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Some corallanid isopods associated with wood from Papua New Guinea, including three new species (Isopoda: Corallanidae)

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Some corallanid isopods associated with wood from Papua New Guinea, including three new species (Isopoda: Corallanidae)

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Introduction

In Papua New Guinea, isopods of the genera *Sphaeroma* and *Limnoria* cause economically significant damage by burrowing into wooden maritime structures (Shillinglaw and Moore 1947). When it became apparent that conventional wood preservation methods were, at least in some cases, inadequate to prevent infestation by *Sphaeroma terebrans* or *S. triste* (Cragg and Levy 1979), detailed studies of the biology and ecology of the *Sphaeroma* spp. were initiated. In the course of these studies a number of other isopods which inhabit burrows in wood were found. Further investigation showed that although some of the isopods could be ascribed to *Corallana nodosa*, many did not correspond to any species described previously. Detailed anatomical studies have revealed the presence of three new species—*C. estuaria*, *C. bidentata* and *C. tridentata* which are described in this paper. In addition, some details of the distribution and ecology of these corallanids are considered, including their association with *S. terebrans* and *S. triste*.

Collection of specimens

Information about the distribution and ecology of corallanids associated with wood in Papua New Guinea has been obtained from collections made by S. Rayner, and the present authors. Rayner collected all types of marine borers at a wide range of sites around the coast of mainland Papua New Guinea and all its major islands. She took specimens from live and dead mangroves, driftwood and man-made structures. In addition, she examined experimental wooden panels that had been installed in both the littoral and sub-littoral zones. Icely and Cragg searched specifically for *Corallana* spp. in the littoral zone, but they looked at fewer sites than Rayner. Additional specimens of *Corrallana* were supplied from collections made in Australia.

Taxonomy

Genus ***Corallana*** Dana

Corallana Dana, 1852: 773; Schioedte and Meinert, 1879: 286; Stebbing 1904: 13; Barnard, 1914: 358 a; Pillai, 1967: 272; Kensley, 1978: 75; Bruce, 1982.

Corallana estuaria sp. nov. (fig. 1)

Material: 3 ♂, 4 ♀ (2 ovigerous) Murray River north of Cardwell North East Queensland, coll. Queensland Museum W 7757.15.V.1978. 2 ♀ (ovigerous) Murray

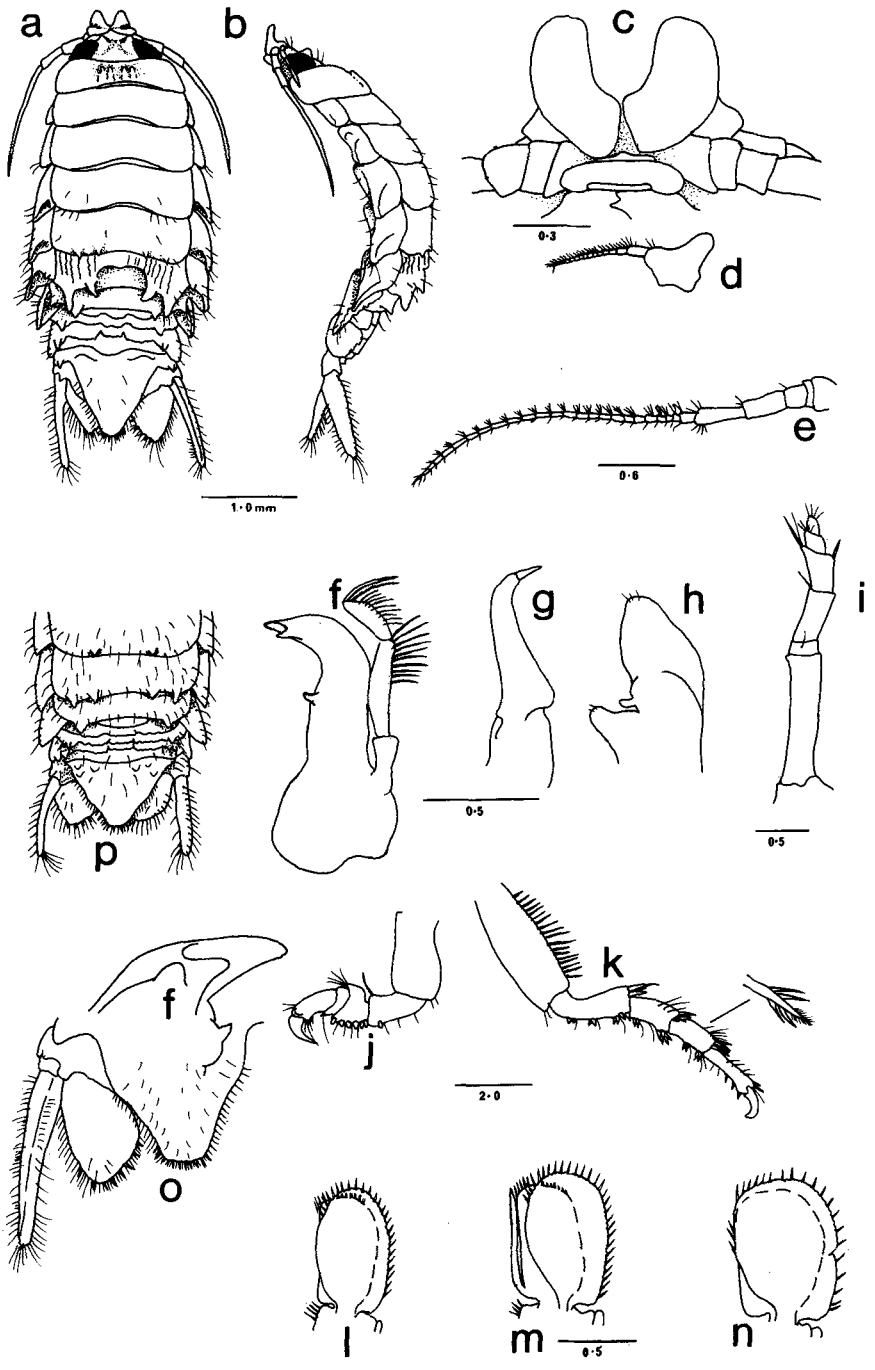

FIG. 1. *Corallana estuaria* sp. nov. Male holotype *a*, dorsal view; *b*, lateral view; *c*, frontal lamina; *d*, antennule; *e*, antenna; *f*, right mandible and palp; *g*, maxillule; *h*, maxilla; *i*, maxilliped; *j*, pereopod 1; *k*, pereopod 7; *l*, pleopod 1; *m*, pleopod 2 with appendix masculina; *n*, pleopod 5; *o*, telson and uropod; *p*, rear dorsal view female.

River estuary N.E. Queensland, coll. Queensland Museum W 7756. 16.V.1978. Galley Reach, coll. Papua New Guinea National Museum 82–67.

Types: HOLOTYPE: ♂ (12·0 mm) QM. Reg. No. W 7757. PARATYPES: ♂ (13·0 mm) QM. Reg. No. W 9860. ♀ (14·0 mm) QM. Reg. No. W 7756. ♀ (13·0 mm) QM. Reg. No. W 9861.

Type Locality: Murray River estuary N.E. Queensland, Australia.

Description: Body about 2·5 times longer than greatest width, coxae prominently visible in dorsal view. Cephalon bearing 2 tubercles between the eyes, 2 pairs of tubercles present on pereonite 1, and 4 small tubercles on the hind margin of pereonite 5. Pereonite 6 with lateral margins drawn out into large posteriorly projecting lobes, 2 smaller sub-medial lobes also present bordering a shallow dorsal concavity. Pereonite 7 also with 4 conspicuous tubercles on posterior margin. Coxae 2–7 with carinae and with postero-ventral angles progressively produced. Pereon and coxae sparsely setose. Pleon with first segment concealed by pereonite 7, pleonites 3 and 4 with lateral tubercles present on posterior margins; lateral margins of pleonite 4 overlapping and concealing lateral margins of pleonite 5. Telson broader than long, length 0·75 greatest width, lateral margins bisinuate terminating in a bluntly rounded apex, both margins and apex setose, apex bearing *c.* 11–12 spines.

Antennule with basal peduncular article strongly expanded, projecting anteriorly and visible in dorsal view. Peduncular article 2 short, one third length of article 1; flagellum slightly longer than peduncle, composed of 13 articles extending to pereonite 1. Antenna with article 5 longest, slightly longer than article 4 and equal in length to articles 1–3 combined; flagellum of 24 articles reaching to pereonite 4.

Frontal lamina inconspicuous, 6 times wider than long with small anterior medial point; clypeus twice as broad as frontal lamina with lateral margins rounded and produced posteriorly to encompass labrum. Mandible well developed with bidentate incisor and vestigial molar process; palp arising basally and just exceeding tip of mandible in length, article 2 twice length of articles 1 and 3 which are subequal. Maxillule exopod hook-shaped terminating in a single spine, endopod (not figured) poorly developed tip slightly spatulate. Maxilla simple flattened lobed structure with 3 apical setae. Maxilliped narrow and elongate, palp of 5 articles, article 2 longest, article 3 longer than combined length of articles 4 and 5, bearing a strong spine on inner and outer distal angles.

Pereopods all ambulatory. Pereopods 1–3 similar; pereopod 1 with posterior margin of ischium bearing a single blunt spine, merus with 6 blunt spines, carpus with 1 spine, propus with 3 pointed spines and dactylus without secondary unguis. Pereopods 4–7 similar; pereopod 7 with row of setae on posterior margin of basis, all other articles with groups of blunt spines on anterior margins, 3 strong spines on posterior distal angle of ischium, 3 on merus, *c.* 5 on carpus and 2 on propus. Ischium slightly shorter than combined length of merus and carpus which are subequal.

Pleopods lamelliform, all rami setigerious except endopods of pleopods 3–5 which are naked; exopods of pleopods 3–5 with partial suture. Inner margin of pleopod peduncles setose, outer margin lobate. Appendix masculina attached basally to endopod of pleopod 2, not extending beyond endopod, parallel sided tapering abruptly to an apical point.

Uropods extending beyond telson apex; endopod slightly longer than wide bearing setae and 8 spines on outer and inner margins. Exopod elongate and narrow, 6 times longer than greatest width, extending beyond endopod by one third of its length; keeled with a row of setae on outer margin and tuft of setae on apex of inner margin.

Female: Antennule bases less expanded, just visible in dorsal view; tubercles absent from cephalon and pereonite 1; 2 small tubercles only on hind margin of pereonite 5, 4 small tubercles on hind margin of pereonite 6, median dorsal concavity absent. Otherwise, apart from sexual characters, similar to the male.

Size: Largest specimen 15·0 mm.

Colour: In alcohol pale buff with purple chromatophores on dorsal surfaces of pereon, pleon and telson.

Remarks: Although several *Corallana* species exhibit sculpturing of the dorsal pereon and pleon surfaces, none approach the elaboration of processes seen on pereonite 6 of male *C. estuaria*. *Corallana nodosa* Schioedte and Meinert is the only other species previously recorded with cephalic tubercles, but differs in the degree of development of processes on pereonites 6 and 7 (Schioedte and Meinert 1879, Pillai 1967). Females are more difficult to identify and the configuration of pereonite processes displayed by female *C. estuaria* (fig. 1) approaches that shown by some female *C. nodosa* (Schioedte and Meinert 1879). However details of the mandible, maxillipeds and pereopods serve to separate the species.

Distribution: Recorded from the Murray River estuary N.E. Queensland where *C. estuaria* is found in rotting mangrove root debris on sandbanks, also from Galley Reach and Waipara river Papua New Guinea in mangroves.

Corallana bidentata sp. nov. (fig. 2).

Material: ♂♂ and ♀♀ including ovigerous ♀♀ Pari village, Port Moresby, Papua New Guinea 9.XII.1979. 1 ♀ (ovigerous) Kanudi, Port Moresby s.VI.1981 Juveniles Tahira, Port Moresby 26.X.1981. Coll. Papua New Guinea Nat. Museum 82–63.

Types: HOLOTYPE: ♂ (15·0 mm) British Museum (Nat. Hist.) Reg. No. 1982 : 220 : 1. PARATYPES: ♂ (16·0 mm) BM(N.H.). Reg. No. 1982 : 221 : 3. ♀ (12·0 mm) BM(N.H.). Reg. No. 1982 : 221 : 3. ♀ (14·0 mm) ovigerous BM(N.H.) Reg. No. 1982 : 221 : 3.

Description: Body about 2·2 times longer than broad, rounded with coxae not particularly obvious in dorsal view. Cephalon bearing a tubercle in front of each eye. Pereonites 1–5 smooth and glabrous; pereonite 6 with 2 median tubercles and lateral margins extended postero-dorsally to form projecting lobes, hind margin deeply concave. Pereonite 7 with hind margin also concave and bearing 2 small lateral tubercles. Coxae 2–7 with carinae and with posteroventral angles progressively produced. Setae virtually absent from pereon and coxae. First pleon segment visible although lateral margins of pleonites 1 and 2 are concealed by pereonite 7; all pleonites glabrous and without tubercles, lateral margins of pleonite 4 overlapping margins of 5. Telson broader than long, length 0·7 width, lateral margins curving regularly to terminate in a subtruncate posterior margin; lateral, and posterior margins setose, posterior margin bearing 6–7 equally spaced spines.

Antennule with basal peduncular article moderately expanded and visible in dorsal view, peduncular article 2 elongate, longer than 1; flagellum equal in length to peduncle, composed of 7 articles and just extending to pereonite 1. Antenna with article 5 longest, slightly longer than article 4 but less than combined length of articles 1–3; flagellum of *c.* 20 articles not reaching beyond pereonite 3.

Frontal lamina triangular and elongate, broad anteriorly, narrowing posteriorly with slightly concave sides; clypeus 5 times wider than long, half-moon shaped, lateral margins encompassing narrow labrum. Mandible small with unidentate incisor and well developed spine row of 3 spines, molar process absent; palp inserted

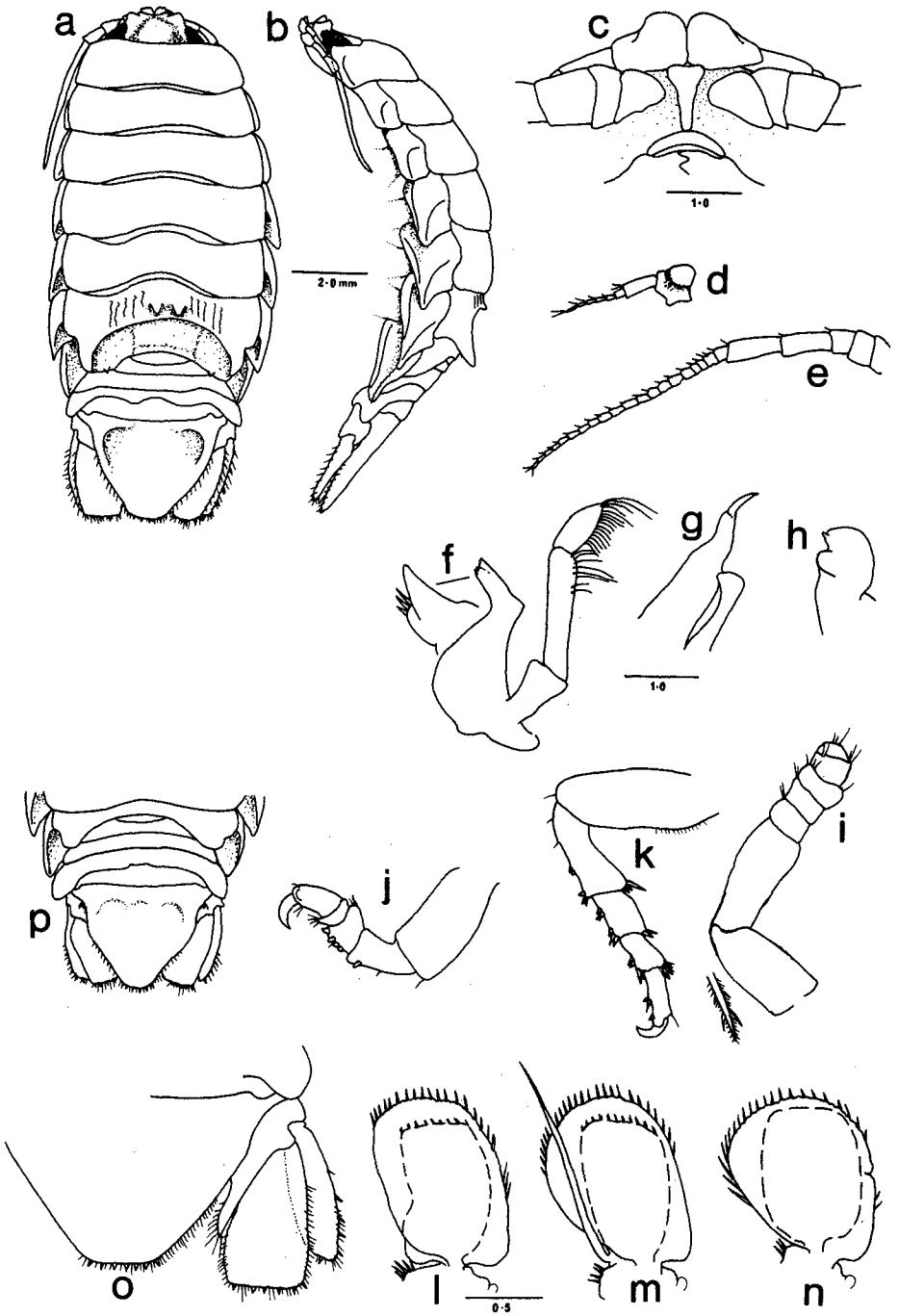

FIG. 2. *Corallana bidentata* sp. nov. Male holotype *a*, dorsal view; *b*, lateral view; *c*, frontal lamina; *d*, antennule; *e*, antenna; *f*, right mandible and palp; *g*, maxillule; *h*, maxilla; *i*, maxilliped; *j*, pereopod 1; *k*, pereopod 7; *l*, pleopod 1; *m*, pleopod 2 with appendix masculina; *n*, pleopod 5; *o*, telson and uropod; *p*, female rear dorsal view.

basally with article 3 exceeding tip of mandible, second article twice length of third. Maxillule exopod hook-shaped terminating in a single spine; endopod well developed, club shaped. Maxilla simple flattened lobe without setae. Maxilliped robust with stout peduncle, palp of 5 articles, fourth longest, fifth shortest and first 3 articles subequal in length.

Pereopods all ambulatory. Pereopods 1–3 similar; ischium of pereopod 1 twice the length of merus, bearing a single blunt spine distally on posterior margin; merus with 4 spines on posterior margin, carpus with a group of setae on posterior distal angle, propus with 2 setae and dactylus without secondary unguis. Pereopods 4–7 similar; pereopod 7 longest, basis with a few short setae on posterior margin, all other articles with groups of blunt spines on anterior margins. Ischium with 3 strong spines on posterior distal angle, 2 on merus, *c.* 8 on carpus and 1 on propus. Ischium longer than combined length of merus and carpus, former longer than latter.

Pleopods lamelliform, all rami setigerous except endopods of pleopods 3–5 which are naked; exopods of pleopods 3–5 with partial suture. Inner margins of peduncles of all pleopods setose, outer margins lobate. Appendix masculina attached basally to endopod of pleopod 2, elongate, extending beyond tip of endopod for one third of its length, tapering gradually to a fine point.

Uropods with endopod extending beyond apex of telson; exopod same length as telson, 3 times as long as wide, terminating in rounded apex; distal half of outer margin with short setae and 4 spines, apex with a short tuft of setae and a single spine. Endopod less than twice as long as broad, posterior margin truncate meeting outer margin at right angles; outer, posterior, and inner margins setose, posterior margin with 5–6 spines.

Female: First peduncular article of antennule reduced but still visible dorsally; tubercles absent from all pereonites, posterior margin of pereonite 6 with slight concavity only, pereonite 7 with deep concavity as in male. All surfaces with exception of uropods and telson margins glabrous. Otherwise, excepting for sexual characters, similar to male.

Size: Largest specimen (♀) 16·5 mm.

Colour: In alcohol fawn with mottled brown chromatophore pattern on dorsal surfaces.

Remarks: Males may be immediately distinguished from all other species by the enlarged lateral processes on pereonite 6, the position of the tubercles, and the deep median concavity. In addition this appears to be the only species with an appendix masculina significantly extending beyond the apex of pleopod 2. In the absence of these features females are more difficult to separate and recourse must be made to details of the frontal lamina, mandible and maxilliped.

Distribution: All records to date are from Port Moresby and Central Province, Papua New Guinea where males, females and juveniles have been found in burrows in treated pilings and dead mangrove wood.

Corallana tridentata sp. nov. (fig. 3).

Material: 2 ♂♂, 16 ♀♀ (10 ovigerous) 3 juveniles Bootless Inlet near Port Moresby, Papua New Guinea 24.X.1981. Coll. Papua New Guinea Nat. Museum 82–64.

Types: HOLOTYPE: ♂ (8·0 mm) BM(N.H.) Reg. No. 1982 : 218 : 1. PARATYPES: ♂ (8·2 mm) BM(N.H.) Reg. No. 1982 : 219 : 3. ♀ (6·5 mm) BM.(N.H.) Reg. No. 1982 : 219 : 3. ♀ (7·0 mm) BM(N.H.) Reg. No. 1982 : 219 : 3.

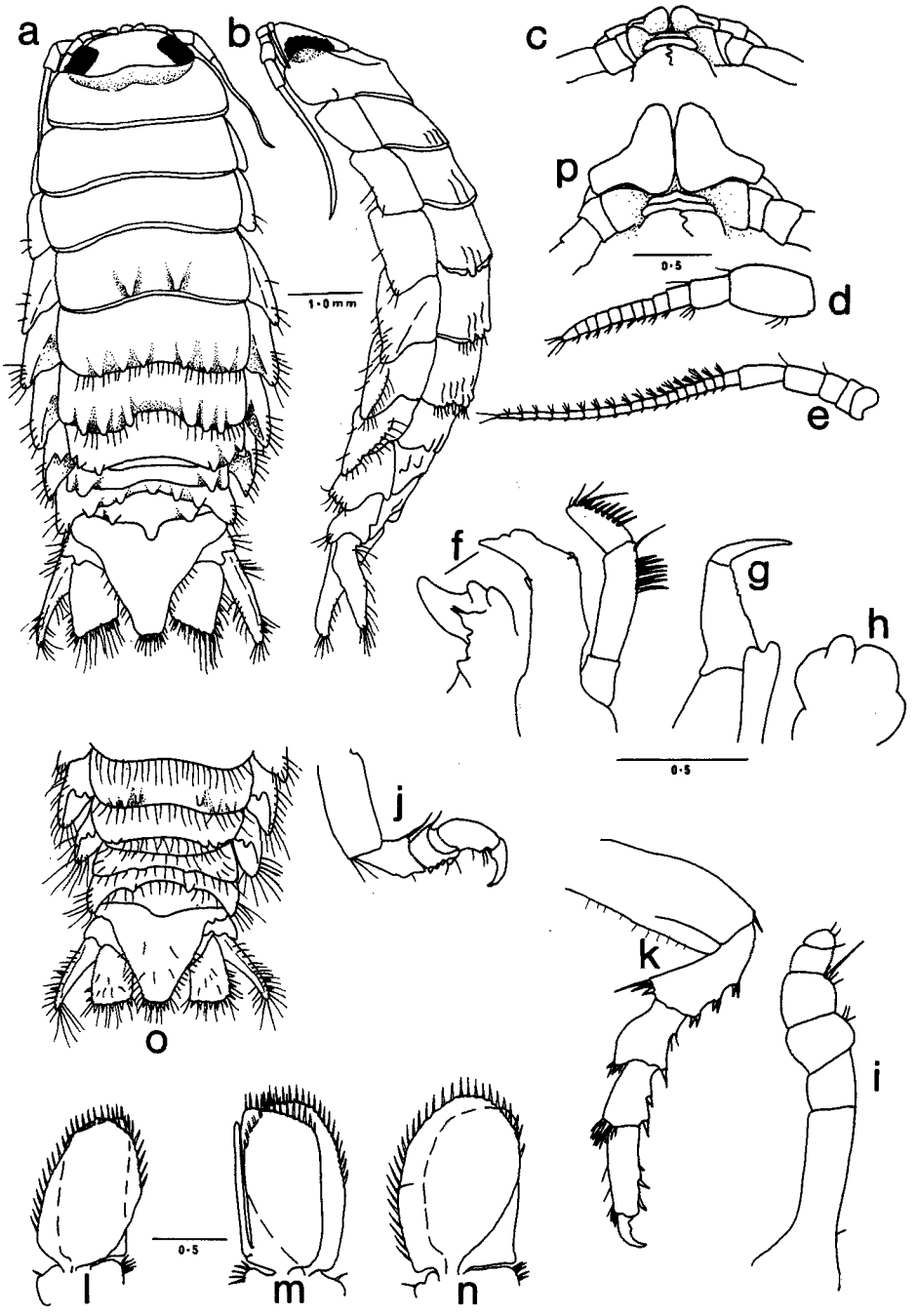

FIG. 3. *Corallana tridentata* sp. nov. Male holotype *a*, dorsal view; *b*, lateral view; *c*, frontal lamina; *d*, antennule; *e*, antenna; *f*, right mandible and palp; *g*, maxillule; *h*, maxilla; *i*, maxilliped; *j*, pereopod 1; *k*, pereopod 7; *l*, pleopod 1; *m*, pleopod 2 with appendix masculina; *n*, pleopod 5; *o*, female rear dorsal view; *p*, *Corallana furcilla* Barnard frontal lamina.

Description: Body about 2·3 times longer than greatest width, coxae prominently visible in dorsal view. Cephalon and pereonites 1–3 without tubercles, pereonite 1 with raised transverse semi-circular ridge. Pereonite 4 with 2 posterior tubercles, pereonites 5–7 with 6 tubercles in groups of 3 on hind margins, those on pereonite 6 most pronounced and bordering a medial concavity on the posterior margin. Coxae 5–7 with carinae and with posteroventral angles progressively produced. Hind margins of pereonites 5 and 6 and coxae 3–7 setose. First pleon segment concealed beneath pereonite 7, pleonite 3 with 2 tubercles on postero-lateral margin angles, pleonite 4 with 6 tubercles on posterior margin, pleonite 5 with a single median tubercle on the posterior margin and 2 lateral tubercles. Lateral margins of pleonite 4 greatly expanded, overlapping and concealing lateral margins of pleonite 5. Telson broader than long, length 0·8 of greatest width, triangular with concave bisinuate lateral margins narrowing rapidly and terminating in a truncate apex; lateral margins and apex setose, apex bearing 6 closely set spines.

Antennule with first peduncular article only moderately expanded just visible dorsally. Peduncular article 2 short, only half length of article 1; flagellum clearly longer than peduncle and composed of 10 articles just extending to pereonite 1. Antenna with peduncular article 5 longest but less than combined length of articles 1–3; flagellum of 19 articles not extending beyond third pereonite.

Frontal lamina represented by a small narrowly rectangular plate with rounded angles, 5 times wider than long; clypeus twice as long as frontal lamina with rounded lateral angles; labrum obscure. Mandible well developed with a tridentate incisor, spine row of 2 spines and vestigial molar process. Palp inserted basally, broad and robust, third article extending beyond tip of mandible by half its length; article 2 longest but less than twice the length of article 3 which is longer than the first article. Maxillule with strongly recurved terminal spine on exopod, endopod not expanded distally. Maxilla simple flattened lobe without setae. Maxilliped elongate, palp of 5 articles with articles 1–3 longer than articles 4–5, sparsely setose but large seta on inner distal angle of article 3.

Pereopods all ambulatory. Pereopods 1–3 similar; pereopod 1 bearing 4 blunt spines on posterior margin of merus, all other articles without spines, dactylus without secondary unguis. Pereopods 4–7 similar; pereopod 7 with a scattering of setae on the posterior margin of basis, all other articles with groups of spines on anterior margins. Posterior distal angle of ischium with 3 spines, merus with 4, carpus with *c.* 9 and propus with 3.

Pleopods lamelliform, all rami strongly setigerous except endopods of pleopods 3–5, exopods of these pleopods with partial sutures. Inner margin of pleopod peduncles setose, outer margins lobate. Appendix masculina inserted basally on endopod of pleopod 2, shorter than endopod, parallel sided with rounded apex.

Uropods with exopods extending slightly beyond telson apex, endopods same length as telson. Endopods 1·5 times longer than wide with lateral margins parallel, posterior margin truncate. Distal lateral margins and posterior margins setose, outer lateral margin bearing 2–3 spines, posterior margin 5–6 spines. Exopod keeled, 5 times longer than wide with setae and 2 spines on outer margin, a tuft of apical setae and 1 or 2 groups of setae on inner margin.

Female: Antennule base only slightly expanded but visible dorsally; tubercles absent from pereonites 4 and 5, 2 groups of 3 on pereonite 6, median concavity absent, groups of 1–2 tubercles on pereonite 7. Tubercles absent on pleonite 3, 2 only on pleonite 4 and median tubercle on pleonite 5 poorly defined, no lateral tubercles.

Hind margins of pereonites 5–7, pleonites 2–4 and lateral margins of coxae substantially more setose than in male. In other respects, excepting sexual characters, similar to male.

Size: Largest specimen 8·2 mm.

Colour: In alcohol pale buff with purple chromatophores on dorsal surfaces.

Remarks: The arrangement and numbers of pereonite and pleonite tubercles distinguish males from all other species, details of antennae, frontal lamina, mouthparts and pereopods are also characteristic. This species is close to *C. africana* Barnard and *C. hirsuta* Schioedte and Meinert and care must be taken in identification of females. However close comparison with *C. africana* (Barnard 1914) and British Museum (Natural History) material of *C. hirsuta* deposited by Stebbing (1904), reveals specific differences in tubercle numbers and mouthparts, particularly the shape of the frontal lamina.

Distribution: All records are from Bootless Inlet, Port Moresby, Papua New Guinea where specimens were taken from burrows in pier piles.

General remarks: The present authors echo the observation by Bruce (1982) that the genus *Corallana* is in urgent need of revision. The problem, as in other genera (Jones in press), lies in previous incomplete descriptions and scattered type material, much of which has been lost. As an aid to future revision it seems most useful to describe new material as fully as possible thus extending the range of available taxonomic characters within the genus. Although the three species described above fall within the provisional diagnosis given by Bruce (1982) for the genus, unfortunately they do little towards clarifying relationships within *Corallana*.

Both *Corallana estuaria* and *C. tridentata* have a short broad frontal lamina as does *C. furcilla* Barnard (1914, fig. 3). The frontal lamina is absent in *C. africana* and *Corallana* sp. (Bruce 1982), somewhat expanded in *C. brevipes* Schioedte and Meinert and *hirticauda* Dana, and becomes triangular or elongate in *C. nodosa* Schioedte and Meinert, *C. collaris* Schioedte and Meinert, *C. kulai* Bruce and *C. bidentata*.

The mandible is equally variable, *C. tridentata*, *C. nodosa* and *C. hirsuta* all with a tridentate cutting edge, *C. estuaria* and *C. kulai* bidentate, and *C. bidentata* having a single incisor process with a well-developed setal row.

Ecology

Of the fifteen species that have been ascribed to the genus *Corallana*, the habitats of only nine have been described: three are deep-water species and the remaining six are associated with wood. In Papua New Guinea five species of corallanid have been identified. However, one of these has not been described fully (Bruce 1982). Details on the distribution and the ecology of the other four species—*C. nodosa*, *C. estuaria*, *C. bidentata* and *C. tridentata*—are summarized in the table.

Most of the sites where *Corallana* spp. have been observed in Papua New Guinea are fully saline. However, *C. estuaria* occurs only in sites with a low salinity in both Papua New Guinea and Australia, whilst *C. bidentata* has been taken from sites with high and low salinities. All four species occur in the intertidal zone, but one specimen of *C. nodosa* has been taken from an experimental wooden panel suspended approximately 8 m below the surface of the water. Thus, although mangroves in the littoral zone appear to provide the typical habitat for all these species, it is possible that these animals can inhabit sublittoral areas.

C. nodosa, *C. estuaria* and *C. tridentata* have not been found together on the same site, although *C. bidentata* has been observed on the same site as the other three

Table 1. Aspects of the ecology of corallinids associated with wood in Papua New Guinea.

Species	Latitude	Longitude	Salinity	Density†	Habitat	
C. nodosa	9°26′26″	147°08′05″	Marine	High	Stump of *Avicennia eucalyptifolia.*	Own burrows
	9°29′01″	147°10′12″	Marine	Medium	Treated pilings.	Burrows of *S. triste*
	9°31′12″	147°13′00″	Marine	Medium	Prop roots of *Rhizophora stylosa.*	Burrows of *S. triste*
	9°31′52″	147°14′14″	Marine	Medium	Stump of *Avicennia eucalyptifolia.*	Own burrows
	10°09′39″	147°59′11″	Marine	Medium	Stump of *Avicennia eucalyptifolia.*	Own burrows
	8°32′30″	151°04′00″	Marine	Medium	Untreated pilings.	Burrows of *S. terebrans*
	8°53′48″	148°29′34″	Marine	Medium	Treated test panel of *Alstonia scholaris*	Own burrow
C. estuaria	9°02′28″	146°59′27″	Brackish	?	Mangrove timber.	Burrows of *S. terebrans?*
	10°00′19″	148°09′11″	Brackish	?	Mangrove timber.	Burrows of *S. terebrans?*
	10°00′	151°58′	?	?	Mangrove timber.	Burrows of *S. triste*?
C. bidentata	9°02′28″	146°59′27″	Brackish	Low	Fallen mangrove timber.	Own burrow
	9°26′26″	147°08′05″	Marine	Low	Pneumatophores of *Sonneratia alba.*	Own burrow
	9°31′12″	147°13′00″	Marine	Low	Pneumatophores of *Sonneratia alba.*	Own burrow
	9°30′39″	147°17′02″	Marine	Low	Treated pilings.	Burrows of *S. terebrans*
	9°31′29″	147°17′01″	Marine	Low	Mangrove timber.	?
C. tridentata	9°30′39″	147°17′02″	Marine	Medium	Treated piling.	Burrows of *S. terebrans*

† Density refers to the approximate numbers of animals found within a mangrove tree or a timber pile. Thus, High = 20+; Medium = 4–20 and Low = 1–3.

species. Apart from *C. estuaria*, the other three species have been taken from man-made structures. However, most of the structures that have been examined are sited in fully saline habitats, which are probably unsuitable for *C. estuaria*.

All four species of *Corallana* have been found in association with the woodboring isopods, *Sphaeroma terebrans* and *S. triste*. *Corallana nodosa*, *C. bidentata* and *C. tridentata* have all been taken from burrows of *Sphaeroma* spp. in mangroves and man-made structures. At present there is not sufficient information about the precise habitat of *C. estuaria*. However, both *C. nodosa* and *C. bidentata* have also been observed in timbers where they have produced their own burrows. Stebbing (1904) has also recorded the presence of *C. nodosa*, *C. furcilla* Barnard and *C. hirsuta* in burrows constructed by other wood borers or in rotting wood.

In general, *Corallana* spp. occur only in small colonies, numbering around twenty specimens per pile in the case of man-made structures. However, *C. nodosa* has been observed in much larger colonies in the stumps of *Avicennia eucalyptifolia*. *Corallana bidentata* occurs only singly or in pairs. There is no previous information on the feeding habits of *Corallana* species, and as all specimens examined in the present work had empty guts, nothing is yet known of their diet.

Summary

The corallanid isopods, *C. nodosa*, *C. estuaria* sp. nov. *C. bidentata* sp. nov. and *C. tridentata* sp. nov. have been found within timbers of mangroves and man-made structures in marine and brackish waters around Papua New Guinea. *Corallana estuaria*, *C. bidentata* and *C. tridentata* are new to science and are described in detail. In addition, aspects of the ecology of all four species are considered, including their association with the marine-boring isopods, *Sphaeroma terebrans* and *S. triste*.

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