50 µm; E 25 µm.

Figure 1. *Copidognathus aenigmatus* sp. nov., femelle. **A** idiosome, vue dorsale. **B** plaque oculaire. **C** idiosome, vue ventrale. **D** vue ventrale de la base du gnathosome et du rostre. **E** palpe, vue dorsale. (AD) plaque dorsale antérieure; (AE) plaque épimérale antérieure; (ds-1) à (ds-4) soies dorsales 1-4 de l'idiosome; (ep) pore épiméral; (GA) plaque génitoanale; (gb) base du gnathosome; (glp-1) à (glp-4) pores des glandes 1-4; (ll) lamelle latérale; (ms) soie maxillaire; (OC) plaque oculaire; (pc) pore canaliculaire; (PD) plaque dorsale postérieure; (PE) plaque épimérale postérieure; (P-2, P-4) segments 2 et 4 du palpe; (pgs) soie périgénitale; (ro) rostre; (sgs) soie subgénitale. Echelles: A, C 100 µm; B, D 50 µm; E 25 µm.

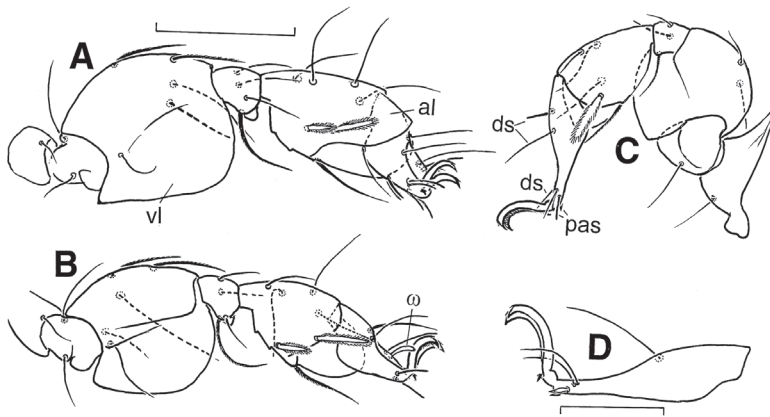


Figure 2. *Copidognathus aenigmatus* sp. nov., adult. **A** leg I, medial view. **B** leg II, medial view. **C** leg III, medial view. **D** tarsus IV, medial view. (al) articular lamella; (ds) dorsal setae; (pas) parambulacral seta(e); (vl) ventral lamella; (ω) solenidion. Scale bars : A, B, C 50 μm; D 25 μm.

Figure 2. *Copidognathus aenigmatus* sp. nov., adulte. **A** patte I, vue médiane. **B** patte II, vue médiane. **C** patte III, vue médiane. **D** tarse IV, vue médiane. (al) lamelle articulaire; (ds) soie dorsale; (pas) soie parambulacraire; (vl) lamelle ventrale; (ω) solenidion. Echelles : A, B, C 50 μm; D 25 μm.

tarsus II with three dorsal setae, but no ventral seta (Fig. 4I), both tarsi with solenidion in dorsolateral position. Tarsi III and IV with three or four dorsal but no ventral setae (Fig. 4E,H). Paired claws large, median claw small (Fig. 4E). One larval and one nymphal stage.

gibbus group - Newell, 1971

Diagnosis

Trochanters III and IV each with triangular dorsal process (Fig. 2C); telofemora I-IV with very large ventrolateral lamella; tibiae I and II, often also tibiae III and IV, with pair of articular lamellae (Fig. 2A); tarsi I and II each with a large lateral membrane of claw fossa (Fig. 4F); tarsi III and IV slender and the membranes of claw fossa very small or absent (Fig. 4E). Number of setae from trochanter to tibia: I 1-2-5-4-7, II 1-2-5-4-7, III 1-1/2-2-3-5, IV 0-1/2-2-3-5.

Remarks

Apart from the diagnostic characters of *Copidognathus* and the *gibbus* group, the species described here share other characters which are also not included in their descriptions: idiosoma anteriorly with pointed protuberance (Fig. 5A), in slide-mounted specimens, often bent due to compression by the cover slip (Figs 1A, 3A). Membranous cuticle between plates strongly reduced or absent (Figs 1A,C; 3A,C). Anteriorly with ds-1 and glp-1 adjacent (Fig. 1A). Dorsal and ventral plates densely pierced by canaliculi (Fig. 1A,C). Two pairs of pores (glp-3, glp-4) posteriorly (Fig. 1A), glp-4 often seen ventrally in slide-mounted specimens due to compression (Fig. 3C). Idiosoma posteriorly with series of strips of slightly thickened cuticle on either side, their edges

forming arched parallel striae which are indented at level of glp-3 (Figs 1A, 3A, 5A, 6A); the medial-most of the striae usually more pronounced and more complete than the others. OC oblong, at least as long as 1/3 of idiosoma (Fig. 1A); cornea absent or poorly defined; glp-2 and pore canaliculus near lateral margin (Fig. 1B) but in mounted specimens glp-2 usually seen ventrally due to compression (Fig. 5C). GA laterally with net-like ornamentation (Figs 3C, 5C); female with two pairs pgs directly anterior to GO and third pair near posterior margin of GO (Figs 1C, 5C).

Segment P-4 at least as long as P-2 (Fig. 1E). Rostrum shorter than gnathosomal base (Fig. 1D) and approximately as long as wide.

Tibiae I and II ventrally with two dent-like processes (Fig. 4B). Dorsal setae on telofemur I and II, ventral setae on all genua and ventral setae on tibiae I-IV or II-IV slightly serrated (Figs 2A,B,C; 4A-E,G). Tarsi II-IV with pair of pas-singlets. Tarsus III with four dorsal setae (Fig. 4H). Paired claws of II and III with pecten and accessory process (Fig. 4H,I), those of I and IV apparently smooth but with accessory process (Fig. 4E,F). Basifemur III with one seta (Fig. 2C).

Descriptions

Copidognathus aenigmatus sp. nov. (Figs 1, 2)

Material examined

Holotype, female, QMS105547, Coral Sea, South Willis Island, ca. 16°18'S 149°58'E, 15 Sep. 1998, G. A. Diaz-Pulido, coral rubble at 0-10 m. Paratypes: 3 females, QMS105544-105546, Coral Sea, Lihou Reef, ca. 17°25'S 151°40'E, D. Fenner, sand at 7 m; female, ZMH A36/00, Coral Sea, Flinders Reefs, 17°42.73'S 148°26.29'E, A. Burja, coarse sand at 5 m.

Female

Idiosoma 303-346 μm long (holotype 317 μm). AD and PD separate (Fig. 1A); AD drawn out into very delicate barely visible membranous flap that conceals part of OC and anterior part of the PD. Similar flaps also laterally on the PD. Canaliculi on AD and PD surfacing through shallow pits (on right and left, respectively, in Fig. 1A,C). Setae ds-3 on PD, 1.4-1.5 times further apart than ds-4. OC opposite pore canaliculus with a pore-like mark (arrowed in Fig. 1B); posterior margin developed into short tail. PE laterally with lamella. GA in deeper layers (broken line in Fig. 1C) widened and overlapping with AE and PE anteriorly.

Ventral gnathosomal base with shallow pits on surface and canaliculi in deeper layers (on left and right in Fig. 1D,

respectively). Seta on P-2 plumose (Fig. 1E); all three basal setae on P-4 inserted no further than 5 μ m from proximal end of segment.

Ventral lamella of telofemur I as smooth as that of telofemur II. Pectination of distal bipectinate seta on tibia I (Fig. 2A) and of bipectinate setae on tibiae III and IV (Fig. 2C) as fine as that of distal bipectinate seta on tibia II (Fig. 2B). Proximal bipectinate seta on tibia II slightly longer than half the other. Tarsus IV with three dorsal setae (Fig. 2D). Solenidion on tarsus II apically swollen (Fig. 2B), that on tarsus I slender. Pectination of claws on legs II and III only on apical half.

Male : Unknown.

Etymology : aenigma [Latin] = something obscure.

Remarks

Copidognathus aenigmatus sp. nov. is most similar to *C. bispinus* Bartsch, 1994, and *C. laminifer* Bartsch, 1994, both from Rottnest Island in Western Australia. It differs from *C. bispinus* by having setae ds-3 inserted 1.4–1.5 times further apart than setae ds-4 instead of both pairs being inserted equally far apart. Both species also differ in size with *C. aenigmatus* being larger than *C. bispinus* (females of the latter species measure 219–242 μ m in length). From Bartsch's (1994) illustration of the palp of *C. bispinus* the seta on P-2 appears to be smooth. However, examination of the holotype revealed that this seta is plumose as in *C. aenigmatus* and this character therefore does not separate these species.

The most conspicuous differences between *C. aenigmatus* and *C. laminifer* are the fusion of AE and GA and the presence of a heavy serrated bristle on genu I in the latter species.

Copidognathus asketus sp. nov. (Figs 3, 4)

Material examined

Holotype, female, QMS105482, 18°42.03'S 147°06.54'E, Loadstone Reef, 12 Apr. 1998, coral rubble at 12–15 m. Paratypes: male, QMS105483, female, QMS105484, data as for holotype; female, ZMH A37/00, 18°42.05'S 147°05.98'E, Loadstone Reef, 12 Apr. 1998, coarse sand and rubble at 8 m; female, 18°41.91'S 147°06.49'E, Loadstone Reef, 12 Apr. 1998, sand and rubble at 2 m (ANIC); 2 males, QMS105485/105486, female, QMS105487, 19°20.12'S

149°02.85'E, Elizabeth Reef, 25 Dec. 1997, coarse sand and rubble at 3 m; 2 males, QMS105488/105489, 4 females, QMS105490–105493, 19°22.36'S 149°01.05'E, Club 21 Reef, 26 Dec. 1997, coarse sand and rubble at 15 m; female, QMS105494, male, QMS105495, Elizabeth Reef & Club 21 Reef, 24–26 Dec. 1997, sand, rubble and *Halimeda* at 3–26 m; male, QMS105496, female, QMS105497, 18°16.69'S 147°23.21'E, Myrmidon Reef, 14 Apr. 1998, coarse sand and rubble at 17 m; male, QMS105498, female, QMS105499, 18°16.69'S 147°23.21'E, Myrmidon Reef, 14 Apr. 1998, coarse sand at 17 m; 3 males, QMS105500–105502, female, QMS105503, 18°26.36'S 146°42.24'E, Bramble Reef, 9 Apr. 1998, sand and rubble at 6–15 m; female, QMS105504, 18°25.70'S 146°40.90'E, Bramble Reef, 9 Apr. 1998, sand & rubble at 12 m; 2 females, QMS105505/105506, 18°38.25'S 147°04.42'E, John

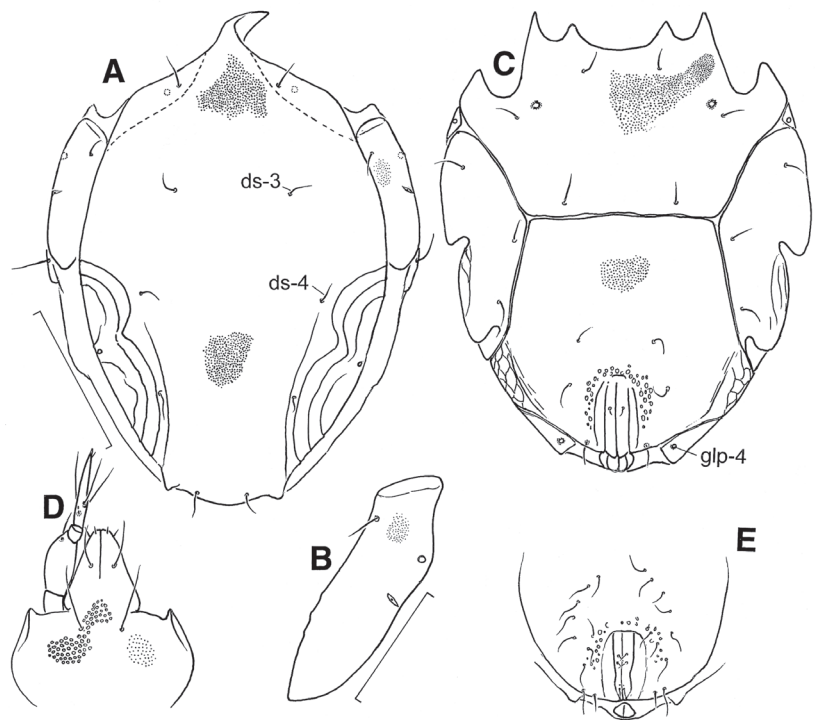


Figure 3. *Copidognathus asketus* sp. nov., adult. **A** idiosoma of female, dorsal view. **B** right ocular plate. **C** idiosoma of female, ventral view. **D** gnathosoma, ventral view. **E** posterior part of male genitoanal plate. (ds-3) and (ds-4) dorsal idiosomal setae; (glp-4) gland pore 4. Scale bars : **A**, **C**, **E** 100 μ m; **B**, **D** 50 μ m.

Figure 3. *Copidognathus asketus* sp. nov., adulte. **A** vue dorsale de l'idiosome de la femelle. **B** plaque oculaire droite. **C** vue ventrale de l'idiosome de la femelle. **D** gnathosome, vue ventrale. **E** partie postérieure de la plaque génitoanale du mâle. (ds-3) et (ds-4) soies dorsales de l'idiosome ; (glp-4) pore de la glande 4. Echelles : **A**, **C**, **E** 100 μ m; **B**, **D** 50 μ m.

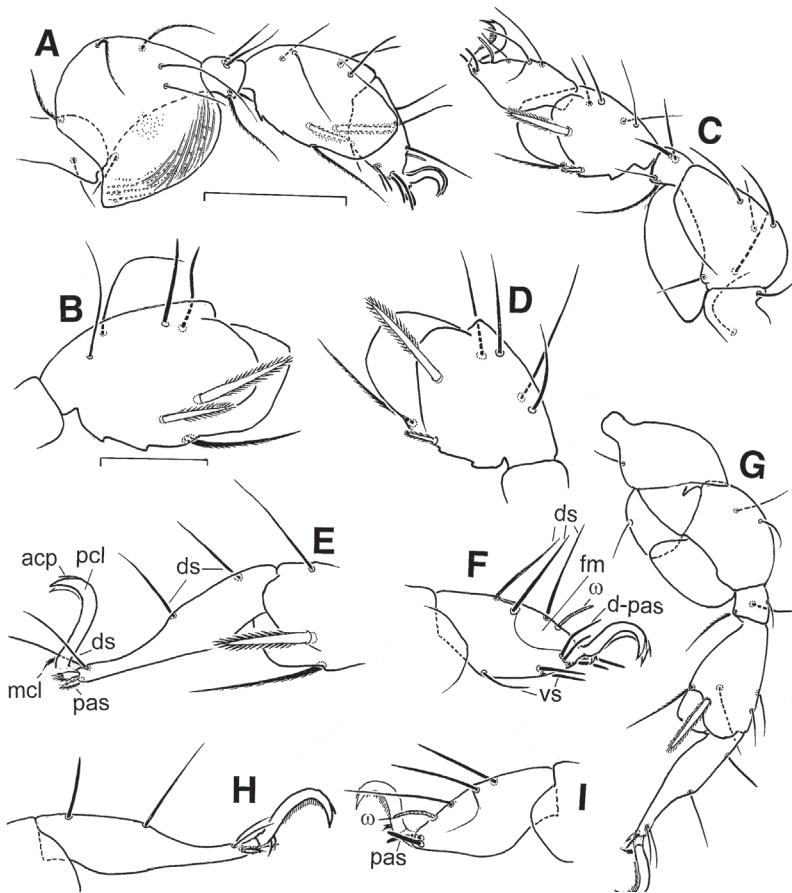


Figure 4. *Copidognathus asketus* sp. nov., adult. **A** leg I, lateral view. **B** tibia I, medial view. **C** leg II, medial view. **D** tibia II, medial view. **E** tarsus and apical part tibia IV, medial view. **F** tarsus I, medial view. **G** leg III, medial view. **H** tarsus III, lateral view. **I** tarsus II, medial view. (*acp*) accessory process; (*d-pas*) doubled parambulacral seta; (*fm*) lateral membrane of claw fossa; (*ds*) dorsal setae; (*mcl*) median claw; (*pas*) parambulacral seta; (*pcl*) paired claw; (*vs*) ventral setae; (ω) solenidion. Scale bars : **A, C, G** 50 μ m; **B, D, E, F, H, I** 25 μ m.

Figure 4. *Copidognathus asketus* sp. nov., adulte. **A** patte I, vue latérale. **B** tibia I, vue médiane. **C** patte II, vue médiane. **D** tibia II, vue médiane. **E** tarse et partie apicale du tibia IV, vue médiane. **F** tarse I, vue médiane. **G** patte III, vue médiane. **H** tarse III, vue latérale. **I** tarse II, vue médiane. (*acp*) processus accessoire; (*d-pas*) double soie parambulacraire; (*ds*) soies dorsales; (*fm*) membrane latérale de la griffe; (*mcl*) griffe médiane; (*pas*) soie parambulacraire; (*pcl*) double griffe; (*vs*) soies ventrales; (ω) solenidion. Echelles : **A, C, G** 50 μ m; **B, D, E, F, H, I** 25 μ m.

Brewer Reef, 11 Apr. 1998, coarse sand at 15 m; male, ZMH A37/00, 21°09.80'S 151°41.77'E, Reef 21-155, 20 Apr. 1999, coarse sand (mainly *Halimeda* flakes) at 15 m; female, QMS105507, 21°57.54'S 152°04.60'E, Reef 21-551, flank, 14 Apr. 1999, coarse sand at 10-15 m; female, QMS105508, ca. 14°36'S 145°38'E, Yonge Reef, 10 Oct. 1998, coral rubble at 9 m; female QMS105509, 18°25.93'S 147°21.11'E, Faraday Reef, 13 Apr. 1998, coarse sand & rubble at 6-9 m.

Female

Idiosoma 303-343 μ m long (holotype 335 μ m). AD and PD

fused (Fig. 3A). Setae ds-4 further apart than ds-3. OC broad throughout, posterior margin slightly pointed but not forming a distinct tail (Fig. 3B). AE with canaliculi increasing in density towards lateral margin of plate (Fig. 3C); no reticulation visible. GO anterolaterally lined by a series of irregularly shaped shallow pits.

Gnathosomal base coarsely pitted, in deeper layers with much finer canaliculi (on left and right side, respectively, in Fig. 3D). Distal-most basal seta on P-4 inserted ca. 9 μ m from proximal end of segment.

Lamella on telofemur I conspicuously ornamented with ridges and pits (Fig. 4A), that on other legs without such ornamentation (Fig. 4C,G). Proximal bipectinate seta on tibia II not longer than 1/3 of the other (Fig. 4D). Tarsus IV with four dorsal setae (Fig. 4E). Solenidion on tarsus II (Fig. 4I) similar to that of tarsus I (Fig. 4F).

Male : Idiosoma 293-333 μ m long. GA surrounded by 19-21 pgs (Fig. 3E).

Etymology : asketos [Greek] = ornamented; referring to the conspicuous ornamentation of the telofemur of the front legs.

Remarks

Among the species of the *Copidognathus gibbus* group *Copidognathus asketus* sp. nov. is most similar to *C. canaliculifer* Bartsch, 1994, *C. scutellus* Bartsch, 1985, *C. seductus* sp. nov., *C. squarrosus* sp. nov. and *C. thompsoni* sp. nov., all of which have the AD and PD fused. *C. asketus* can be distinguished from these species by having a series of pits surrounding the GO.

Copidognathus canaliculifer
Bartsch (Fig. 5)

Copidognathus canaliculifer
Bartsch, 1994: 541

Material examined

Male, QMS105521, ca. 14°36'S 145°38'E, Yonge Reef, 10 Oct. 1998, A. Thompson, fine-medium coarse sand at 5 m; male, QMS105522, ca. 14°36'S 145°38'E, Yonge Reef, G. Diaz-Pulido, medium coarse sand at 7 m; female, QMS105510, 2 females ZMH A41/00 and (ANIC), Howard Patch, ca. 22°24'S 152°37' E, 6 July 1998, D. Fenner, sand at 6 m; male, QMS105511, female, QMS105512, Reef 21-151, back, 21°07'S 151°45' E, 20 Apr. 1999, medium coarse sand at 2 m; male, QMS105513, Reef 21-433, 21°33'S 151°28'E, 22 Apr. 1999, coarse sand at 0.5 m; 3

males, QMS105514-105516, 18°41.29'S 147°05.83'E, Loadstone Reef, 11 Apr. 1998, coarse sand at 1-6 m; 2 females, QMS105517/105518, 18°25.25'S 146°40.65'E, Bramble Reef, 10 Apr. 1998, medium coarse sand at 3-6 m; female, QMS105519, ca. 14°39'S 145°40'E, No Name Reef, reef flat, 9 Oct. 1998, A. Thompson, coarse sand at 5 m; female, QMS105520, Lizard Island, Horseshoe Reef, ca. 14°41'S 145°27'E, 13 Oct. 1998, coarse sand at 3 m.

Female

Idiosoma 293-313 µm long. AD and PD fused (Fig. 5A). Seta ds-4 further apart than ds-3. OC posteriorly tail-like (Fig. 5B). Canaliculi on medial part of AE less densely distributed than near lateral margins and forming aggregations (Fig. 5C), in some specimens more clearly visible than in others. Area surrounding GO finely punctate or smooth.

Punctations on gnathosomal base (Fig. 5D) at least as fine as those on lateral parts of AE. Distal-most basal seta on P-4 inserted no further than 8 µm from proximal end of P-4, equivalent to 0.3 of entire length of P-4.

Ornamentation on lamella of telofemur I in form of ridges (Fig. 5F) more poorly developed than in previous species. Length of proximal bipectinate seta on tibia II at least half the other (Fig. 5G). Pectination of all bipectinate setae equally fine. Tarsus IV with three dorsal setae (Fig. 5H). Solenidion on tarsus II similar to that of tarsus I.

Male

Idiosoma 293-303 µm long. GA surrounded by 12 pgs, arranged more or less in a single row on either side (Fig. 5E).

Remarks

On examination of the holotype of *C. canaliculifer* I found three dorsal setae on both tarsi IV, contrary to Bartsch's (1994) description of four dorsal setae, while four setae are clearly visible in the paratype. Either holotype and paratype belong to separate species or this species is polymorphic for this character. The number of dorsal setae on the tarsus IV is extremely constant within halacarid species. Newell (1971) reported having found an exception in *C. sinuosus*, with some specimens apparently showing three setae while others possess four setae. However, his statement that the specimens with four setae occurred at greater depths than those with three setae raises the question whether they are in

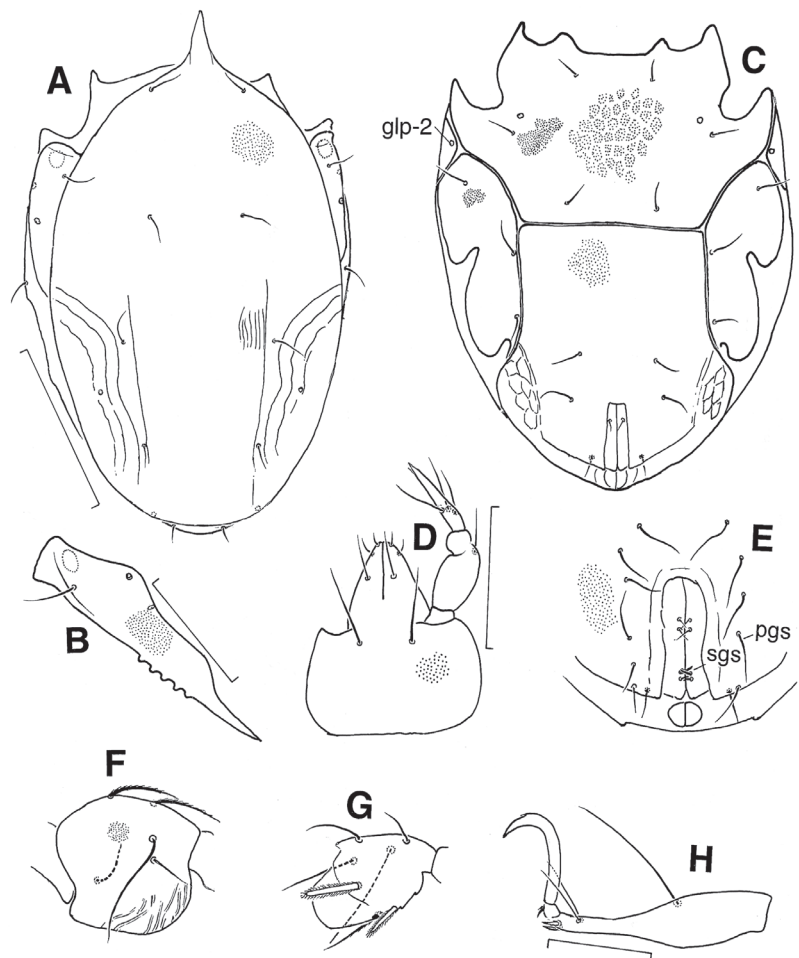


Figure 5. *Copidognathus canaliculifer* Bartsch, adult. **A** idiosoma, dorsal view. **B** right ocular plate. **C** idiosoma of female, ventral view. **D** gnathosoma, ventral view. **E** genital opening of male. **F** tibia I, lateral view. **G** tibia II, medial view. **H** tarsus IV, lateral view. (glp-2) gland pore 2; (pgs) perigenital seta; (sgs) subgenital setae. Scale bars : **A, C** 100 µm; **B, D, E, F, G** 50 µm; **H** 25 µm.

Figure 5. *Copidognathus canaliculifer* Bartsch, adulte. **A** idiosome, vue dorsale. **B** plaque oculaire droite. **C** idiosome de la femelle, vue ventrale. **D** gnathosome, vue ventrale. **E** pore génital du mâle. **F** tibia I, vue latérale. **G** tibia II, vue médiane. **H** tarse IV, vue latérale. (glp-2) pore de la glande 2 ; (pgs) soie périgénitale ; (sgs) soie subgénitale. Echelles : **A, C** 100 µm ; **B, D, E, F, G** 50 µm ; **H** 25 µm.

fact of the same species. Newell's observation therefore does not necessarily contradict the constancy and reliability of this character.

In addition to the number of setae on tarsus IV, holotype and paratype of *C. canaliculifer* also differ, if only slightly, in the proximal setae on P-4; in the holotype these are slightly further apart than in the paratype (Figs 19, 20 in Bartsch, 1994, respectively). The position of these setae was found also to be fairly constant in related species and on balance, I therefore regard it as most likely that holotype and paratype belong to separate species. However,

examination of further material from Rottneest Island and perhaps genetic studies may be needed to prove this idea.

The males from the Great Barrier Reef (GBR) differ slightly from the Western Australian holotype in the number of perigenital setae (pgs). While in the GBR specimens twelve pgs were consistently observed, 15 setae are described for the holotype. The number of male pgs is often variable within species. Until further males from Western Australia can be examined the significance of this difference remains in doubt.

Copidognathus seductus sp. nov. (Fig. 6)

Material examined

Holotype, male QMS105526, Coral Sea, Lihou Reef, ca. 17°25'S 151°40'E, 22 July 1998, D. Fenner, sand at 8 m. Paratypes: 2 males, QMS105527-105529, female, QMS105530, data as holotype; 3 females, QMS105531-105533, 2 males ZMH A38/00 and (ANIC), Coral Sea, Flinders Reefs, ca. 17°35'S 148°27'E July 1998, D. Fenner, sand.

Female

Idiosoma 293-319 µm long. AD and PD fused (Fig. 6A). Seta ds-4 further apart than ds-3. Posterior margin of OC developed into a narrow tail (Fig. 6B). AE with faint reticulation, most clearly visible anteriorly (Fig. 6C). Area surrounding GO finely punctate or smooth, not coarsely pitted.

Punctations on gnathosomal base at least as fine as those on AE. The distal-most basal seta on P-4 (arrowed in Fig. 6D) inserted 13 µm from proximal end of segment, equivalent to 0.43 of entire length of P-4.

Ornamentation on lamella of telofemur I poorly developed (Fig. 6H). Proximal bipectinate seta on tibia II half the length of the other or slightly shorter (Fig. 6E). Pectination of bipectinate setae of all legs equally fine (Fig. 6E,F,G). Tarsi III and IV each with four dorsal setae (Fig. 6I). Solenidion on tarsus II similar to that on tarsus I.

Male

Idiosoma 293-317 µm long (holotype 317 µm). GA surrounded by 18-20 pgs (Fig. 6C), posterior ones usually obscured by GA.

Etymology: *seductus* [Latin] = remote, apart; referring to the species occurrence on the isolated reefs in the Coral Sea.

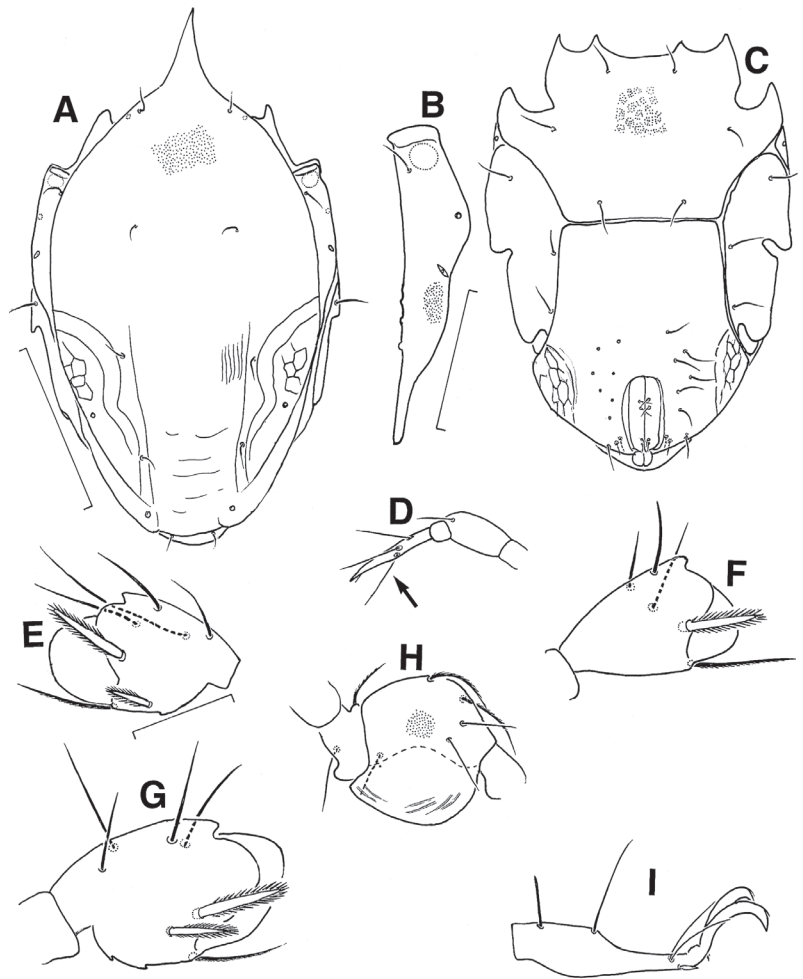


Figure 6. *Copidognathus seductus* sp. nov., adult. **A** idiosoma, dorsal view. **B** right ocular plate. **C** idiosoma of male, ventral view. **D** palp, medial view. **E** tibia II, medial view. **F** tibia IV, medial view. **G** tibia I, medial view. **H** basifemur and telofemur I, lateral view. **I** tarsus IV, lateral view. Scale bars: **A**, **C** 100 µm; **B**, **D**, **H** 50 µm; **E**, **F**, **G**, **I** 25 µm.

Figure 6. *Copidognathus seductus* sp. nov., adulte. **A** idiosome, vue dorsale. **B** plaque oculaire droite. **C** idiosome du mâle, vue ventrale. **D** palpe, vue médiane. **E** tibia II, vue médiane. **F** tibia IV, vue médiane. **G** tibia I, vue médiane. **H** basifémur et telofémur I, vue latérale. **I** tarse IV, vue latérale. Echelles: **A**, **C** 100 µm; **B**, **D**, **H** 50 µm; **E**, **F**, **G**, **I** 25 µm.

Remarks

Among the species of the *gibbus* group with fused dorsal plates the only other ones with four dorsal setae on tarsus IV are *C. scutellus*, *C. asketus* sp. nov. and *C. canaliculifer*, the latter only if the paratype of this species is correctly identified (see remarks to *C. canaliculifer*). *C. seductus* differs from all three by the distal-most basal setae on P-4 being inserted at a distance from the proximal margin of the segment that is equivalent to 0.43 rather than 0.30 - 0.33 of the length of P-4.

Copidognathus squarrosus sp. nov. (Fig. 7)

Material examined

Holotype, male, QMS105534, Coral Sea, Lihou Reef, ca. 17°25'S 151°40'E, 20 July 1998, D. Fenner, sand at 5 m. Paratypes: 4 males, QMS105535-105538, 3 females, QMS105539-105541, 2 females ZMH A 39/00 and (ANIC), data as holotype except 20-22 July 1998, sand at 5-8 m; female, QMS105542, Coral Sea, Flinders Reefs, ca. 17°35'S 148°27'E, sand; male, QMS105565, female, QMS105566, female ZMH A 39/00, Coral Sea, Flinders Reefs, 17°47.22'S 148°24.65'E, 3 July 1999, coarse sand at 10 m; female, QMS105567, male ZMH A39/00, Coral Sea, Flinders Reefs, cay, 17°42.73'S 148°26.29'E, 2 July 1999, coarse sand mainly consisting of *Halimeda* flakes at 15 m; female, QMS105543, Coral Sea, Herald Cays, 16°57.171'S 149°12.036'E, 16 Sep. 1998, G. A. Diaz-Pulido, site 3.1.1, slope, coarse sand at 5-15 m.

Female

Idiosoma 297-303 µm long. AD and PD fused. Seta ds-4 further apart than ds-3. Posterior margin of OC tail-like (as for *C. seductus* in Fig. 6B). Canaliculi on AE distributed evenly, not conspicuously increasing in density towards lateral margin. Reticulation pattern on AE absent (Fig. 7A) or barely discernible. Area surrounding GO finely punctate or smooth.

Punctations on gnathosomal base slightly finer than on AE. Distal-most basal seta on P-4 inserted 13-14 µm from proximal end of P-4, equivalent to 0.43-0.48 of entire length of P-4 (as for *C. seductus* in Fig. 6D).

Ornamentation on lamella of telofemur I in form of

ridges and pits absent or very poorly developed. Proximal bipectinate seta on tibia II at least half the length of the other (Fig. 7E). Pectination of distal bipectinate seta on tibia I (Fig. 7B, arrowed) and bipectinate setae on tibiae III and IV (Fig. 7C) distinctly coarser than that of distal bipectinate seta on tibia II (Fig. 7E, arrowed). Tarsus IV with three dorsal setae (Fig. 7D). Solenidion on tarsi I and II similar.

Male

Idiosoma 299-305 µm long (holotype 299 µm). GA flanked by 15-18 pgs, not arranged in single row.

Etymology : *squarrosus* [L.] = rough; referring to the coarsely bipectinate setae on tibia I.

Remarks

The only other species of the *gibbus* group with fused dorsal plates and three dorsal setae on tarsus IV are *C. canaliculifer* and *C. thompsoni* sp. nov.. *C. squarrosus* sp. nov. can be distinguished from *C. canaliculifer* by the distal bipectinate seta on tibia I being more coarsely bipectinate than the distal bipectinate seta on tibia II. For differences between *C. squarrosus* and *C. thompsoni* see the remarks to the latter species.

Copidognathus thompsoni sp. nov. (Fig. 8)

Material examined

Holotype, male, QMS105548, GBR, Rosser Reef, ca. 15°37'S 145°33'E, 8 Oct. 1998, A. Thompson, sand & rubble at 4 m. Paratypes: male, QMS105549, male (ANIC), data as holotype; male, QMS105363, male (ZMH A 40/00, Reef 14-056, 14°19.5'S 144°57.5'E, 21 Oct. 1998, P. Tomkins, medium coarse sand.

Male

Idiosoma 295-306 µm long (holotype 303 µm). AD and PD fused. Seta ds-4 further apart than ds-3. OC progressively narrowing posteriorly without forming a distinct tail. Faint reticulation pattern on AE, best developed anteriorly (Fig. 8A). Area surrounding GO finely punctate or smooth. PE and GA fused (Fig. 8A). GA with 11-13 pgs, posterior-most pair often obscured.

Punctations on gnathosomal base at least as fine as that on ventral plates. The distal-most basal seta on P-4 inserted ca. 8 µm from proximal end of segment, equivalent to 0.3 of length of P-4.

Ornamentation in form of narrow ridges on lamella of telofemur I conspicuous, similar to that shown for *C. asketus* in Fig. 4A. Proximal bipectinate seta on tibia ca. half as long as the other. Pectination of distal

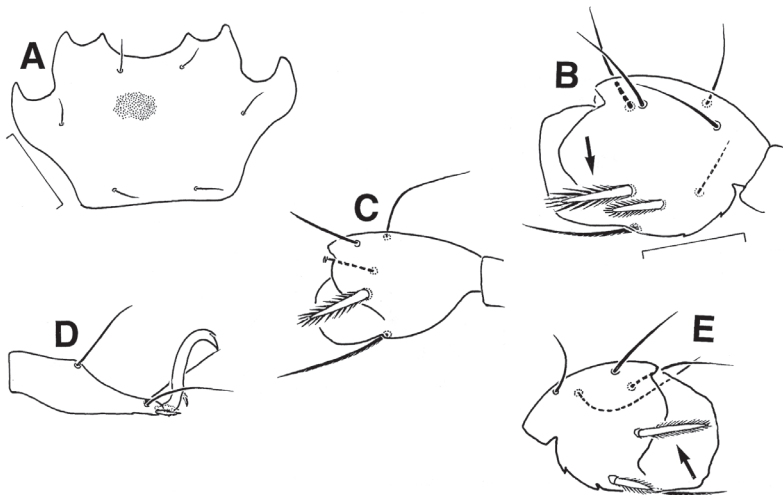


Figure 7. *Copidognathus squarrosus* sp. nov., adult. **A** anterior epimeral plate. **B** tibia I, medial view. **C** tibia IV, medial view. **D** tarsus IV, lateral view. **E** tibia II, medial view. Scale bars : **A** 50 µm; **B, C, D, E** 25 µm.

Figure 7. *Copidognathus squarrosus* sp. nov., adulte. **A** plaque antérieure épimérale. **B** tibia I, vue médiane. **C** tibia IV, vue médiane. **D** tarse IV, vue latérale. **E** tibia II, vue médiane. Echelles : **A** 50 µm; **B, C, D, E** 25 µm.

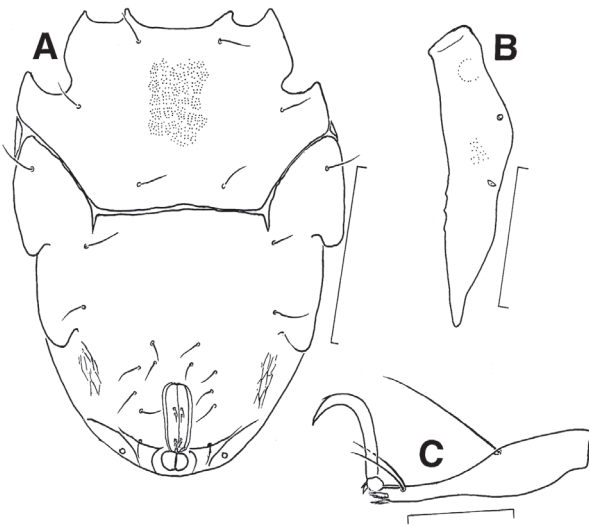


Figure 8. *Copidognathus thompsoni* sp. nov., female. **A** idiosoma, ventral view. **B** right ocular plate. **C** tarsus IV, medial view. Scale bars : **A** 100 µm; **B** 50 µm; **C** 25 µm.

Figure 8. *Copidognathus thompsoni* sp. nov., femelle. **A** idiosome, vue ventrale. **B** plaque oculaire droite. **C** tarse IV, vue médiane. Echelles : **A** 100 µm ; **B** 50 µm ; **C** 25 µm.

bipectinate seta on tibia I and bipectinate setae on tibiae III and IV as fine as that of distal bipectinate seta on tibia II. Tarsus IV with three dorsal setae (Fig. 8C). Solenidion on tarsus II similar to that of tarsus I.

Female: Unknown.

Etymology : In honour of Angus Thompson, who collected the holotype.

Remarks

Copidognathus thompsoni sp. nov. is the only species in the *gibbus* group that has a fused AD and PD as well as a fused GA and PE. I examined a female specimen (QMS105550) from the type locality that lacked the fusion of the ventral plates but appeared otherwise similar to *C. thompsoni*. Whether it belongs to *C. thompsoni*, and females of this species perhaps lack the fusion of the plates, is unknown.

Observations on phylogenetic relationships

Together with *C. bispinus* Bartsch, 1994, *C. canaliculifer* Bartsch, 1994, *C. laminifer* Bartsch, 1994, and *C. scutellus* Bartsch, 1985, the new species described here form an easily recognizable group which is probably monophyletic. Shared characters that are otherwise unknown in the *gibbus* group and are therefore perhaps commonly derived are the densely punctate and relatively wide dorsal plates, a series of posterolateral arched striae on the posterior dorsal plate, and the lack of ornamentation in the form of costae or

areolae on the dorsal and ventral plates, which when viewed under the dissecting microscope, appear smooth and shiny. Within this group two subgroups may be distinguished. In species of subgroup I (*C. asketus*, *C. canaliculifer*, *C. seductus*, *C. squarrosus*, *C. scutellus*, and *C. thompsoni*) AD and PD are fused, the solenidia on tarsi I and II closely resemble one another, the seta on P-2 is slender and smooth, and lateral lamellae on the idiosoma are absent. In species of group II (*C. aenigmatus*, *C. bispinus*, and *C. laminifer*), the AD and PD are separated, the seta on the P-2 is plumose, and a lamella is present laterally on the PE. The fusion of the dorsal plates may be synapomorphic for group I and the swollen solenidion on tarsus II, the plumose seta on P-2 and the lamella on the PE may be synapomorphic for group II. The remaining characters which are common in *Copidognathus* are likely to be plesiomorphic.

Acknowledgements

I thank the Australian Biological Resources Study (ABRS) for funding this project and the Australian Institute of Marine Science for providing all necessary facilities. The Great Barrier Reef Marine Park Authority kindly gave permission to collect mites within the boundary of the Marine Park. I wish to acknowledge Ilse Bartsch and Mark Harvey for the loan of specimens and Ilse Bartsch for comments on the manuscript. Doug Fenner, Guillermo Diaz-Pulido, Angus Thompson and Paula Tomkins have contributed by collecting some of the material. This paper is publication no. 997 of the Australian Institute of Marine Science.

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