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Terrestrial Amphipods (Amphipoda: Talitridae) of Tasmania : Systematics and Zoogeography

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ABSTRACT. Amphipods of the family Talitridae form an important part of the cryptozoa of Tasmanian forests. The terrestrial amphipod fauna of the Tasmanian mainland consists of fifteen species. The previously widely used grouping of land amphipods into the genera *Orchestia* and *Talitrus* is considered unsatisfactory and consequently a number of genera are created to receive the Tasmanian species. Three new genera, *Neorchestia, Orchestiella* and *Tasmanorchestia,* are described, and *Mysticotalitrus, Arcitalitrus* and *Keratroides* are raised to generic status. Twelve new species, *Austrotroides longicornis, A. leptomerus, A. maritimus, Neorchestia plicibrancha, Mysticotalitrus cryptus, Arcitalitrus bassianus, Keratroides albidus, K. rex, K. pyrensis, Orchestiella neambulans, O. quasimodo* and *Tasmanorchestia annulata,* are described. *Mysticotalitrus tasmaniae* is redescribed, and a description of the male is given. *Keratroides vulgaris* and *K. angulosus* are also recorded from Tasmania, and *Protaustrotroides victoriae* from King Island. *Talitrus assimilis* is considered a doubtful species. Among the Tasmanian fauna (excluding *P. victoriae),* four of the seven genera, but only one of the fifteen species also occurs on the Australian mainland. Examination of geological and paleoclimatic data suggests that this is due to the conditions which prevailed on the Bassian isthmus during Tertiary and late Quaternary times.

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INTRODUCTION

Amphipods are an important element of the leaf-litter/soil fauna of the wetter forests of Australia, both in terms of numbers (Sayce, 1909; Campbell & Gray, 1942; Clark, 1954; Sandell, 1977; Friend & Richardson, 1977; Friend, 1980) and in terms of their contribution to litter decomposition (Clark, 1954; Friend, 1975). These amphipods live independently of water bodies and occur away from the supralittoral zone; they are referred to hereafter as 'terrestrial amphipods', 'land amphipods' or 'landhoppers'. All belong to the family Talitridae, (as defined by Bulycheva, 1957; emended by Bousfield, 1979, 1982) which also contains supralittoral, palustral (Bousfield, 1982) and freshwater (Ruffo & Paiotta, 1972; Hurley, 1975) representatives. The Tasmanian terrestrial talitrids are treated as a unit here for practical reasons, with the acknowledgement that the terrestrial amphipods as a whole are most probably a polyphyletic group within the Talitridae (Bousfield, 1982, 1984). Landhoppers are widely distributed in tropical and southern hemisphere areas of the world (Hurley, 1968; full review in Friend, 1980). Published records exist from Australia, New Guinea, New Zealand and its subantarctic islands, South Africa, Madagascar, India, Sri Lanka, Burma, Singapore, Indonesia, the Philippines, Japan, most major Pacific and Indian Ocean island groups, the Azores, Madeira, Canary Islands, and Annobon Island. Native landhoppers have also been found in Central America (Bousfield, 1982) and South America (Friend, in preparation). A review of the biology of terrestrial amphipods has been prepared by Friend & Richardson (1986).

Although land amphipods were first recorded from Tasmania in 1880, published knowledge of the island's fauna before the present study was sketchy. Haswell (1880) described *Talitrus assimilis* from Tasmanian material but later (1885) decided that this species (calling it '*affinis*' by mistake) was a junior synomym of a species from New South Wales, *T. sylvaticus* Haswell. Thomson (1893) figured some specimens from near 'The Springs' on Mount Wellington, identifying them as *T. sylvaticus,* while noting differences both within the material and

between his specimens and Haswell's types. In 1909, Smith noted that he had found some specimens of *T. sylvaticus* near the Magnet Mine, Western Tasmania, and Sayce (1909) reported the same species as 'very common in Tasmania', but named no material.

In his review of the genus *Talitrus,* Hunt (1925) provided some drawings of an undescribed landhopper from Tasmania, which he thought might belong to the genus *Parorchestia* Stebbing. This species was later described by Ruffo (1949a) as *T. tasmaniae,* from two specimens among old material in an Italian museum, originally collected on Mount Wellington, south-eastern Tasmania. He identified another specimen in the same lot as *T. sylvaticus.* Hurley's paper on the genus *Talitrus* in New Zealand (1955) included some figures of a Tasmanian landhopper which he identified as the Victorian species, *T. kershawi* Sayce. At that stage, then, the recorded landhopper fauna of Tasmania comprised only three species, or four including *T. assimilis.*

Recent studies of newly collected material have shown that the terrestrial amphipod fauna of Tasmania is much richer than the previous literature would suggest. As a result of this work, two new species, *T. vulgaris* and *T. angulosus*, have already been described (Friend, 1979); the present study describes a further 12 new species, and reviews earlier records in the light of new knowledge.

The Tasmanian landhopper fauna proved to consist of several morphological groups of species. Examination of a large number of collections from mainland Australia during this study showed that some of these groups had members on both sides of Bass Strait. For some time, terrestrial amphipods have been allocated to the shore-hopper genera *Orchestia* (those with sexually dimorphic gnathopods) and *Talitrus* (those with gnathopods not sexually dimorphic) (e.g. Ruffo, 1949a,b; Ruffo & Paiotta, 1972; Hurley, 1955, 1957, 1975; Barnard, 1960; Bowman, 1977). Recent work based on a wide range of characters from all body regions (Bousfield, 1971, 1982, 1984; Friend, 1980, 1982) has demonstrated that a number of regionally endemic morphological groups of species warrant generic recognition. This approach has resulted in a more satisfactory classification, with far greater internal congruence than the previous, apparently polyphyletic groupings.

Since the completion of the present work in thesis form (Friend, 1980), an important contribution to the taxonomy and phylogeny of landhoppers has been made by Bousfield (1982, 1984). Briefly, this has been the discovery that there are two groups of terrestrial talitrids, distinguished by the morphology of the peraeopod dactyls, which appear to have developed convergently from different groups of shore-dwelling talitrids.

These groups, the simplidactylate landhoppers and the cuspidactylate landhoppers, are both represented in Tasmania. Bousfield (1984) has not formalized these groupings and this policy has been followed here; the species described are merely grouped under those headings. It is interesting, however, that the two genera judged most plesiomorphic on the basis of a range of characters (see below) both possess cuspidactylate peraeopods, while the remaining five genera belong to the simplidactylate group of landhoppers. The latter are listed first, however, in recognition of Bousfield's (1984) deduction that the simplidactylate landhoppers form the more ancient group.

The phylogeny of the Tasmanian landhopper fauna is not treated here. However, terms such as plesiomorphic and apomorphic are used in the text to describe various landhopper character states. The polarity of these character states is based on the following justification. There is widespread agreement that the Hyalidae and the Talitridae are descended from a common hyalid-like ancestor (Bulycheva, 1957; Hurley, 1968; Barnard, 1972, 1974; Bousfield, 1982, 1984). Synapomorphies possessed by these two families include the small uniramous uropod 3, the lack of an accessory flagellum on antenna 1, and the lack of a mandibular palp. The Hyalidae is considered to be an appropriate outgroup for determining character state polarity within the Talitridae. In this study, a set of 18 characters is used to characterize the taxa, and the polarity of the character states is based on their condition within the Hyalidae (Table 1).

Types and paratypes are deposited in the Australian Museum, Sydney (AM), the British Museum (Natural History), London (BMNH), and the National Museum of Natural Sciences, Ottawa (NMNS). Names of other institutions are abbreviated as follows: Tasmanian Museum and Art Gallery, Hobart, TMAG; Museum of Victoria, Melbourne, MV; Museo Civico di Storia Naturale, Genova, MCSN. Where no other collector's name is given, material was collected by the author. Map references given in locality data refer to the TASMAP 1:100 000 map series. LGRSS refers to the Lower Gordon Scientific Survey, 1975–1977.

The following codes are used in the figures: UL: upper lip; LL: lower lip; Lft Md, Rt Md: left, right mandible; Mx1,2: maxilla 1,2; Mxpd: maxilliped; OP: outer plate of maxilliped; PD: distal segments of maxilliped palp; Gn1,2: gnathopod 1,2; P3–7: peraeopod 3–7; O2–5: oostegite of gnathopod 2–peraeopod 5; G2–6: gill of gnathopod 2–peraeopod 6; Pl1–3: pleopod 1–3; U1–3: uropod 1–3; Tel: telson; HD: head and anterior peraeon segments; PU: pleon and urosome.

The information contained in descriptions of type specimens is amplified by the inclusion of range data from a sample of other specimens. These data are shown in square brackets. 'Dentition formula' refers to the number of teeth on each of the apical spines of the outer plate of maxilla 1, from lateral to medial side.

Table 1. Polarity of selected characters in Tasmanian landhoppers.

No.	Character	Plesiomorphic	Apomorphic
1	Maxilla 2 width	narrow	broad
	$\frac{\text{inner plate length}}{\text{outer plate width}}$	>1.8	<1.7
2	Maxilliped palp segment 3 mediodistal lobe	present	absent
3	Maxilliped outer plate shape	distally rounded	distally truncate or arcuate
4	Maxilliped outer plate spination	even spine-row	spines in groups
5	Maxilliped inner plate	setose	poorly setose
6	♂ gnathopod 1 palm	present	absent or exceeded by dactyl
7	♀ gnathopod 1 palm	present	absent or exceeded by dactyl
8	♂ gnathopod 2	subchelate	mitten-shaped
9	♀ gnathopod 2 oostegite	present	absent
10	♀ peraeopod 3 oostegite	with marginal setae	lacking marginal setae
11	Gill shape	all sac-like	some lobate or anseriform
12	Gill relative size	subequal	posterior and anterior gills much larger
13	Peraeopods	simplidactylate	cuspidactylate
14	Pleopod 1	biramous and setose	lacking one or both rami or non-setose
15	Pleopod 3	biramous and setose	lacking one or both rami or non-setose
16	Epimeral plate 3	lower margin convex	lower margin concave
17	Uropods 1&2	♂ & ♀ similar	sexually dimorphic
18	Uropod 3	ramus as long as peduncle	ramus much shorter than peduncle

KEY TO THE TERRESTRIAL AMPHIPODS OF TASMANIA

This key also applies to the offshore islands of Tasmania, excluding King Island and the eastern Bass Strait islands.

1. Gnathopod 1, hand subchelate, small; palm lateral, subequal to or longer than dactyl. 2

—Gnathopod 1, hand simple, or palm, if present, oblique and either strongly exceeded by dactyl or hand swollen, much larger than hand of gnathopod 2. 5

2. Gills all of similar size (shortest more than ½ length of longest), basically sac-like. 3

—Gills of grossly unequal size, anterior and posterior pairs largest; posterior pair convoluted, lobate . . . . . *Neorchestia plicibrancha*

3. All pleopods long, slender, biramous, setose and subequal; antenna 1 short, just exceeding distal end of penultimate peduncular segment of antenna 2; epimeral plates converging beneath body, forming ventral slit through which pleopods protude. . . . . *Orchestiella* . . . 4

—Pleopods 1 and 2 biramous and setose, third pair reduced to small stumps; antenna 1 long, almost reaching distal end of last peduncular segment of antenna 2; epimeral plates not as above. . . . . *Tasmanorchestia annulata*

4. Body anteriorly hunched, giving 'teardrop' appearance (Fig. 59); appendages extremely short, peraeopod 7 about ⅓ overall body length; body cuticle hard, difficult to pierce with a needle. . . . . *O. quasimodo*

—Body of normal landhopper shape; appendages fairly short, peraeopod 7 about ½ overall body length, body cuticle not unusually hard. . . . . *O. neambulans*

5. All three pairs of pleopods biramous and setose. 6

—One or more pairs of pleopods reduced to vestigial stumps, sometimes extremely small, difficult to find, but always present. 8

6. Gill of peraeopod 6 large, convoluted, with a large rounded posterior lobe. ..... *Mysticotalitrus*. . . . 7

—Gill of peraeopod 6 long, slender, laterally flattened and anseriform *, with a large subdistal posterior incision (Fig. 32). ..... *Arcitalitrus bassianus*

7. Hind corners of epimeral plates 2 and 3 sharp; telson with marginal and apical spines. ..... *M. cryptus*

—Hind corners of epimeral plates 2 and 3 rounded; telson with apical spines only. ..... *M. tasmaniae*

8. Antenna 1 long, reaching more than half way along last peduncular segment of antenna 2; telson with apical spines only; hind margin of segment 2, peraeopod 7, meeting main trunk of segment some distance above lower edge of segment i.e. posterodistal lobe absent (e.g. Fig. 1). ..... Tasmanian *Austrotroides* . . . 9

—Antenna 1 short, only reaching or just exceeding distal end of penultimate peduncular segment of antenna 2; telson with marginal as well as apical spines; hind margin of segment 2, peraeopod 7, meeting main trunk of segment at lower edge of segment i.e. posterodistal lobe present (e.g. Fig. 42). ..... *Keratroides* . . . 11

9. Outer ramus of uropod 2 with margins naked; peraeopod 6 gill margins distally crenate (Fig. 6). ..... *Austrotroides leptomerus*

—Outer ramus of uropod 2 with marginal spines; peraeopod 6 gill margins not distally crenate. 10

10. Gill of peraeopod 6 strongly incised posteriorly, forming a neck proximal to pointed distal lobe (Fig. 2); telson bearing two small spines only, near the apex; gnathopod 1, segment 6 slender, narrowing gently to very small oblique palm, hind margin straight (Fig. 2); body and legs slender. ..... *A. longicornis*

—Gill of peraeopod 6 hardly incised posteriorly (Fig. 11); telson bearing two large spines and two small spines near the apex; gnathopod 1, segment 6 swollen, hind margin convex; palm not short (Fig. 10); body and legs not excessively slender. ..... *A. maritimus*

11. Epimeral plate 3 the longest, front corner sharp below, lower margin deeply concave (Fig. 52), third plates usually curving beneath the body. ..... *K. angulosus*

—Epimeral plate 3 with rounded front corner, lower margin slightly concave, third plates flat. 12

12. First and second pleopods broad, bearing broad rami with long setae, first pleopod biramous, second uniramous; third pleopod a small stump; antenna 2 short, shorter than head and first three body segments; head dorsally strongly rounded, eye small (width about ⅕ head length). ..... *K. albidus*

—Pleopods slender, vestigial, rami reduced to small papillae if present; long setae only found on narrow pleopods of some first instar specimens; antenna 2 much longer than head and first three body segments; head only gently dorsally rounded, eye width about ⅓ head length. 13

13. Third epimeral plate deeper than second, front corner rounded, lower margin concave; gill of peraeopod 6 anseriform*, narrowing distally, with a slender, linear distal extension. ..... *K. vulgaris*

—Third epimeral plate just shallower than second, front corner rounded, lower margin slightly concave; gill of peraeopod 6 anseriform*, narrowing distally right to blunt apex, distal margins crenulate (Fig. 49). ..... *K. pyrensis*

—Third epimeral plate strongly exceeded by second, front corner rounded, lower margin almost straight; gill of peraeopod 6 anseriform*, distally incised, forming a distinct posterior lobe (Fig. 44). ..... *K. rex*

*Like the head, neck and upper body of a goose, in lateral view

SYSTEMATICS

Superfamily TALITROIDEA Bulycheva, 1957, revised Bousfield 1979,1982

Family TALITRIDAE Bulycheva, 1957

The Simplidactylate Group

Protaustrotroides Bousfield, 1984

Protaustrotroides Bousfield, 1984: 208.

Diagnosis. Body medium-large, deep-plated. Antenna 1 elongate (about equal to peduncle A2), peduncular segment 3 longest. Maxilliped, palp 3-segmented, outer plate not arcuate, subapically broadly spinose. Gnathopod 1 weakly subchelate, dactyl exceeding palm (female), segments 4,5,6 tumescent behind (weakly in female). Gnathopod 2 (male) strongly subchelate (or partly reduced neotenically), in female, distal segments slender, tumescent behind. Peraeopods 3–7 elongate, 5–7 strongly heteropodous, coxa 5 strongly anterolobate. Pleopods vestigial, rami minute or lacking, without setae. Uropods 1 and 2, rami subequal, all marginally spinose; uropod 3, ramus distinct, with lateral spines. Telson, lobes nearly fused, with a few apical and lateral spines. Coxal gills variously convoluted, those of P2 and P6 attenuated. Brood plates medium broad, marginal setae short.

Type species. *Protaustrotroides victoriae* Bousfield, 1984 (original designation).

Remarks. The diagnosis of this genus of simplidactylate landhoppers (given above) appears in the appendix to a recent article by Bousfield (1984). These amphipods are remarkable in their possession of a strongly subchelate gnathopod 2 of the male, in combination with apomorphic features found also in the closely related genus *Austrotroides* Friend (see remarks under *Austrotroides).*

Protaustrotroides victoriae Bousfield, 1984

Protaustrotroides victoriae Bousfield, 1984: 208.

Material examined. Victoria: HOLOTYPE ♂, MV; ALLOTYPE ♀, MV; 6 PARATYPES (6♀♀), MV; Apollo Bay, under leaves, coll. G. Coghill, 25 Dec 1904. ♂, MV; same data as paratypes.

Other material examined. 2♀♀ (1 ovig.), MV; Warburton, coll. Dixon, pres. 2 July 1914. ♂,♀, MV; Otway Range, coll. Dixon, Jan 1913. ♀, MV; Lower Tarwin, under log near freshwater swamp, coll. G.F. Hill, 24 Nov 1925. ♂,♀(ovig.), MV; Grampians, 10 yds from Jimmy's Creek, in rotten bark and leaves at base of tree, coll. R.D. Sandell, 15 June 1974. 2♀♀, MV; Mt William, 10 yds from summit, soil under rock, coll. R.D. Sandell, 16 June 1974. ♀(ovig.), MV; south of Yarragon, coll. R.D. Sandell, 10 Nov 1974. Tasmania (King Island): 12 ♂♂, 15 ♀♀(3 ovig.), 1 juv., AM; near Currie, beside Porky Creek, coll. G. Edgar, 19 April 1976. 2 juv., AM; Grassy, under treeferns beside creek, coll. G. Edgar, 19 April 1976. ♀(ovig.), 1 juv., AM; near Loorana, in teatree beside creek, coll. G. Edgar, 19 April 1976.

Diagnosis. Uropod 1 (male), outer ramus with spines on inner and outer margins; uropod 2, inner ramus with one distal marginal spine; uropod 3, ramus with one marginal spine; pleopod 1, rami very short, slender base; pleopods 2 and 3 shorter, lacking rami; gill of peraeopod 6, attenuated apex with two ventral notches.

Remarks. This is the only named species of the genus. The type specimens were collected at Apollo Bay, which is on the south coast of Victoria nearest to King Island. By comparison with the type specimens and other Victorian material, the King Island specimens listed above were identified as *P. victoriae.* This interesting species, which has yet to be fully described and figured, does not occur in collections from the mainland of Tasmania.

Austrotroides Friend, 1982

Austrotroides Friend, 1982: 462

Diagnosis. Non sexually dimorphic landhoppers with slender appendages. Antennae long, first exceeding midpoint of last peduncular segment of second. Maxilliped, outer plate apically rounded or bluntly produced, submarginal row of spines present, sometimes clustered near apex. Palp segments 2 and 3 with spinose lateral lobes; segment 4 distinct, small, masked by lateral lobe of segment 3. Gnathopod 1 strong, segment 6 with very small palm, or secondarily swollen in both sexes; segment 6 of gnathopod 2 long, slender and mitten-shaped. Anterior and posterior gills well developed; gnathopod 2 gills large, peraeopod 6 gills large, somewhat lobate proximally. Other gills smaller, those of peraeopods 3 and 4 basically sac-like, peraeopod 5 gill bilobate. Females with 4 pairs of oostegites, anterior 3 long with short, simple apical setae, posterior pair somewhat reduced. Peraeopods 3–7 simplidactylate. Epimeral plate 1 deep, plates 2 and 3 slightly produced behind, convexly rounded below. Pleopods reduced or vestigial, rami short or absent. Uropods 1 and 2 long, slender, outer ramus of uropod 2 not shorter than inner; outer ramus of uropod lacking marginal spines, distolateral spine of peduncle long, curved and simple. Telson with small apical cleft.

Type species. *Austrotroides pectinalis* Friend, 1982 (original designation).

Additional species. *A. occidentalis* Friend, 1982; *A. crenatus* Friend, 1982; *A. longicornis* n.sp.; *A. leptomerus* n.sp.; *A. maritimus* n.sp.

Remarks. The genus closest to *Austrotroides* is *Protaustrotroides,* which displays a very similar combination of features, but differs from *Austrotroides* in its possession of weakly subchelate

female gnathopod 1, enlarged subchelate male gnathopod 2, and marginal spines on the outer ramus of uropod 1. Both genera display a combination of plesiomorphic and apomorphic features. The following characteristics of the genera are generally found in talitrids less well adapted to terrestrial life (shore-dwelling and palustral species) and are regarded as plesiomorphic character states: broad spinose maxilliped palps with the fourth segment entirely masked, rounded outer plate with numerous blunt submarginal spines, setose inner plate with small apical spine-teeth; deep, narrow upper and lower lips, maxillae 1 and 2; broad oostegites bearing lateral as well as apical spines; gnathopod 1, inner shelf present, though weak; uropod 3 ramus subequal to peduncle and bearing marginal spines.

The possession of so many significant plesiomorphic features renders *Austrotroides* and *Protaustrotroides* the most plesiomorphic of the simplidactylate Tasmanian genera, despite the loss (in *Austrotroides)* of sexual dimorphism of the gnathopods.

However, *Austrotroides* also displays a number of derived features found in groups of landhoppers showing the greatest divergence from shore-dwelling types and occupying habitats at the dry end of the landhoppers' range (e.g. *Keratroides).* These characters are generally expressed in the plesiomorphic state in the cuspidactylate Tasmanian genera *Orchestiella* and *Tasmanorchestia.*

They are as follows: reduced, usually vestigial pleopods; long, slender peraeopods; slender gnathopods, similar in both sexes; enlarged anterior and posterior gills, last pair long, laterally flattened and anseriform.

Austrotroides is distinguished from other Australian genera with flattened anseriform gills of peraeopod 6 *(Keratroides* and *Arcitalitrus)* by the possession of an elongate, marginally spined ramus of uropod 3, and the form and spination of maxillipeds, particularly the possession of medial lobes on the outer plate palp segments 2 and 3.

Three species of *Austrotroides* are found in mainland Australia (Friend, 1982). The Tasmanian species share several features not found in the northern species, although these differences are not sufficiently great to warrant further generic division. In the Tasmanian species the maxilliped outer plate spines form a submarginal row rather than a subapical group, the gnathopod 2 gill has a slender anterior extension rather than a broad rounded one, and segment 2 of peraeopod 7 is narrowly expanded behind, the hind margin distally indented and not forming the distinct distal lobe found in the mainland species. No mainland species of *Austrotroides* has spines on the outer ramus of uropod 2 (as do two of the Tasmanian species) and all three Tasmanian species have vestigial pleopods (those of the Western Australian *A. occidentalis* are biramous and setose).

Austrotroides longicornis n.sp.

Figs 1–3

Type material. HOLOTYPE ♀, AM P37335; southern Tasmania, left bank of South Cape Rivulet, South Coast Track, in rotten eucalypt wood, above ground, map ref. 8210-826726, coll. P. Allbrook, 6 Sept 1976. ALLOTYPE ♂, AM P37336; southern Tasmania, beside Cockle Creek Road, 200 m south of Catamaran River, map ref. 8210-907793, under a large *Eucalyptus obliqua,* 23 Aug 1974. 7 PARATYPES (7 ovig.♀♀), AM P37337; same data as holotype. 2 PARATYPES (♂,♀), BMNH; same data as allotype. 1 PARATYPE (♀), NMNS; same data as allotype.

Other material examined. Tasmania: 22 further specimens in 11 collections listed in Friend (1980).

Diagnosis. Antenna 2 as long as head and first 5 peraeon segments. Maxilliped, outer plate, spines forming submarginal row. Gnathopod 1, segment 6 slender, narrowing gently to a very small oblique palm, hind margin straight, hand never swollen. Gnathopod 2, gill with slender anterior process. Peraeopod 6, posterior margin of gill strongly incised, forming a neck proximal to pointed distal lobe, margins otherwise smooth. Peraeopod 7, segment 2 narrowly expanded behind, hind margin not forming distinct distal lobe. Pleopods reduced to vestigial stumps, second and third much smaller than first. Uropod 2, outer ramus bearing marginal spines. Telson with 1 minute spine on either side of the apex, no spines on margins.

Description. Female: Length 14.2 mm, ovigerous, with 2 eggs [2–9]. Head longer than deep, eye almost round, width just over ¼ head length. Antenna 1 very long, reaching ¾ along last peduncular segment of antenna 2; flagellum 8-segmented [most found: 9], longer than peduncle. Antenna 2 also long and slender, as long as head and first 5 peraeon segments, peduncular segment 5 long, slender, longer than rest of peduncle; flagellum much longer than peduncle, 29 long segments [most found: 30] mostly bearing 4 groups of 3 bristles, longer than the width of the segment.

Upper lip deep, apically pilose, indentation of right distal margin prominent. Lower lip narrow, inner shoulders thickly pilose, margins of central trough lightly pilose, naked proximally. Left mandible 5-cuspate, lacinia mobilis with 5 teeth, molar 21-striate. Right mandible 5-cuspate, lacinia bicuspate with proximal ridge crenulate. Maxilla 1, inner plate short, terminal plumose setae long; outer plate narrowing distally, stout 2-segmented palp at broadest part, terminal spines short, dentition formula 1-3-0-5-5-4-4-5-6. Maxilla 2, plates slender, inner shorter and narrower, apical spines short, densely set, longer at inner end of distal margin, proximal plumose seta slender. Outer plate bearing 2 long sharp apical spines, distal spine row of short uneven spines.

Maxilliped, inner plate narrow, broadening distally, apical spine-teeth prominent, outer largest,

inner smallest; 7 plumose setae on inner margin, 4 submarginal on medial surface, 8 grouped subapically on lateral surface. Outer plate broad, apex obtusely rounded, strong submarginal spine-row with blunt spines grouped in pairs. Palp fairly broad, spines on lateral surface small, substantial lateral lobes on second and third segments; medial face of lobe on second segments crenulate, inner margin well spined, lobe on third segment broad, spinose, masking small fourth segment which carries several apical spinules.

Gnathopod 1, coxal plate rounded below, inner shelf weak with a few long spines, segment 2 long, slender, broadening distally, anterior margin spinose. Segment 4 spinose behind, tumescence hardly discernible. Segment 5 longer than 6, deep, posterior tumescence deep and long, surrounded by numerous spines on lateral and medial sides. Segment 6 long, almost linear, narrowing slightly distally, with short oblique palm defined by small posterior spine-group; posterior margin quite densely spinose, anterior margin with 3 small groups of spines. Dactyl strong, exceeding palm, terminal spine curved.

Gnathopod 2, coxal plate deep, lower margin smoothly rounded, spinulose, posterior process prominent, acute. Gill large, distal part broad, anterior extension a small slender lobe; oostegite broad, bearing 13 slender setae near apex and along distal half of anterior margin. Segment 2 long, broadening gently distally, anterior margin spinose. Segment 4 very weakly spinose, posterior tumescence prominent. Segment 5 very elongate, slender, posterior margin expanded into broad lobe, row of spines near distal margin. Segment 6 shorter, also slender and elongate, terminal lobe prominent, medial spine-row of tiny spinules. Dactyl small.

Peraeopod 3, coxal plate broader than deep, smoothly rounded below, spinulose; posterior process acutely rounded. Gill simple, sac-like, oostegite fairly broad, just shorter than segment 2, with 13 setae around apex and along distal half of anterior margin. Remainder of limb long, slender, segment 6 spinose behind, dactyl slender, terminal spine long.

Peraeopod 4, coxal plate like 3 but posterior process smaller, blunt-ended; oostegite with 12 setae, more distally placed; limb otherwise similar to peraeopod 3.

Peraeopod 5, anterior coxal lobe broad, smoothly rounded below, lightly spinulose; posterior lobe small, much shallower, almost straight behind. Gill small, bilobed; oostegite about ⅔ as long as others, with 3 slender setae and 2 spinules near apex. Segment 2 small, narrowing evenly distally, hind margin almost straight, spinulose. Segments 4–6 long, slender, spinose, dactyl slender, terminal spine long.

Peraeopod 6, posterior coxal lobe semicircular

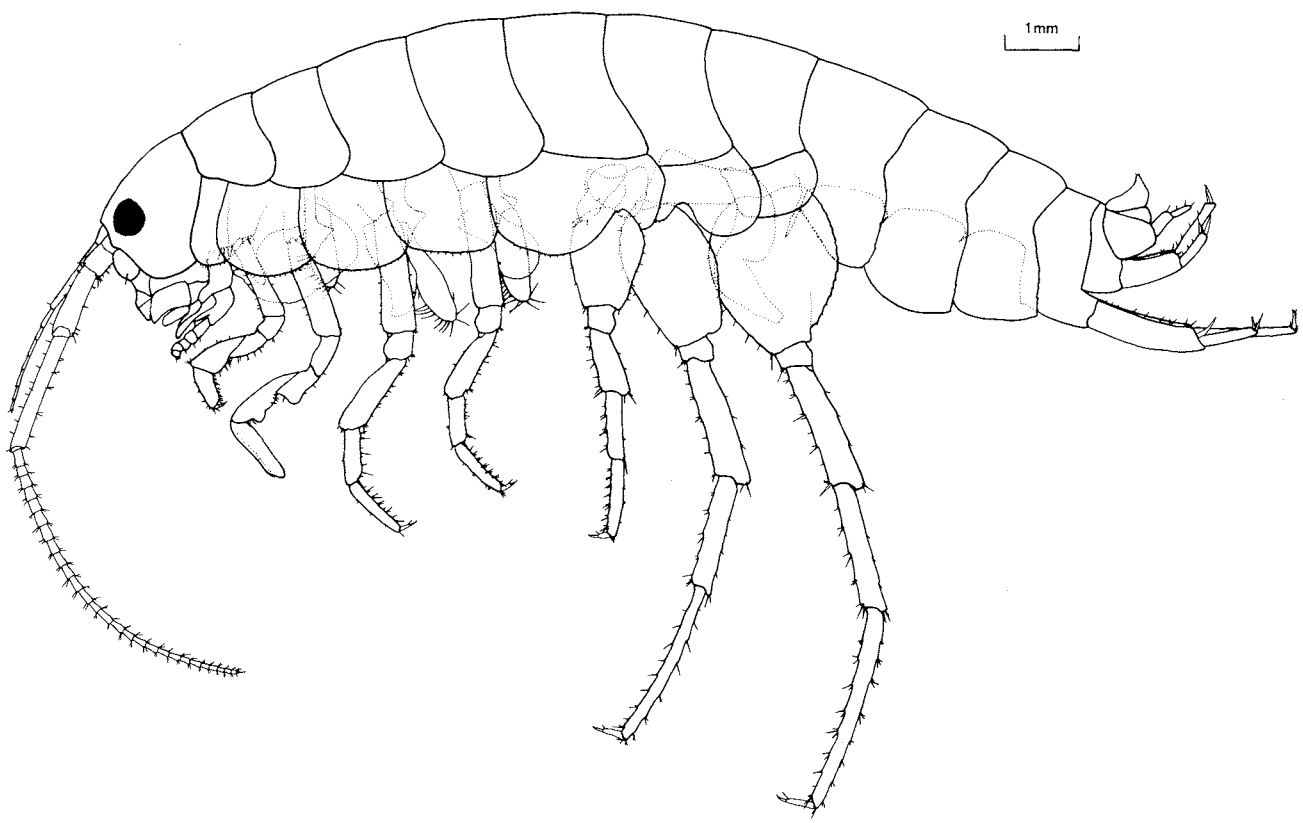

Fig. 1. *Austrotroides longicornis* n. sp., holotype, female, 14.2 mm, near South Cape Rivulet, southern Tasmania.

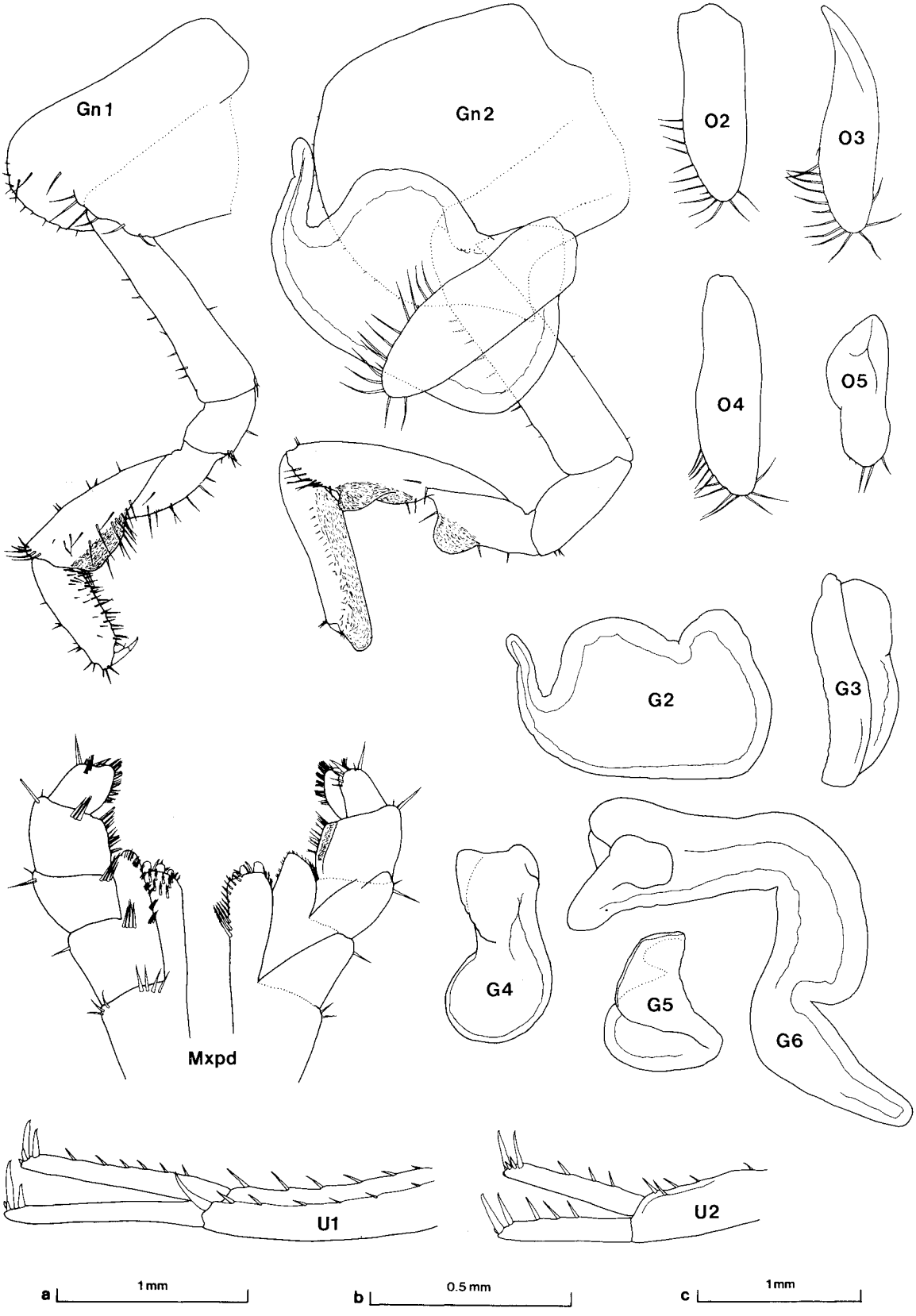

Fig. 2. *Austrotroides longicornis* n. sp., holotype, female, 14.2 mm, near South Cape Rivulet, southern Tasmania. Scale a: Gn1&2; scale b: Mxpd; scale c: G2-6, O2-5, U1&2.

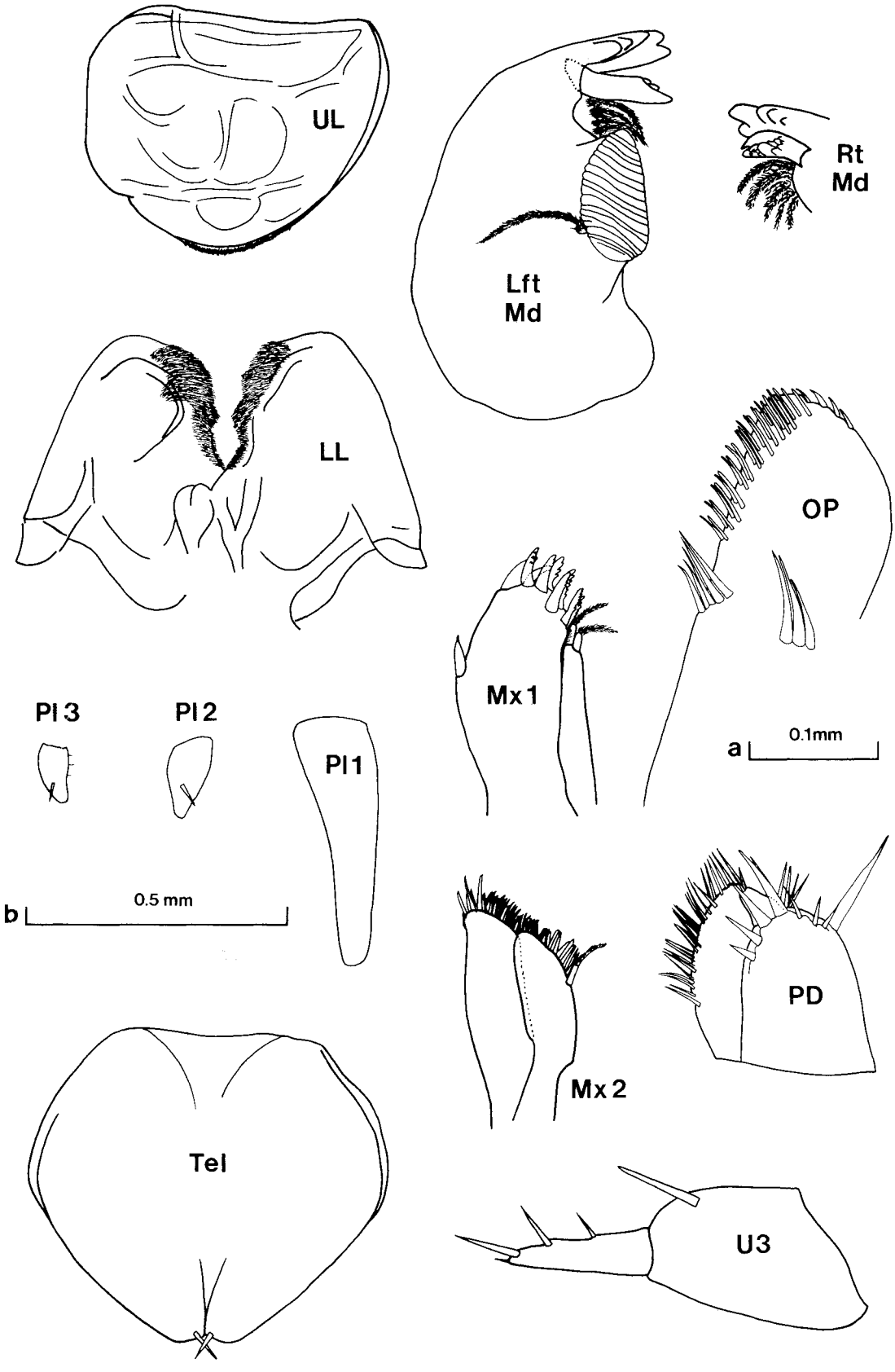

Fig. 3. *Austrotroides longicornis* n. sp., holotype, female, 14.2 mm, near South Cape Rivulet, southern Tasmania. Scale a: OP, PD; scale b: Lft Md, Rt Md, Mx1&2, UL, LL, Tel, U3, P11-3.

below, posterodistally serrulate. Gill large, distally lobate, anseriform, with posterior constriction just before distal 'head' section, which tapers to a rounded apex. Segment 2 slender-ovate, hind margin convex, serrulate, distal lobe present, small. Segments 4–6 elongate, slender, with many groups of fairly small spines. Dactyl slender, terminal spine almost straight.

Peraeopod 7, coxal plate small, serrulate posterodistally. Segment 2 broad-ovate, hind margin serrate, spinulose, meeting trunk of segment slightly proximal to distal end. Segments 4–6 extremely elongate, slender, well spined; segment 6 with 9 groups of spines on anterior margin. Dactyl elongate, slender, terminal spine slightly curved.

Epimeral plate 1 deep, lower margin oblique, rounded posteriorly; hind margin convex, serrulate. Plate 2 larger than 3, anterior corners smoothly rounded, lower margins convex, hind corners sharp, almost square; hind margins fairly straight, distally serrulate.

Pleopods reduced to peduncular vestiges; pleopod 1 as long as depth of coxa 7, naked peduncle narrowing from base to near midway, apex rounded. Pleopod 2 a tiny stump less than ⅓ as long as first, narrowing distally, with small submarginal spine. Pleopod 3 an even smaller stump, with 1 spine and some marginal pilosity.

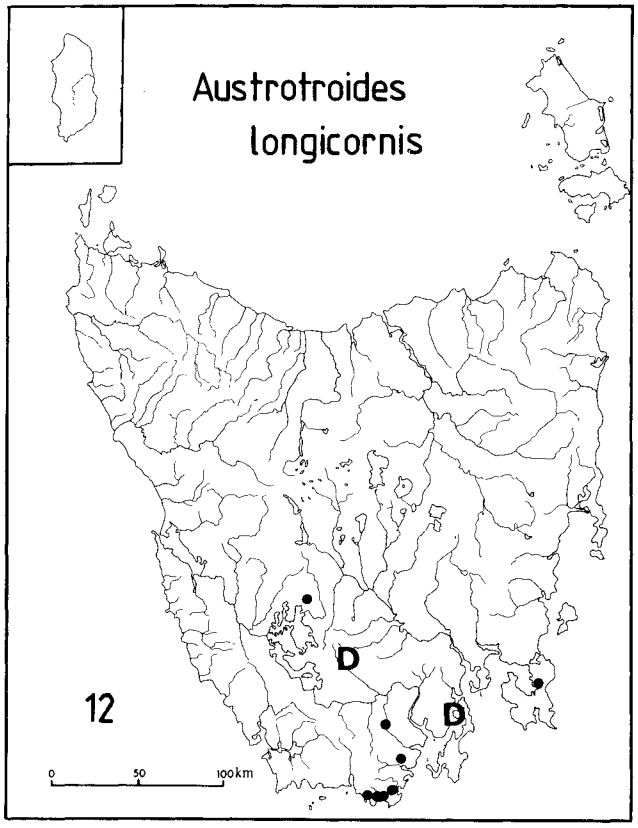

Fig. 4. Distribution of *Austrotroides longicornis*. 'D' refers to an apparent disjunction in distribution. Total number of records is shown at lower left.

Uropod 1 elongate, peduncle slender, with inner and outer marginal rows of 6 spines and 1 curved distolateral spine; rami slender and long, subequal, shorter than peduncle; outer ramus without marginal spines, armed distally with 4 strong spines, one as long as peduncular apical spine, other 3 smaller; inner ramus with 6 small marginal spines, 2 large and 2 small distal spines. Uropod 2 elongate, peduncle poorly spined, slender, just longer than subequal rami, both of which bear 3 marginal spines. Uropod 3 long, peduncle sub-cylindrical, with 1 slender spine; ramus slender, elongate, with 2 marginal spines and 2 unequal apical spines.

Telson broad, minutely cleft apically, with a tiny spine on each apical lobe.

Male: length 10.1 mm. Antenna 1, flagellum 9-segmented [most found: 9], antenna 2 with 29 segments [most found: 29].

Etymology. The specific epithet, meaning 'long-horned', refers to the possession of elongate antennae.

Remarks. This species, which is distinguished by its long antennae and uropods (especially uropod 3), is otherwise most similar in morphology to *A. maritimus*.

Distribution. (Fig. 4) A relatively rare species, *A. longicornis* is mainly found in the far south, but two isolated records indicate a disjunct distribution. One of these is near Lake Rhona, in the western half of the island, and the other is on Forestier Peninsula on the east coast.

Austrotroides leptomerus n.sp.

Figs 5–7

Type material. HOLOTYPE ♀, AM P37338; southern Tasmania, South Coast Track, top side of ridge 2 km west of Surprise Bay, beside track in dry woodland, map ref. 8210-708757, 28 Dec 1975. ALLOTYPE ♂, AM P37339; 2 PARATYPES (2♂♂), AM P37340; 3 PARATYPES (2♂♂,♀), BMNH; 3 PARATYPES (2♂♂,♀), NMNS; southern Tasmania, beside Old Hartz Track at head of Arve River, west of Taylor's Ridge, ex dry *Richea pandanifolia* foliage, map ref. 8211-829146, coll. J.L. Hickman & A.M.M. Richardson, 24 Aug 1973.

Other material examined. Tasmania: 9 specimens in 6 collections listed in Friend (1980).

Diagnosis. Antenna 2 longer than head and first 5 peraeon segments. Maxilliped, outer plate, spines forming submarginal row. Gnathopod 1, segment 6 slender, hind margin slightly concave, palm short, oblique. Gnathopod 2, gill with slender anterior process. Peraeopod 6, gill margins broadly crenate. Peraeopod 7, segment 2 narrowly expanded behind, hind margin not forming distinct distal lobe. Pleopods reduced to peduncular stumps bearing vestigial rami, 2 rami on first pleopod (inner ramus fused with peduncle), 2 on second, 1 on third, all with plumose setae. Uropod 2, outer ramus with no

marginal spines. Telson with 2 unequal spines on each side of minutely cleft apex.

Description. Female: Length 14.5 mm, ovigerous, with 4 eggs. Head just longer than deep; eye large, almost round, width more than ⅓ head length, anteriorly placed. Antenna 1 very long, reaching to ⅘ of last segment of antenna 2; flagellum longer than peduncle, 10-segmented [most found: 11]. Antenna 2 very long, slender, longer than head and first 5 peraeon segments, peduncular segment 5 slender, longer than rest of peduncle; flagellum 27-segmented [most found: 29], with 4 groups of 3 short setae.

Upper lip fairly deep, pilose apically, with lateral pilose patches; indentation of right margin not discernible. Lower lip deep, some sparse pilosity on outer margins, inner shoulders and central trough margins thickly pilose; lateral lobes slender. Left mandible 5-cuspate, lacinia mobilis 5-dentate, molar with 18 striations. Right mandible with 4 cusps, lacinia with 2 teeth. Maxilla 1, inner plate narrowing distally; outer plate narrow, 2-segmented palp distal of midway along outer margin, apical spine-teeth short, dentition formula 2-2-1-3-4-4-4-4-5. Maxilla 2, outer plate much broader than inner, inner plate armed distally with numerous short spines, slightly longer at inner end, plumose seta prominent; outer plate with several small spines on outer margin, 4 large sharp spines near apex.

Maxilliped, inner plate fairly narrow, apical spine-teeth prominent, inner small; lateral surface with group of 6 small plumose spines, inner margin of medial surface with 7 plumes, and 2 submarginal plumose spines distally. Outer plate narrow, rounded apically, submarginal spines small, mostly blunt-tipped. Palp fairly broad, lobe of segment 2 distally crenulate, spinose; spines of segment 3 mostly distal, some rather stout; segment 4 very small, masked by distal section of lobe of previous segment.

Gnathopod 1, coxal plate shallow, inner shelf weak, lower margin spinose. Segment 2 spinulose anteriorly. Segment 5 long, deeply tumescent posteriorly, medial surface with group of small spines. Segment 6 shorter than 5, gently narrowing distally, lightly spinose behind, anterior margin with 3 groups of spines, very short palm exceeded by strong dactyl.

Gnathopod 2, coxal plate broad, spinulose below, posterior process elongate, acutely pointed. Gill large, anterior extension long, slender; oostegite broad, ¾ as long as segment 2, 12 slender setae set near apex and back along anterior margin to near midpoint. Segment 2 slender, elongate, spinose anteriorly. Segment 4 short, posterodistal tumid lobe small. Segment 5 very long, slender, very weakly spinose, posterior lobe shallow, long. Segment 6 very slender, elongate, shorter than 5, medial spine-row of tiny spinules, distal lobe small, dactyl weak, longitudinal.

Peraeopod 3, coxal plate broad, shallow, posterior lobe elongate, acutely pointed. Gill broad, sac-like, oostegite broadening distally, 17 slender setae near apex and along anterior margin. Segment 2 linear, poorly spinose, segments 4–6 elongate, spinose behind, dactyl slender, terminal spine curved.

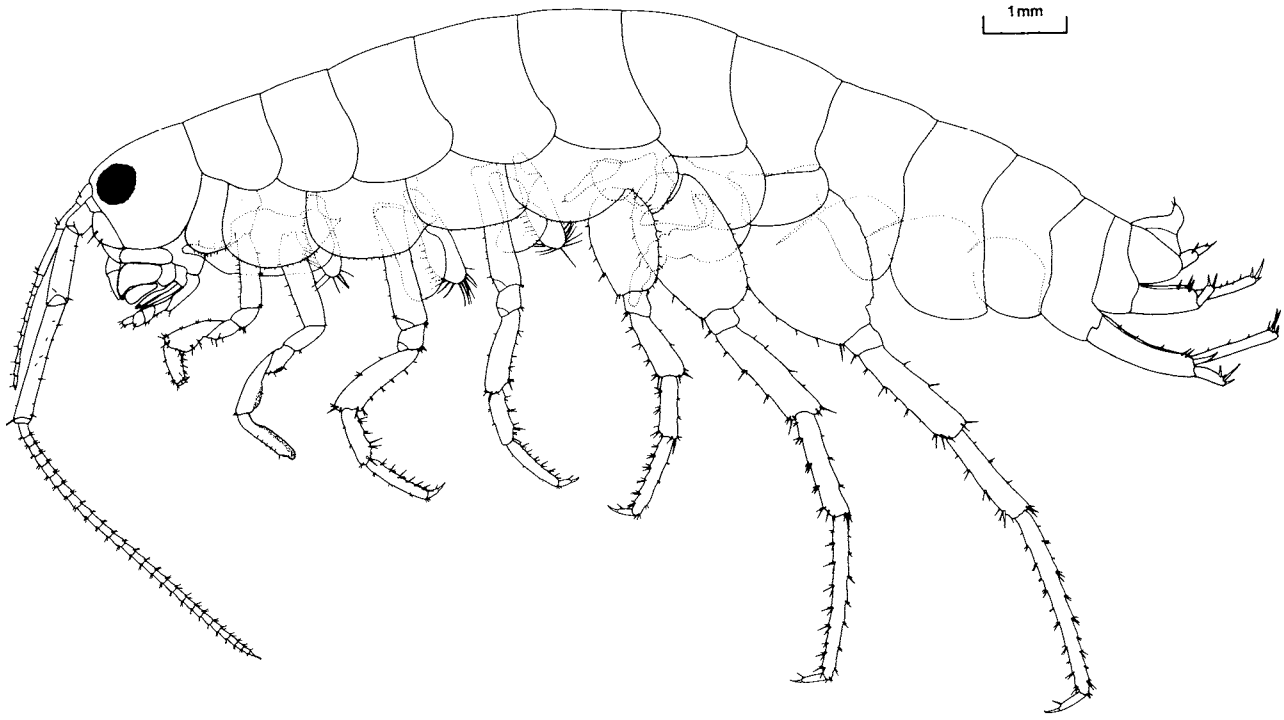

Fig. 5. *Austrotroides leptomerus* n. sp., holotype, female, 14.5 mm, near Surprise Bay, southern Tasmania.

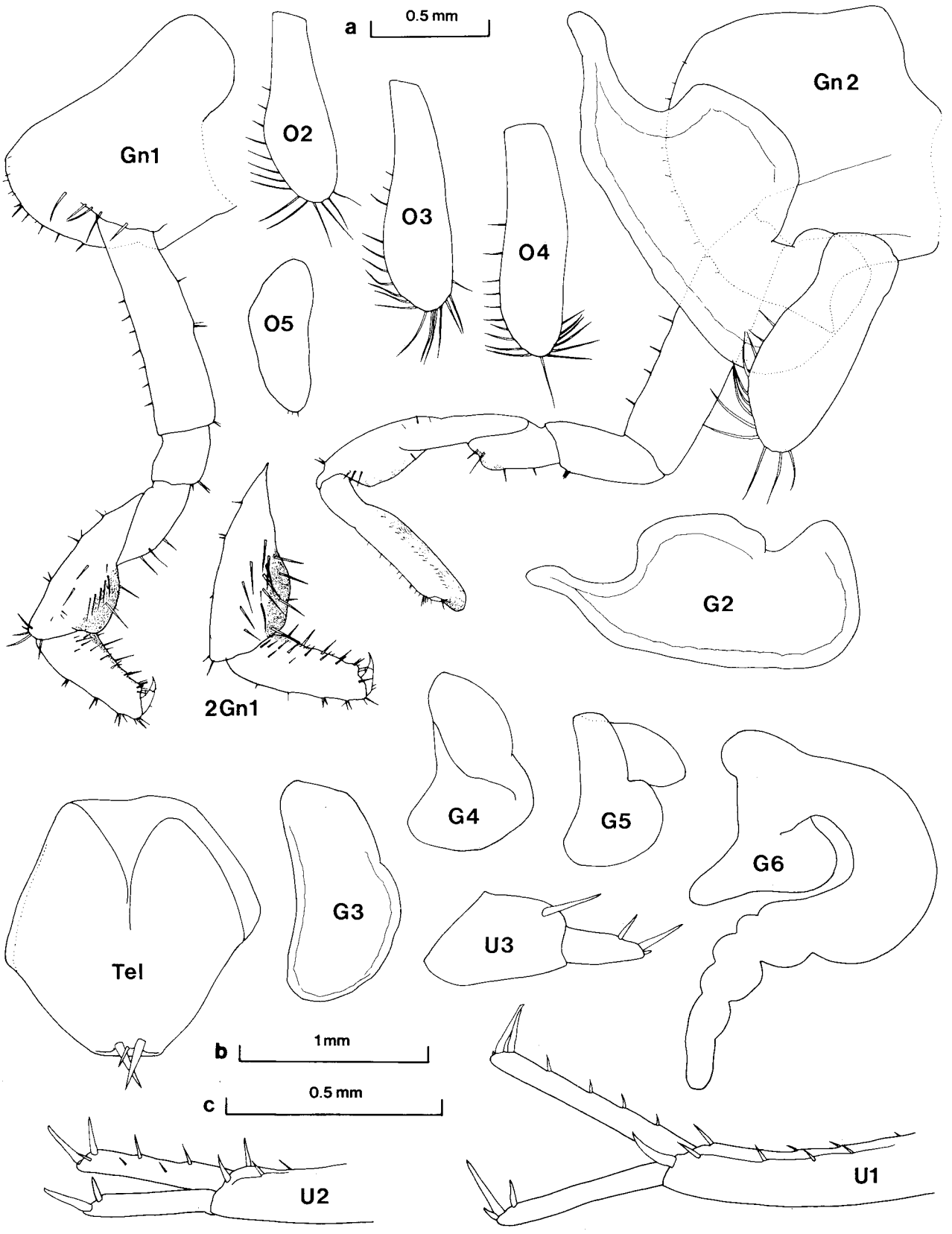

Fig. 6. *Austrotroides leptomerus* n. sp., holotype, female, 14.5 mm, near Surprise Bay, southern Tasmania. 2, allotype, male, 13.1 mm, head of Arve River valley, southern Tasmania. Scale a: Gn1&2, 2Gn2; scale b: G2-6, O2-5, U1&2; scale c: Tel, U3.

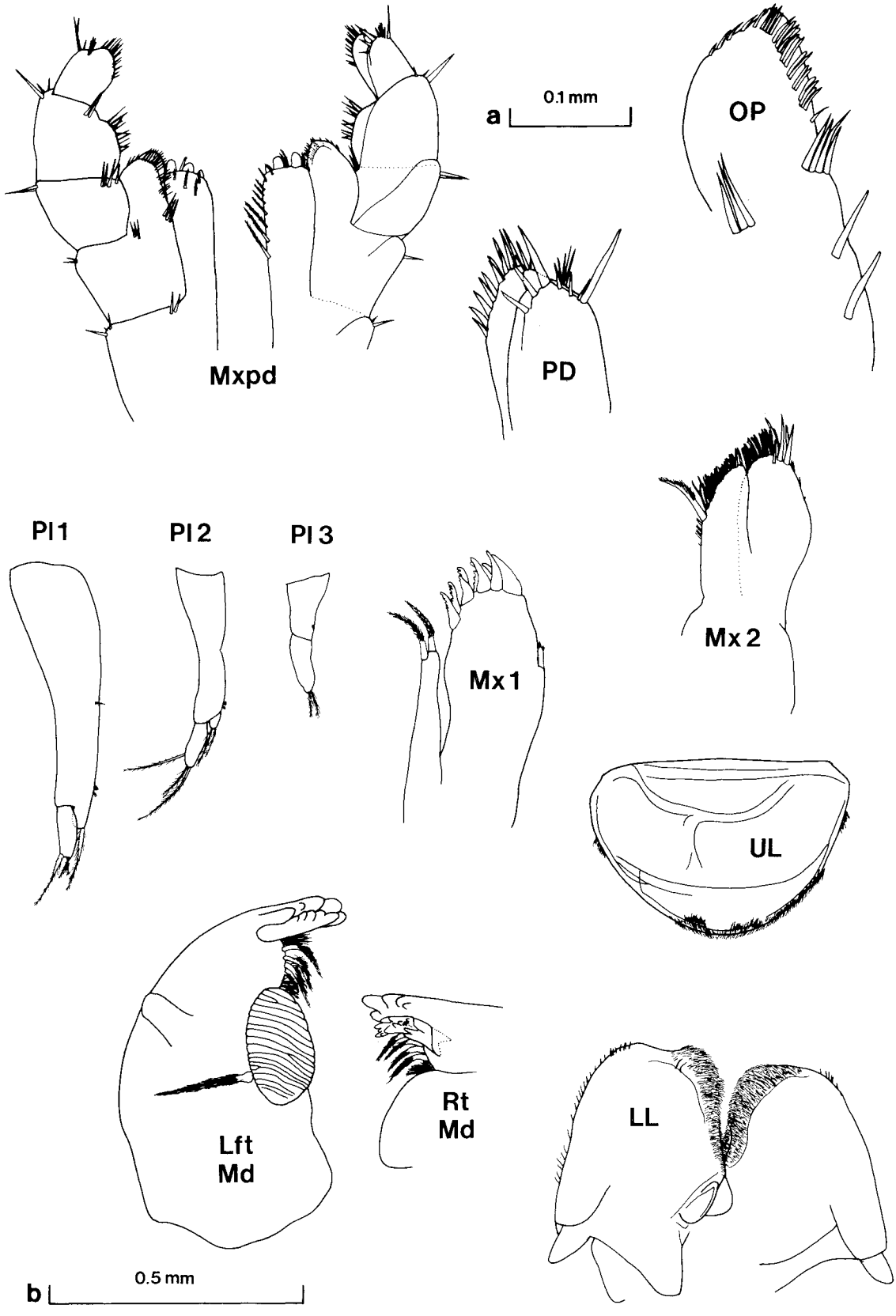

Fig. 7. *Austrotroides leptomerus* n. sp., holotype, female, 14.5 mm, near Surprise Bay, southern Tasmania. Scale a: OP, PD; scale b: Mxpd, Mx1&2, UL, LL, Lft Md, Rt Md, P11-3.

Peraeopod 4 similar, but coxal plate broader, shallower, oostegite with 17 setae.

Peraeopod 5, anterior coxal lobe broad, shallow, rounded and spinulose below; posterior lobe just shallower, strongly rounded distally. Gill small, bilobate; oostegite just over half as long as those of peraeopods 3 and 4, narrowing to rounded apex with 3 spinules. Segment 2 small, slender-ovate, serrulate and spinose behind. Segments 4–6 long, spinose in front; dactyl long, slender, terminal spine curved.

Peraeopod 6 coxal plate small, posterior lobe shallow, semicircular below. Gill long, anseriform but 'neck' strongly curved anteriorly, distally tapering, margins broadly crenate. Segment 2 slender-oblong, distal lobe very shallow, broad, hind margin distally spinose. Segments 4–6 elongate, slender, spinose, dactyl slender, terminal spine almost straight.

Peraeopod 7, coxa small, smooth below. Segment 2 small, distal margin meeting trunk of segment subapically, forming very small subdistal lobe. Segments 4–6 very elongate, slender, with numerous spine-groups; segment 6 with 11 on each margin. Dactyl slender.

Epimeral plate 1 deep, narrow, rounded below, convex behind. Plate 2 projecting well beyond plates 1 and 3, broadening distally, round below, produced minutely behind, hind margin straight. Plate 3 much smaller than plate 2, rounded below, slightly produced posterodistally, hind margin sinuous.

Pleopods greatly reduced. Pleopod 1, peduncle narrowing distally, 1 small spine near midway on inner margin, 2 coupling spines subapically. Inner ramus longer than outer, slender, with 3 small apical plumose setae. Outer ramus fused with peduncle, bearing 1 apical seta. Pleopod 2 smaller, biramous, with 2 coupling spines, inner ramus longer than outer, with 1 subapical and 2 apical setae, outer with 2 apical setae. Pleopod 3 shortest, single ramus as long as peduncle, which bears 2 coupling spines; ramus with 2 short apical setae.

Uropod 1 elongate, peduncle longer than rami, slender, with 3 spines on each margin, distolateral spine strong, short. Outer ramus with naked margins, 1 of the distal spines slender and longer than peduncular apical spine. Inner ramus subequal to outer, with 4 marginal spines, 2 distal spines long, slender. Uropod 2, peduncle slender, with 2 spines on each margin. Rami subequal to each other and peduncle, outer ramus with naked margins, inner with 2 sets of 2 marginal spines, both rami bearing long apical spines. Uropod 3, ramus long, subcylindrical, ramus slender, with 1 subapical and 2 unequal apical spines.

Telson fairly broad, apically hardly cleft, with 1 strong spine on each side and 1 small spine on side of apex.

Male: length 13.1 mm. Antenna 1 flagellum 12-segmented [most found: 12], antenna 2 flagellum with 34 segments [most found: 34].

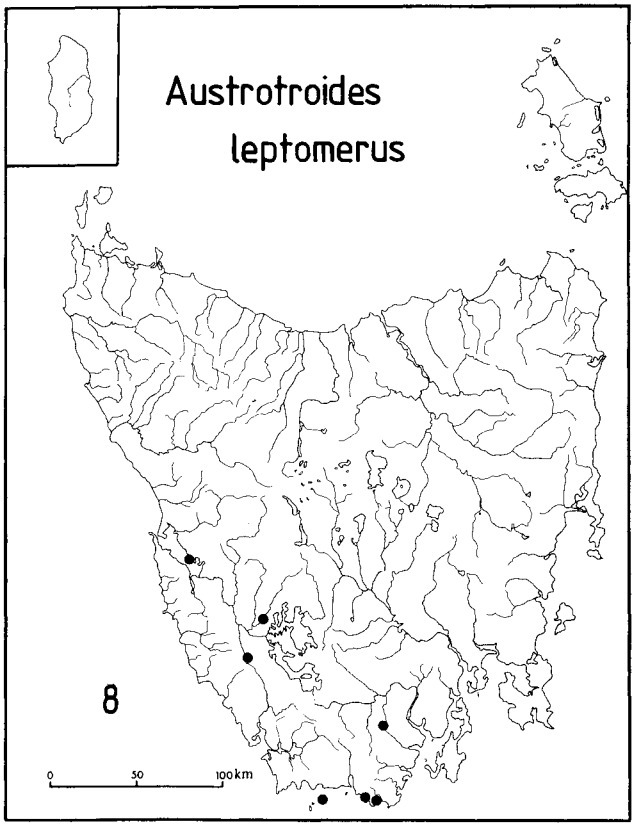

Fig. 8. Distribution of *Austrotroides leptomerus*. Total number of records is shown at lower left.

Remarks. The long, slender, distally crenate gills of *Austrotroides leptomerus* are characteristic and easily recognized, as are the large eyes, slender body and long appendages. *Austrotroides crenatus* Friend, a South Australian species, also has crenate gills and bears a number of other similarities to this species, although it is superficially different in terms of the slenderness of the body and relative length of limbs. *Austrotroides leptomerus* can also be distinguished from *A. crenatus* by features listed above as common to the Tasmanian *Austrotroides* species.

Males and females of this species are of similar size.

Etymology. The name of this species refers to the slender body, which is a very distinctive feature.

Distribution. (Fig.8) *Austrotroides leptomerus* appears to be a rare species, found in low numbers in litter, at only a few sites in the southern half of western Tasmania. The largest collection, however, came from litter caught up in the dry head of a dead Giant Grass Tree *(Richea pandanifolia* Hook.f.) so it may be that *A. leptomerus* occupies a specialised micro-habitat which has usually been missed in collections. Both this species and *A. longicornis* occur only in rather inaccessible parts of the island.

Austrotroides maritimus n.sp.
Figs 9–12

Type material. HOLOTYPE ♀, AM P37341; Maatsuyker Island, off south coast of Tasmania, near top of haulage, under teatree, map ref. 8110-419669, 16 Jan 1979. ALLOTYPE ♂, AM P37342; 5 PARATYPES [2♂♂, 2♀♀(1 ovig.), 1 juv.], AM P37343; 3 PARATYPES (♂, ♀, 1 juv.), BMNH; 5 PARATYPES [♂, 2♀♀(1 ovig.), 2 juv.], NMNS; southern Tasmania, coast 3 km north of Cockle Creek, in seaweed, eucalypt and bush litter at high water mark, map ref. 8210-912787, coll. A.M.M. Richardson, B. Knott, D. Coleman, 19 May 1976.

Other material examined. Tasmania: 327 specimens in 20 collections listed in Friend (1980).

Diagnosis. Antenna 2 as long as head and first 4 peraeon segments. Maxilliped, outer plate spines forming a submarginal row. Gnathopod 1, segment 6 swollen, hind margin convex (hand greatly swollen in adult males). Gnathopod 2, gill with slender anterior process. Peraeopod 6, hind margin of gill with obtuse indentation, margins otherwise smooth. Peraeopod 7, segment 2 narrowly expanded behind, hind margin not forming distinct distal lobe. Pleopods reduced to vestigial stumps, progressively smaller posteriorly. Uropod 2, outer ramus with marginal spines. Telson with 1 large and 1 small spine on either side of apex.

Description. Female: Length 13.8 mm, with 9 young [4–9]. Head as deep as long, eye almost round, width ⅓ head length. Antenna 1 long, slender, reaching ⅔ along last peduncular segment of antenna 2; peduncle longer than flagellum, segment 3 longer than 1 and 2 together; flagellum 10-segmented [3–10]. Antenna 2 as long as head and first 4 peraeon segments, segment 5 of peduncle over half peduncular length, slender; flagellum 27-segmented [8–27], each segment with groups of short bristles.

Upper lip fairly deep, with small patch of apical pilosity, indentation of right margin prominent. Lower lip narrow, lateral lobes small, inner shoulders moderately pilose, margins of central trough only faintly pilose. Left mandible 4-cuspate, lacinia mobilis 4-toothed, molar process 17-striate. Right mandible with 5 cusps, lacinia 2-cuspate, with distal field of minute rounded projections, toothed ridges running towards proximal end. Maxilla 1, inner plate short, narrowing distally, apical plumes strong; outer plate slender, narrowing distally from position of 2-segmented palp, beyond midpoint of convex outer margin; apex narrow, spine-teeth strong, dentate, clustered; dentition formula 0-0-3-2-4-4-4-4-5. Maxilla 2, inner plate narrower than outer, plume near inner margin strong, distal spines densely clustered, short at outer end, long at inner end. Outer plate apex armed with 5–6 large sharp spines, several shorter ones outside these and submarginally; other spines of medium length.

Maxilliped inner plate slender, broadening distally

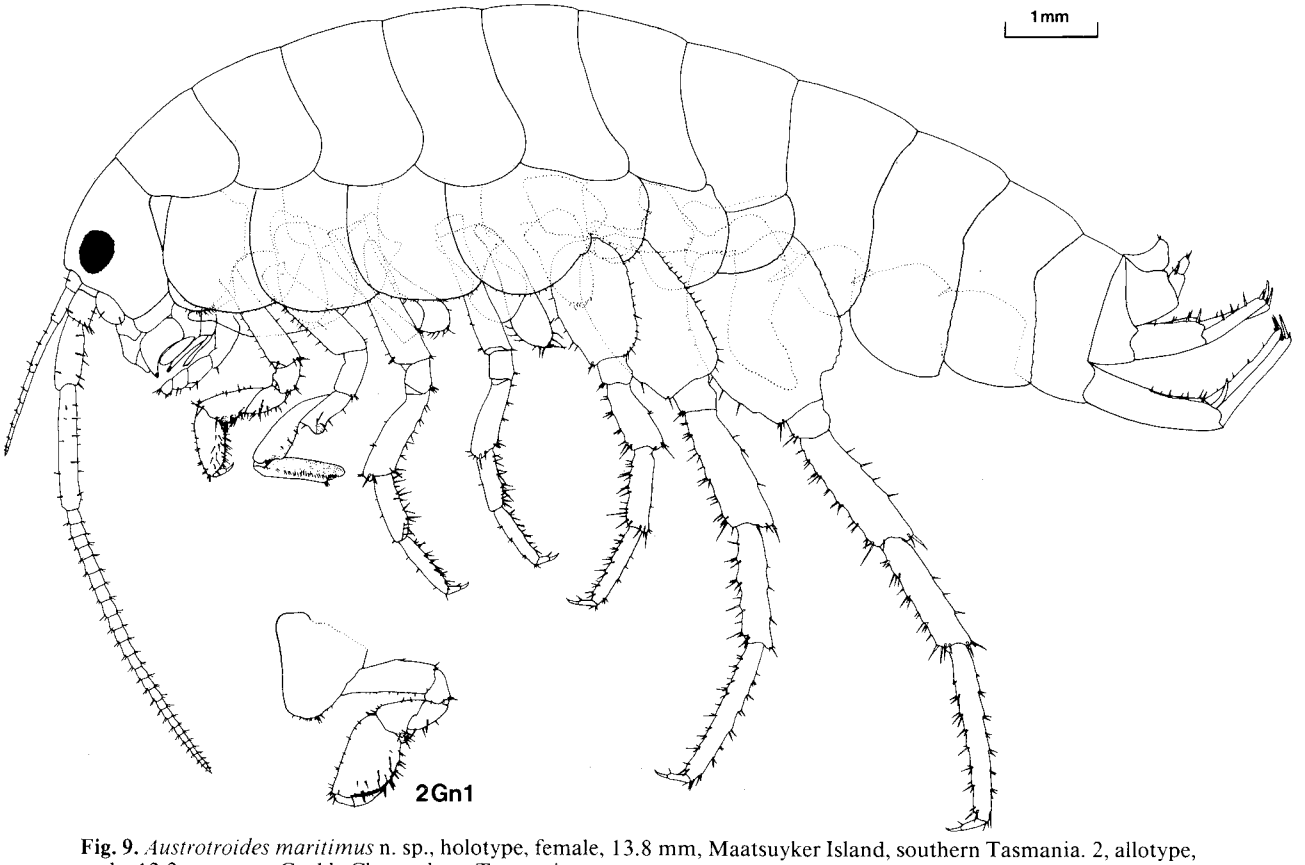

Fig. 9. *Austrotroides maritimus* n. sp., holotype, female, 13.8 mm, Maatsuyker Island, southern Tasmania. 2, allotype, male, 12.2 mm, near Cockle Ck, southern Tasmania.

to rounded apex, which bears 3 unequal, bluntly rounded spine-teeth, 5 plumose spines set on the outer distal margin; inner margin with row of 10 plumose spines, 4 submarginally near inner distal corner. Outer plate apically rounded, submarginally profusely spined, proximal groups of long, strong spines. Palp fairly strong, lobe of segment 2 narrow, with 4 groups of spines near inner margin; segment 3 with broad lateral and distal lobe which masks slender, conical segment 4; mediodistal spines of segment 3 strong.

Gnathopod 1, coxa distally spinulose, inner shelf bearing row of slender spines. Segment 2 elongate, broadening distally, spinose in front. Segment 3 with negligible posterior blister. Segment 4 quite broad, spinose on posterior margin, medial surface with many slender spines; tumid lobe fairly deep. Segment 6 subequal to 5, swollen and very spinose behind; palm very oblique, defined by 2 strong spines between which the powerful dactyl closes.

Gnathopod 2, coxa large, deeper than broad, distally smoothly convex and spinulose, posterior process prominent, acute. Gill large, proximally broad, anterior extension short, slender; oostegite broad, just shorter than segment 2, with 12 small slender setae near apex. Segment 2 slender, broadening distally, anterior margin spinose. Segment 3 longer than 4, which has a large posterodistal tumescence. Segment 5 slender, elongate, with shallow, broad posterior blister and a row of slender spines distal to this, on the medial surface. Segment 6 long and slender, medial spine-row double, comprising many small spines, distal lobe long.

Peraeopods 3 and 4, coxae large, deeper than broad, distally spinulose, posterior process prominent, sharp. Gills large, sac-like; oostegites broad, longer than that of gnathopod 2, with 10–12 small setae near apex. Second segments almost linear, segments 4–6 spinose behind, dactyls slender.

Peraeopod 5, coxa very large, anterior lobe broad and deep, distally rounded, spinulose; posterior lobe much smaller, shallower, almost straight behind. Gill small, bilobed, oostegite over half as long as those of peraeopods 3 and 4, half as broad as long, distally with 4 small and 2 tiny setae. Segment 2 slender, oblong, posterior margin serrate, spinose. Segments 4–6 slender, spinose in front; dactyl slender, terminal spine curved.

Peraeopod 6, anterior coxal lobe small, distal margin straight, posterior lobe deep, broad. Gill long, anseriform, lobate proximally, distal section broad, then narrowing to the blunt apex. Segment 2 narrow, oblong, posterior margin serrulate, spinose, just convex, distal lobe broad but shallow. Segments 4–6 slender, spinose anteriorly, dactyl small and slender.

Peraeopod 7, coxa deep, anterior margin concave, spinulose, forming blunt anterior projection, lower margin rounded, serrulate posteriorly. Segment 2 fairly slender, hind margin serrulate, curving round to meet trunk of segment subapically, forming shallow subdistal lobe. Segments 4–6 slender, spinose, dactyl small, slender.

Epimeral plate 1 deep, convex, serrulate behind. Plate 2 markedly longer than third, both rounded in front and below, hind corner sharp, obtuse, hind margin straight, serrulate.

Pleopods reduced to vestigial stumps, representing peduncle only. Pleopod 1 narrowing distally with 4 spinules arrayed longitudinally and submarginally.

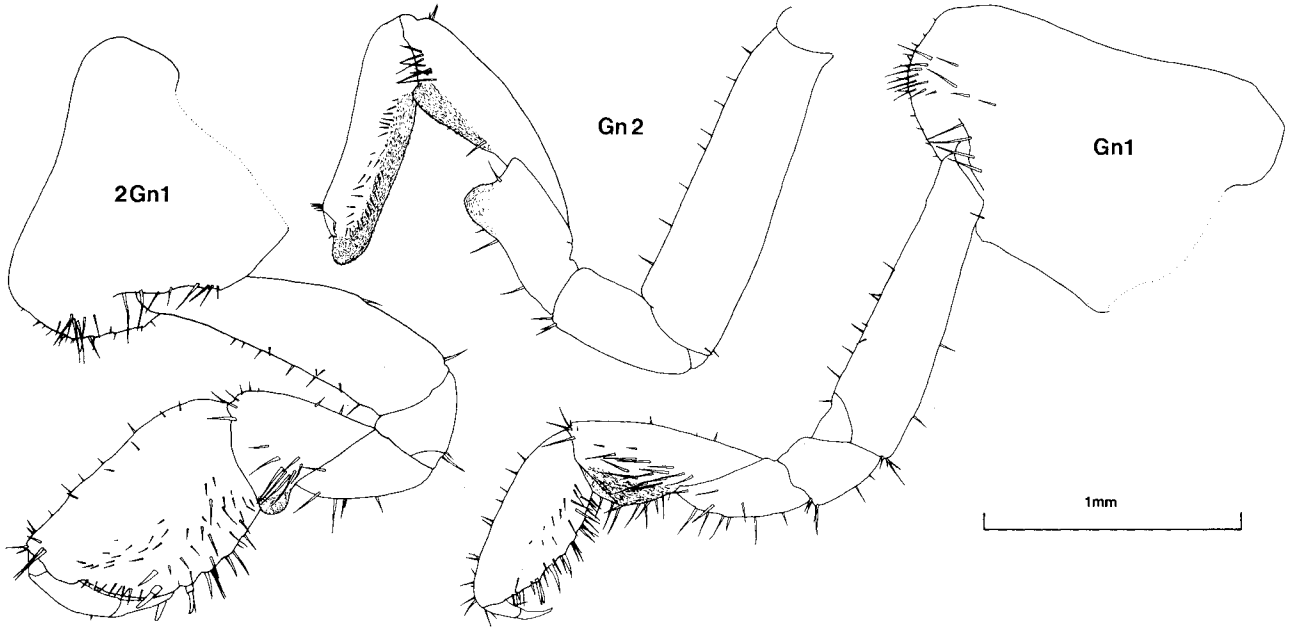

Fig. 10. *Austrotroides maritimus* n. sp., holotype, female, 13.8 mm, Maatsuyker Island, southern Tasmania. 2, allotype, male, 12.2 mm, near Cockle Ck, southern Tasmania.

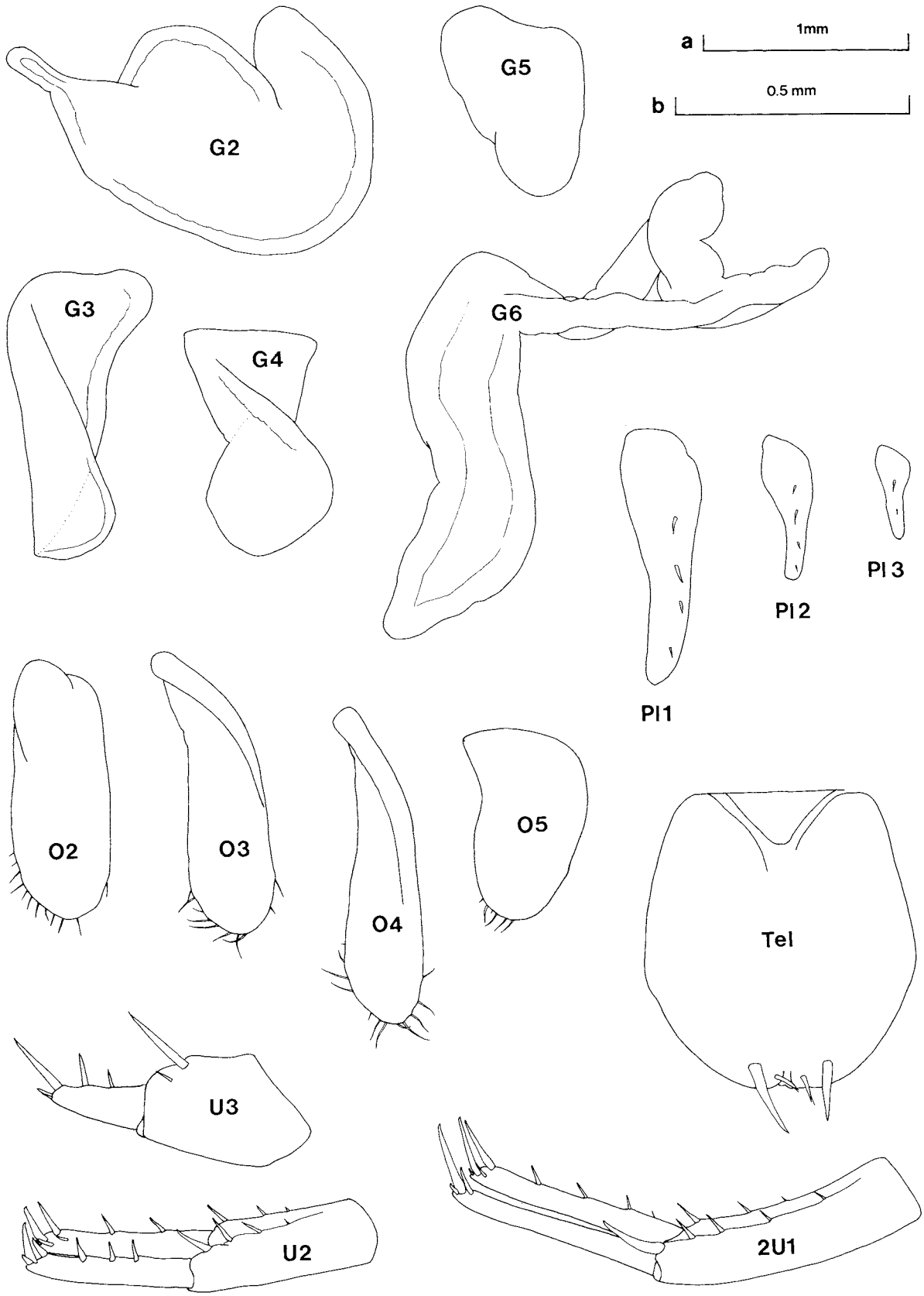

Fig. 11. *Austrotroides maritimus* n. sp., holotype, female, 13.8 mm, Maatsuyker Island, southern Tasmania. 2, allotype, male, 12.2 mm, near Cockle Creek, southern Tasmania. Scale a: G2-6, O2-5, 2U1, U2; scale b: Tel, U3, P11-3.

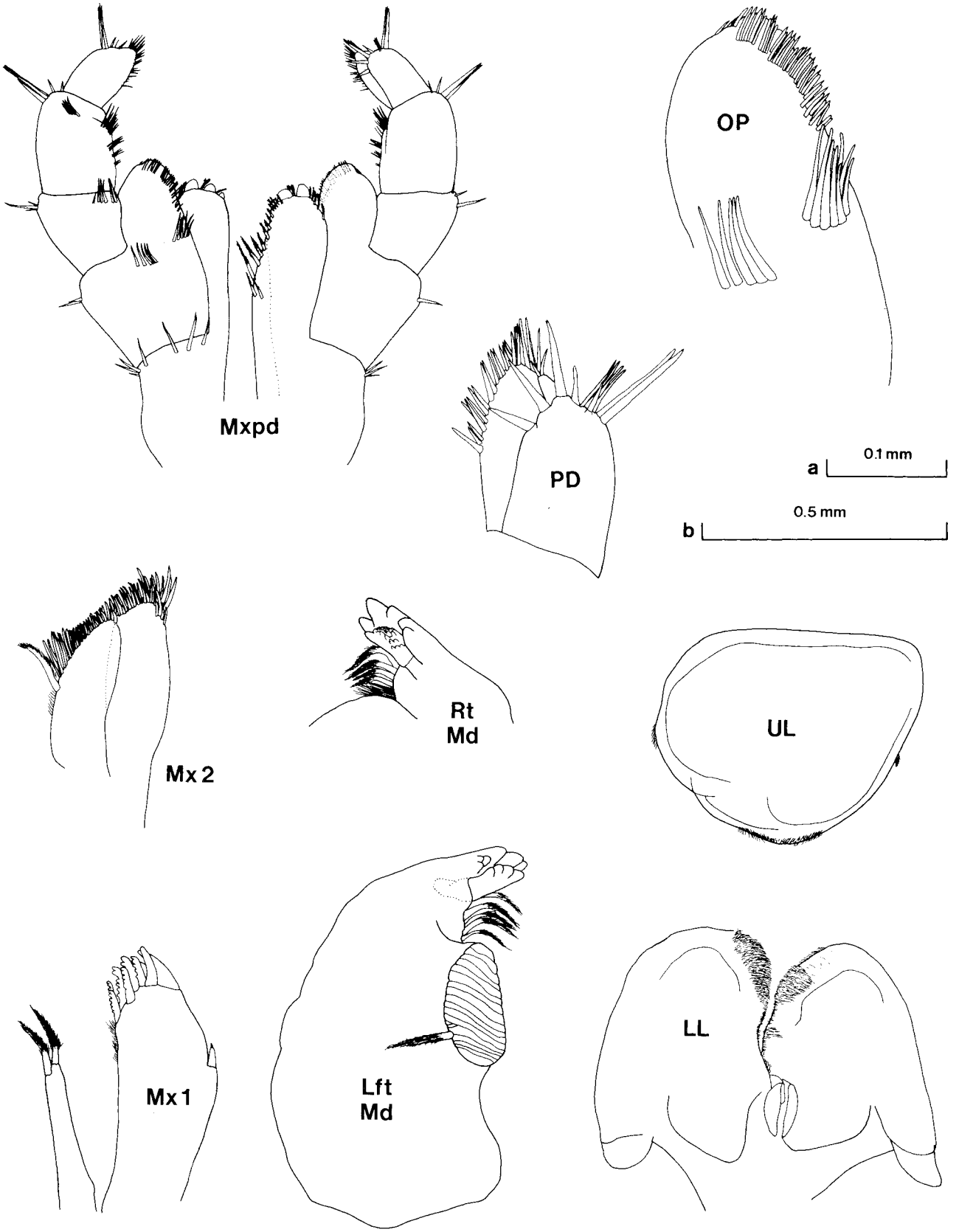

Fig. 12. *Austrotroides maritimus* n. sp., holotype, female, 13.8 mm, Maatsuyker Island, southern Tasmania. Scale a: OP, PD; scale b: Mxpd, Mx1&2, UL, LL, Lft Md, Rt Md.

Pleopod 2, about half length of first, with 4 spinules, pleopod 3 still smaller, a small slender stump, with 2 submarginal spinules.

Uropod 1 slender, peduncle longer than rami, with 3 inner and 4 outer marginal spines, distolateral spine slender, curved; rami very slender, subequal, apical spines long, outer ramal margins naked, inner with 3 spines and a spinule. Uropod 2, peduncle slender, as long as subequal rami, with 3 inner, 3 outer and 1 apical spine; outer ramal margin with 3 spines, inner with 2. Uropod 3, peduncle subcylindrical, armed with 1 large and 1 small slender spine; ramus slender, with 2 marginal spines and 1 large and 2 small spines on the apex.

Telson just longer than broad, apex slightly cleft, with 2 unequal spines on each side.

Male: length 12.2 mm. Antenna 1 flagellum 9-segmented [3–9], that of antenna 2, 28-segmented [8–28]. Gnathopod 1, coxa broad, inner shelf with long slender spines. Segment 2 strong, broadening distally, convex behind. Segments 3 and 4 short, broad, 4 with small posterior tumid lobe, spinose. Segments 6 and 7 forming a powerful subchelate hand; segment 6 greatly swollen, ⅔ as broad as long, spinose behind; distally forming a convex, lightly spinose palm, defined by 2 stout spines, between which the very powerful dactyl closes, exceeding the palm.

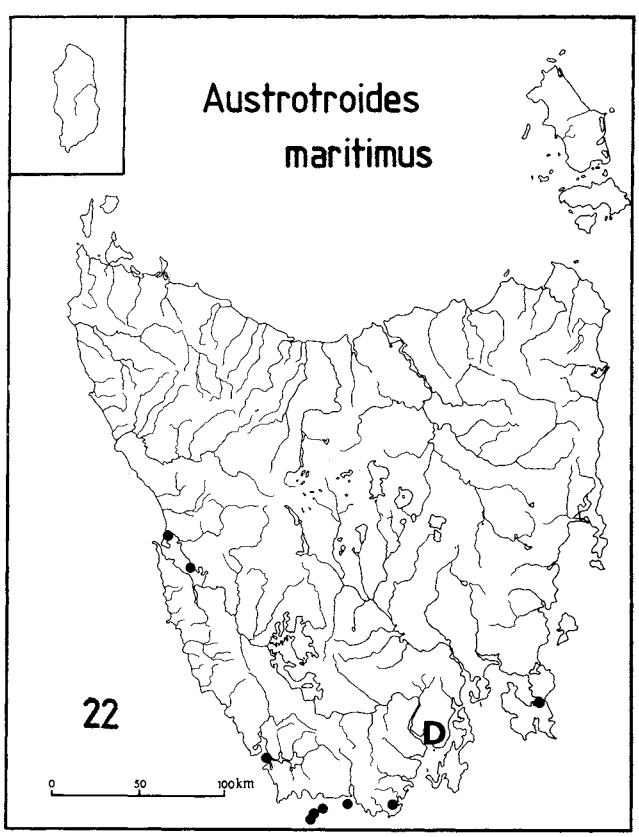

Fig. 13. Distribution of *Austrotroides maritimus*. 'D' refers to an apparent disjunction in distribution. Total number of records is shown at lower left.

Etymology. The specific epithet *maritimus* refers to the apparent restriction of this species to coastal situations.

Remarks. Segment 6 gnathopod 1 of *A. maritimus* is unusually large in males and swollen in females, and this is immediately obvious in adult specimens. Similar features have developed in several other landhopper species (e.g. *Mysticotalitrus tasmaniae)* and appear to be important in systematics only at the species level. In other characters, *A. maritimus* is very similar to *A. longicornis,* however, it lacks the long appendages of the latter species, its peraeopod 6 gill is not as strongly incised posteriorly, and the telson bears only small apical spines, unlike the large prominent pair of *A. longicornis.*

Distribution. (Fig. 13) On the mainland of Tasmania, *A. maritimus* is found only within a few metres of the supralittoral zone. It occurs on the south-western and southern coast from Macquarie Harbour to Recherche Bay and on the Tasman Peninsula, but not on the intervening coastline. The east coast of Bruny Island, however, has not been thoroughly searched for this species.

Austrotroides maritimus is apparently limited to areas of high ionic concentration. It is only found away from the sea on small exposed islands, such as Maatsuyker Island, where sea-spray is blown a long way inland.

Neorchestia n.gen.

Diagnosis. Large sexually dimorphic landhoppers; maxilliped inner plate sparingly setose, outer plate apically rounded with submarginal spine row, palp segments 2 and 3 bearing apically spinose, triangular lateral lobes, segment 4 prominent, not masked by segment 3. Gnathopod 1 subchelate in both sexes, propod heavier in ♂, segment 5 very deep in both sexes (especially in ♂, at least half as deep as long); gnathopod 2 mitten-shaped in ♀. Oostegites with terminal setae long and simple, posterior pair (peraeopod 5) broad and thick with gill-like texture. Peraeopods 3–7 simplidactylate; peraeopods 6 and 7 long, second segments enlarged. Anterior and posterior gills very large, posterior pair folded and lobate. Pleopods reduced, broad, biramous and setose. Epimeral plate 2 deeper than 3. Uropods 1 and 2 , outer rami without marginal spines; uropod 3 small. Telson with a small cleft and bearing apical spines only.

Type species. *Neorchestia plicibrancha* n.sp.

Etymology. The name combines the Greek *neos* (new) and *Orchestia* in recognition of the apomorphy of the genus. Gender, feminine.

Remarks. The genus *Neorchestia* is the only group of simplidactylate landhoppers in which the plesiomorphic gnathopod configuration found in *Orchestia s.l.* is retained. While the expression of some other characters is also plesiomorphic

(morphology of maxilliped inner plate, maxilla 1 and 2) a number of apomorphic features are displayed. Consequently, *Neorchestia* is regarded as displaying more apomorphy than the *Protaustrotroides-Austrotroides* group. Apomorphic character states in *Neorchestia* include modification of the epimeral plates, strong reduction of the pleopods as well as a tendency for the pleopod rami to lose their segmentation, and the long, slender second antennae, peraeopods and general body shape. In addition, the elongate uropod 1 peduncular apical spine, and the highly modified gills, with anterior and posterior pairs greatly enlarged and posterior two pairs lobate, are apomorphic. So is the shape of the maxilliped palp, with the lateral lobes reduced, and the inner plate poorly setose.

While *N. plicibrancha* is the only member of this genus known from Tasmania, two further species are present in collections from the south-west corner of Western Australia (unpublished data). The combination of large, folded, lobate posterior gills, reduced but biramous setose pleopods and subchelate first gnathopods in both sexes distinguishes species of *Neorchestia* from all other known landhoppers. Other Australian genera with this gnathopod morphology *(Agilestia, Orchestiella* and *Tasmanorchestia)* have much more simple, sac-like gills. No species of *Orchestia s.l.* described by Hurley (1957) from New Zealand display this combination of features, although some (*O. 'tenuis', O. lesliensis* and *O. rubroannulata)* possess enlarged anterior and/or posterior gills.

Neorchestia plicibrancha n. sp.

Figs 14–18

Orchestia sp. Richardson & Devitt, 1984: 144.

Type material. HOLOTYPE ♀, AM P37344; ALLOTYPE ♂, AM P37345; 3 PARATYPES (♂, ♀, 1 juv.), AM P37346; 4 PARATYPES (2♂♂, ♀, 1 juv.), BMNH; 5 PARATYPES [2♂♂, 2♀♀(1 ovig.), 1 juv.], NMNS; southern Tasmania, 2 km west of Blackhole Lookout, South Coast Track, in litter beside creek, map ref. 8210-782722, 27 Dec 1975.

Other material examined. Tasmania: 767 specimens in 138 collections listed in Friend (1980). 2♂♂, ♀; Mt Wellington, Zig-zag Track at 1100 m alt., in litter, coll. 3rd year Animal Ecology class, University of Tasmania, 21 March 1981. 2♀♀, same data but 1200 m alt.

Diagnosis. Pleopods biramous, plumose, progressively shorter towards posterior, inner rami all shorter than corresponding outer rami. Pleopod peduncles lacking marginal plumose setae. Epimeral plates 2 and 3, hind corners slightly rounded. Uropod 1, distolateral spine of peduncle long and curved, nearly half as long as peduncle. Gnathopod 2 (♂) strongly subchelate, segment 6 subovate, slender; dactyl long, about ⅞ as long as segment 6.

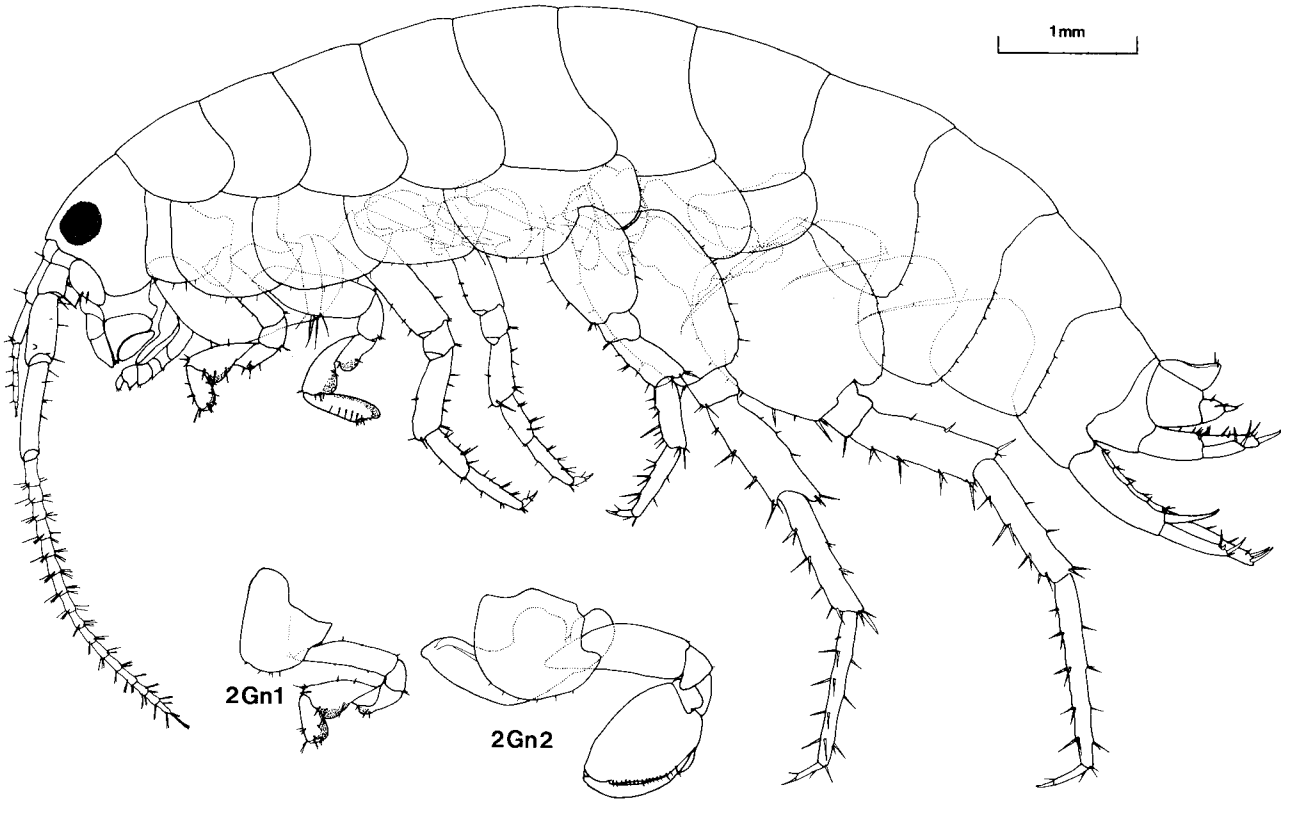

Fig. 14. *Neorchestia plicibrancha* n. gen., n. sp., holotype, female, 8.8 mm; 2, allotype, male, 8.1 mm; near Blackhole Lookout, south coast, southern Tasmania.

Description. Female: length 8.8 mm, with no eggs [2–4]. Head deeper than long, eye almost round, large, width more than ⅓ head length. Antenna 1 exceeding midpoint of last peduncular segment of antenna 2, flagellum 6-segmented [3–6], shorter than peduncle. Antenna 2 as long as head and first 5 peraeon segments, last peduncular segment slender, shorter than rest of peduncle; flagellum longer than peduncle, 17-segmented [7–20], most segments with 4 groups of 3 long slender setae, longer than width of each segment. Upper lip deep, distally finely pilose, indentation of right margin prominent. Lower lip fairly deep, lateral lobes large, pilosity of inner shoulders not extending into proximal area of central cleft. Left mandible with 4 cusps, lacinia mobilis 5-cuspate, molar with 15 striations. Right mandible 5-cuspate, lacinia 3-dentate. Maxilla 1, inner plate long, apical plumose setae strong; outer plate fairly slender, not narrowing distally; palp 2-segmented, distal of midpoint of outer margin; apical spines long, strong, dentate, mostly longitudinally set, dentition formula 2-1-3-4-4-4-4-4-5. Maxilla 2, inner plate slender, much narrower but just shorter than outer plate, apical spines short, round-tipped at outer end, longer and sharper near long plumose seta. Outer plate broad, narrowing distally, 4 small spines and 1 plumose seta near outer apical margin, 5 or 6 long sharp distally serrate spines near apex, row of spines on inner distal margin strong, spines curved, blunt-ended.

Maxilliped, inner plate apically truncate, with 3 unequal spine-teeth and several plumes on apex, 5 plumose spines on lateral face, on medial face 2 near inner margin and 3 subapically. Outer plate distally rounded, submarginal spine row strong, spines stout, blunt-tipped. Palp fairly broad, lateral lobes of segments 2 and 3 distinct, each reduced to a triangular projection capped by 1 strong group of spines; medial spines of segment 3 small, slender; segment 4 prominent, relatively large, apically rounded, with 5–6 blunt spines.

Gnathopod 1, coxa broad, shallow anterodistal corner sharp, lower margin with a few slender spines. Segment 2 sublinear, with several spines on each

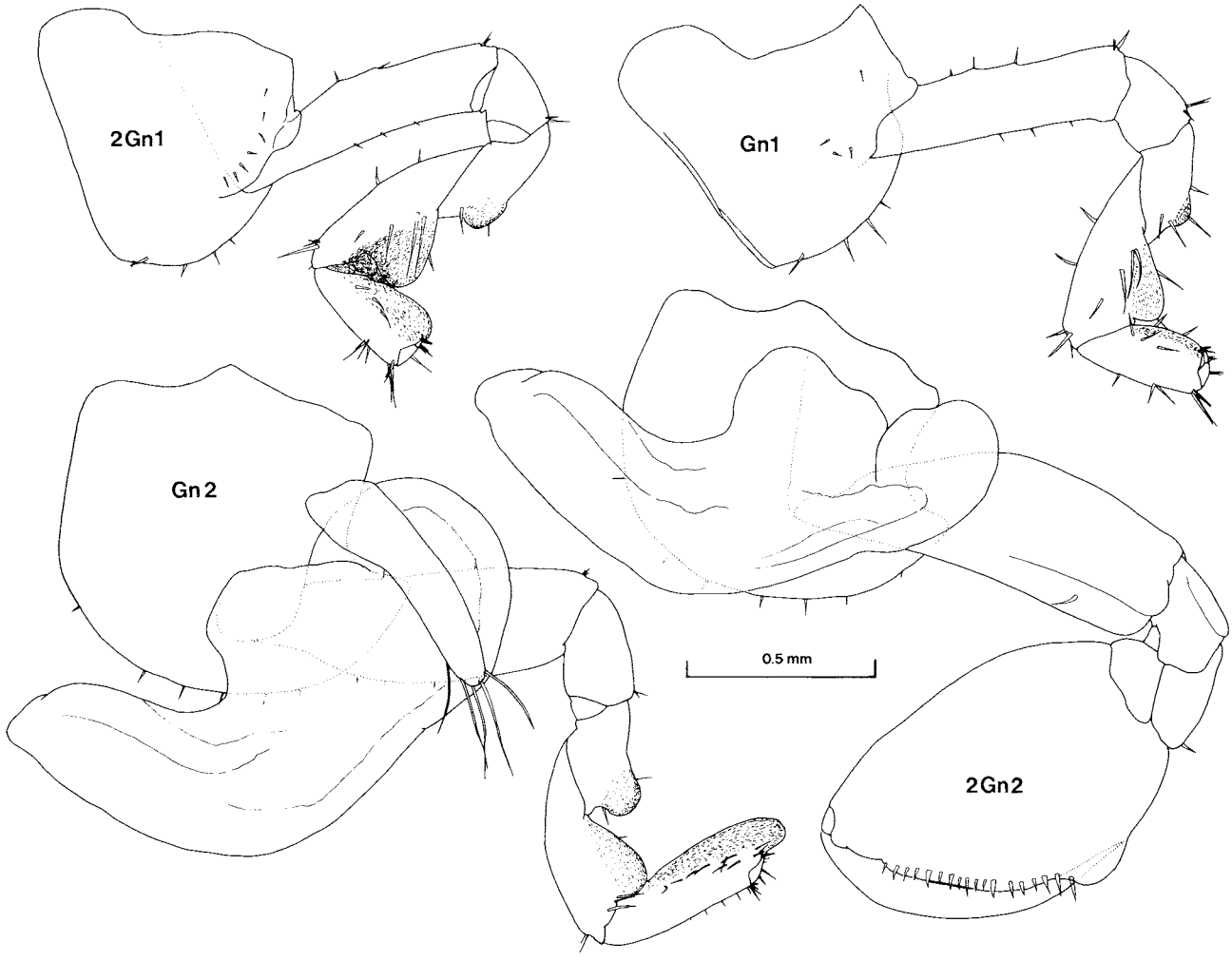

Fig. 15. *Neorchestia plicibrancha* n. gen., n. sp., holotype, female, 8.8 mm; 2, allotype, male 8.1 mm; near Blackhole Lookout, south coast, southern Tasmania.

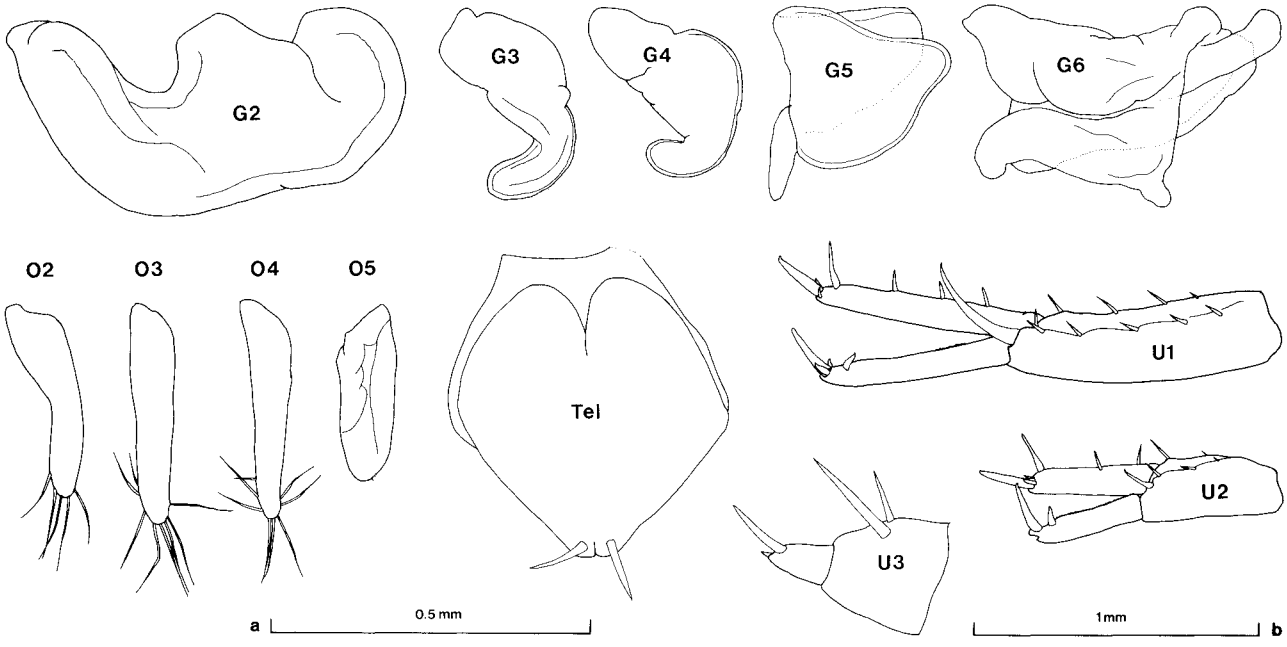

Fig. 16. *Neorchestia plicibrancha* n. gen., n. sp., holotype, female, 8.8 mm, near Blackhole Lookout, south coast, southern Tasmania. Scale a: Tel, U3; scale b: G2-6, O2-5, U1&2.

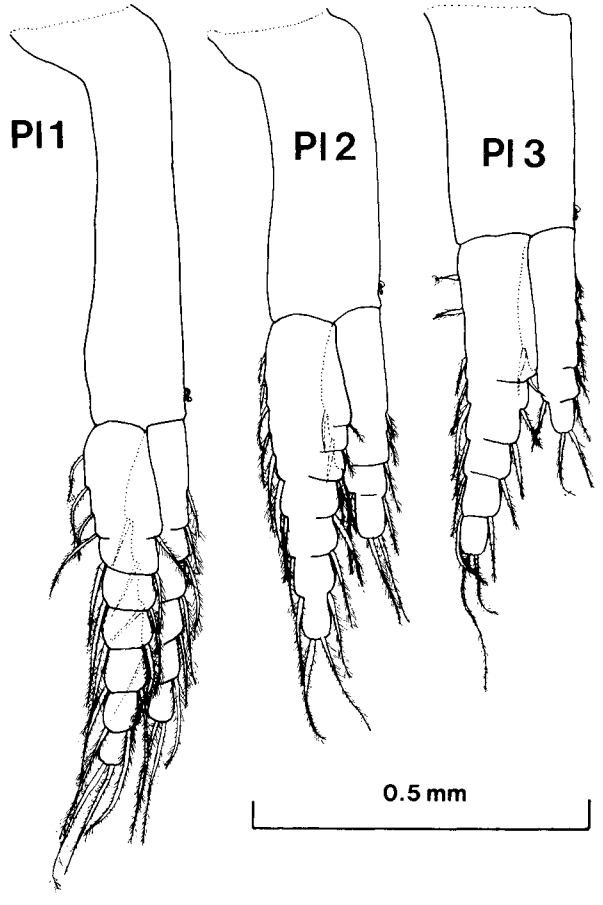

Fig. 17. *Neorchestia plicibrancha* n. gen., n. sp., holotype, female, 8.8 mm, near Blackhole Lookout, south coast, southern Tasmania.

margin. Segment 4 with shallow posterior lobe, segment 5 long, deep, with several long medial spines and a strong tumescence behind; segment 6 shorter, hind margin convex, distally almost square, short palm defined by group of spines near rounded posterodistal corner, equalled by dactyl.

Gnathopod 2, coxa broad, rounded below, posterior process large. Gill very large, with long, broad anterior extension; oostegite slender, much shorter than segment 2, with 5 long, slender setae near rounded apex. Segment 2 strong, expanded anteriorly, segment 3 equal to 4 which bears a strong tumid lobe. Segment 5 deep, poorly spinose, hind lobe deep and broad. Segment 6 just longer, slightly broadening distally, hind margin convex, apical lobe strong; medial spine row composed of small spines, lateral row of long slender spines. Dactyl oblique.

Peraeopod 3, coxa shallow, lower margin sparsely spinose, posterior process prominent. Gill small with distal anterior projection; oostegite small, slender, with 8 distal setae. Segment 2 strong, slightly curved anteriorly, segments 4–6 slender, dactyl small.

Peraeopod 4 similar to 3, but coxa shallower and posterior process more blunt-ended, segments 2 and 4–6 shorter.

Peraeopod 5, anterior coxal lobe shallow, with a few spines below, posterior lobe just shorter, rounded behind. Gill fairly large, folded in half with slender papillate distal lobe, oostegite almost as long as that of gnathopod 2, but broader and thicker than the others, texture resembling a gill, apically with 3 tiny spines. Segment 2 subovate, spinose, convex behind. Segments 4–6 slender, with long spines. Dactyl slender, terminal spine almost straight.

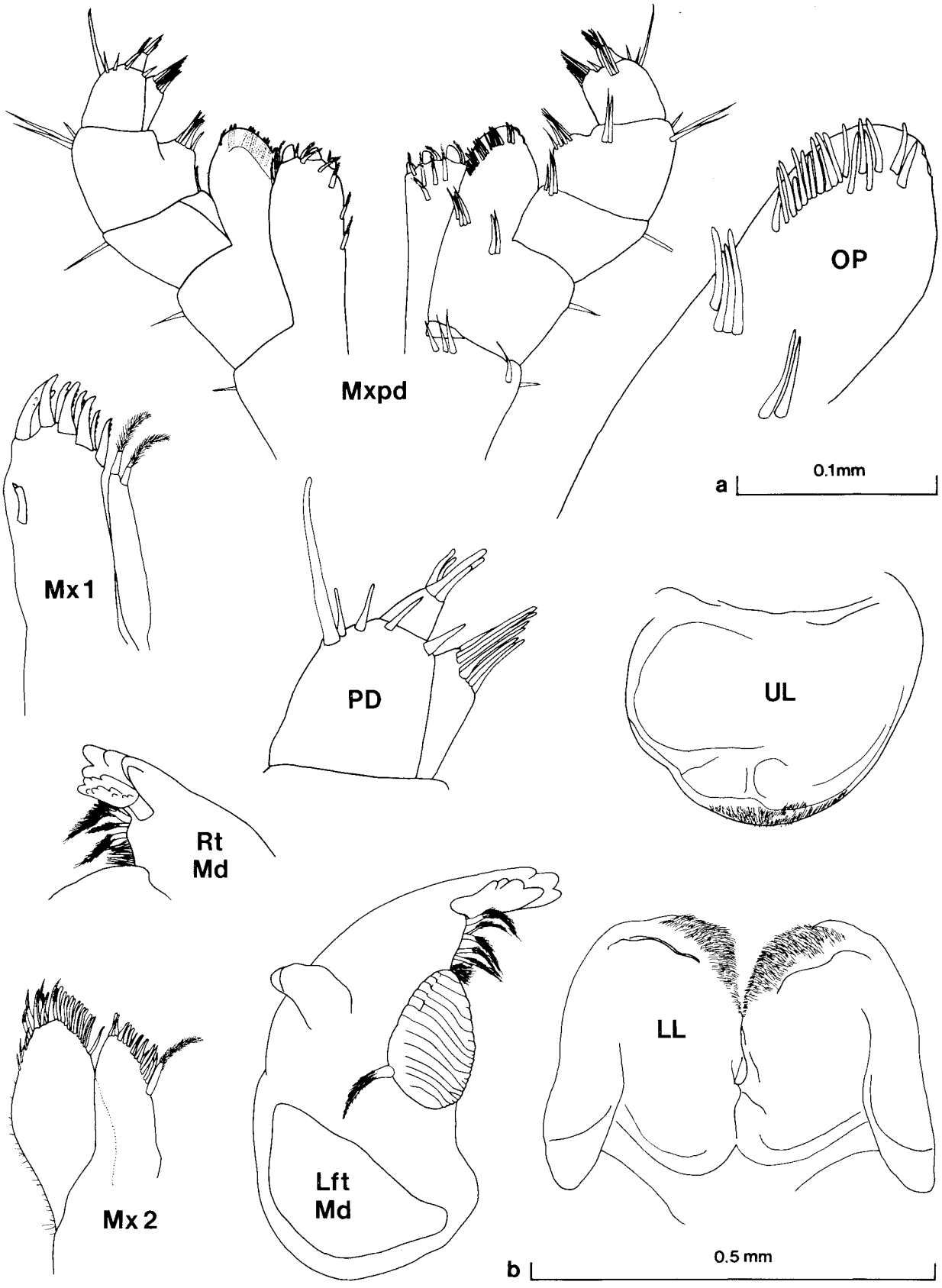

Fig. 18. *Neorchestia plicibrancha* n. gen., n. sp., holotype, female, 8.8 mm, near Blackhole Lookout, south coast, southern Tasmania. Scale a: OP, PD; scale b: Mxpd, Mx1&2, Lft Md, Rt Md, UL, LL.

Peraeopod 6 long, anterior coxal lobe very shallow, posterior lobe deep, expanded posterodistally in an oblique orientation. Gill large, complex, formed of several lobate folds and a posterior papillate lobe. Segment 2 large, subovate, spinose behind and expanded to form a shallow distal lobe. Segments 4–6 with long spines, segment 6 very slender. Dactyl long, slender, terminal spine almost straight.

Peraeopod 7 just longer than 6, coxa shallow, spinulose behind. Segment 2 very large, serrulate hind margin expanded below forming a distal lobe. Segments 4–6 with long spines, segment 6 very slender. Dactyl long, slender.

Epimeral plate 1 shallow, rounded below, posterodistal corner sharp, hind margin convex, spinulose. Plate 2 projecting well below third, front and lower margins forming a single smooth curve, hind corner obtuse, just rounded, hind margin gently convex, spinulose. Epimeral plate 3 subsquare, hind corner sharply rounded, hind margin straight, spinulose.

Pleopods all reduced but biramous and setose, progressively shorter and peduncles broader posteriorly; inner rami shorter than outer rami, peduncles bearing two coupling spines. Pleopod 1, peduncle longer than rami; pleopod 2, peduncle subequal to longer ramus; pleopod 3, peduncle shorter than longer ramus. Segmentation of rami indistinct; inner and outer ramal segment numbers 5 and 7, 3 and 7, 3 and 6 on pleopods 1–3 respectively. All rami with fairly short plumose setae on margins, peduncles naked.

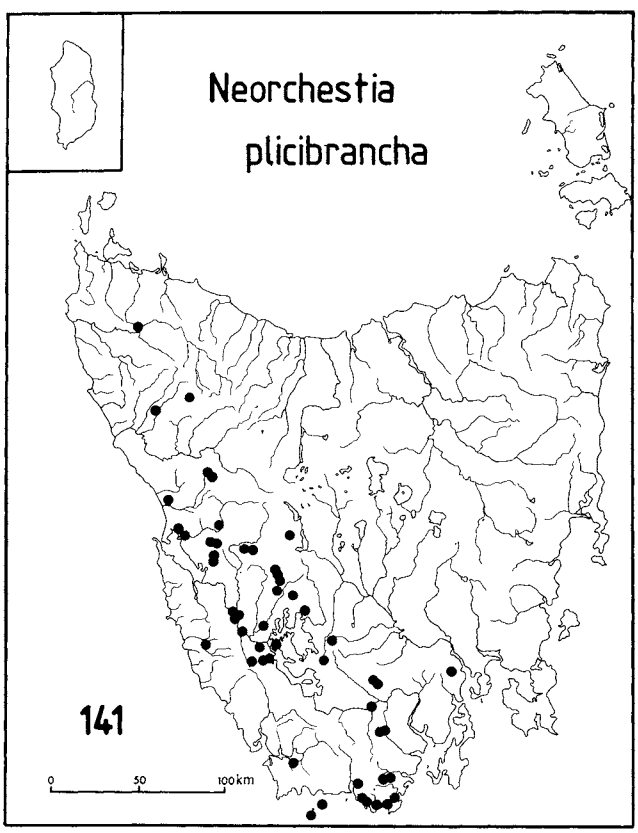

Fig. 19. Distribution of *Neorchestia plicibrancha*. Total number of records is shown at lower left.

Uropod 1, peduncle with 4 inner and 6 outer marginal spines, distolateral spine slender, curved, very long, half length of rami; outer ramus subequal to inner, margins naked but with rugose patch proximally on upper margin, inner ramus armed with 3 marginal spines. Uropod 2, peduncle with 2 inner and 4 outer spines; rami just shorter, subequal, outer ramus without marginal spines but minutely serrulate along the upper margin; inner ramus with 2 marginal spines; 1 apical spine on each ramus very long, almost half as long as ramus. Uropod 3, peduncle short, broad, with 1 very long spine and 1 shorter spine near midpoint of upper margin; ramus slender, small, apically with 2 unequal spines.

Telson broad, apex almost right angle, minutely cleft, with 1 apical spine on each side.

Male: length 8.1 mm. Antenna 1, flagellum 5-segmented [3–6]; antenna 2, flagellum 18-segmented [7–20].

Gnathopod 1, like that of ♀ but posterior lobe of segment 5 deeper, segment 6 broadening distally due to posterior tumid lobe which projects distally past tip of closed dactyl; palm thus exceeds slender dactyl.

Gnathopod 2, coxa similar to that of ♀ but gill smaller; segment 2 strong, expanded posteriorly, anterior trough present on medial side into which powerful subchelate hand folds; segment 6 subovate, large, palm oblique, lined with short, stout spines, dactyl strong, curved, sharp distally, closing between pair of spines against flange-like projection at proximal end of palm. Otherwise similar to ♀.

Etymology. The name combines the Latin *plico* (to fold) and the Greek *branchos* (a gill) in reference to the convoluted form of the gills of peraeopod 6.

Remarks. Live specimens of *N. plicibrancha* are distinguished from other sympatric species by their extremely agile hopping. Adult males and females are of similar size.

Distribution. (Fig. 19) *Neorchestia plicibrancha* is widespread in western Tasmania. Its occurrence is more frequent in the southern half of western Tasmania, becoming less frequent towards the north-west. It is not found right on the coast, but occurs on De Witt Island. An apparently isolated population exists above 1000 m on the south-east slopes of Mt Wellington, south-east Tasmania (Richardson & Devitt, 1984). The habitat of *N. plicibrancha* is apparently limited to wet forests, although it has been found on *Gymnoschoenus* sedgeland plains.

Mysticotalitrus Hurley, 1975 (part)(new status)

Talitrus (Mysticotalitrus) Hurley, 1975: 162 (part).

Diagnosis. Large landhoppers, primarily showing no sexual dimorphism. Antennae fairly long,

eyes large; upper and lower lips broad, shallow, sparingly pilose. Maxilla 1 broad, inner plate short, outer plate with tiny palp; apical spine-teeth well separated, innermost leaning inwards. Maxilla 2 broad, plumose seta long; apical spines short, separated. Maxilliped, inner plate with large outer spine-teeth, few plumose setae; outer plate, outer margin arcuate, sharp apex with 1 group of spines, inner margin with spine groups; palp segments 2 and 3 with narrow lateral lobes with groups of inner marginal spines, segment 4 not masked, broad. Gnathopod 1, hand simple, segment 6 almost linear; secondarily swollen in *M. tasmaniae,* more so in ♂. Gnathopod 2 minutely chelate in both sexes, hand slender, linear, terminal lobe subacute, dactyl small. Peraeopods 3–7 simplidactylate; peraeopods 6 and 7 long, dactyls elongate. Anterior and posterior gills large; gnathopod 2, gill with slender distal extension; peraeopod 6, gill complex, folded, lobate. Oostegites mostly slender, with simple setae, posterior pair short, thick and fleshy. Epimeral plate 2 longest, of distinctive shape; pleopods biramous, reduced, of similar size. Uropods 1 and 2, outer ramal margins naked; uropod 3 small.

Type species. *Talitrus tasmaniae* Ruffo, 1949 (designated by Hurley, 1975).

Additional species. *M. cryptus* n.sp.

Remarks. *Mysticotalitrus* was set up as a subgenus by Hurley (1975) in his subdivision of the genus *Talitrus.* He chose *T. tasmaniae* Ruffo, 1949, from Tasmania, as the type species and included the species *T. fernandoi* De Sylva, 1959, from Sri Lanka, and *T. trukana* Barnard, 1960, from Micronesia. These species were all described from females only, however, and Ruffo's specimens were damaged. Examination of new material of *M. tasmaniae* (fully described below) and the discovery of a new Tasmanian species, *M. cryptus,* morphologically close to *M. tasmaniae,* lead to the conclusion that Hurley's taxon is polyphyletic. The other two species each differ in significant characters from a restricted *Mysticotalitrus,* which is raised to generic status. *'Talitrus' fernandoi* is distinguished from *Mysticotalitrus* (s.s.) by its possession of vestigial pleopods, distally truncate maxilliped outer plate with an even row of spines, and by its extremely small adult size (female length 2.3 mm). *'Talitrus' trukana* displays a number of plesiomorphic features not found in *M. tasmaniae.* These include the broad maxilliped palp, submarginal spine-row on the outer plate, narrow maxilla 2, short deep distal segments of the female gnathopod 2 and the sac-like gills.

In the form of the maxilliped (as well as in other features) *Mysticotalitrus* bears most resemblance to the simplidactylate amphipods *Talitriator eastwoodae* Methuen and *Arcitalitrus* spp. It has stronger lateral lobes of palp segment 3 than either of these groups, however. Other features distinguishing *Mysticotalitrus* from these taxa are the folded, lobate gills of peraeopod 6, the long propod of gnathopod 1 (linear in *M. cryptus,* swollen in *M. tasmaniae),* pleopod 1 peduncle longer than rami (cf. *Arcitalitrus)* and pleopod outer rami shorter than inner rami (cf. *T. eastwoodae*).

Mysticotalitrus tasmaniae (Ruffo, 1949)
Figs 20–23

Parorchestia ? sp. Hunt, 1925: 859, fig. 5.
Talitrus (subg. ?) *tasmaniae* Ruffo, 1949a: 207, figs I (1–9), II (1–3).
Talitrus tasmaniae.—Hurley, 1955: 147.
Talitrus (Mysticotalitrus) tasmaniae.—Hurley, 1975: 160, 162.

Type material. SYNTYPES 2♀♀ (ovig.), Museo Civico di Storia Naturale, Genova, Italy; Mt Wellington, Hobart Town (Tasmania), coll. O. Beccari & E. D'Albertis, 12 Feb 1878 (not examined).

Material examined. Tasmania: ♂ described; ♀ described; 29 ♂♂, 32 ♀♀ (14 ovig.), 5 juv., AM; near Browns Rd, Fern Tree, Mt Wellington, in litter in eucalypt forest unburnt in 1967 fires, above Pipe Track, map ref. 8312-197470, 2 Feb 1979. ♀(ovig), MV; Kingston, leaf mould, coll. C. Oke, 14 May 1948. 456 further specimens in 39 collections listed in Friend (1980).

Diagnosis. Gnathopod 1, hand swollen, especially in the male, greatly enlarged. Epimeral plates 2 and 3, posterodistal corners rounded. Telson with apical spines only.

Description. Female: 13.0 mm, ovigerous, 6 eggs [2–8]. Head longer than deep, eye large, width over ⅓ head length. Antenna 1 reaching over ⅓ along last peduncular segment of antenna 2; flagellum shorter than peduncle, 6-segmented [3–6]. Antenna 2 long, almost as long as head and first 5 peraeon segments, last peduncular segment very long, far exceeding rest of peduncle; flagellum longer than peduncle, 22-segmented [8–25], narrow segments with 4 groups of 3 slender setae.

Upper lip broad, lightly pilose apically, indentation of right margin prominent. Lower lip broad, lateral lobes short, pilosity confined to inner shoulders. Left mandible 5-cuspate, lacinia mobilis with 4 teeth, molar with 16 striations; right mandible 5-cuspate, lacinia 3-dentate. Maxilla 1, inner plate fairly stout, short, terminal setae short; outer plate broad, palp minute, 2-segmented, near midpoint of outer margin, spine-teeth strong, curved, mostly dentate, innermost spine-tooth leaning inwards; dentition formula 0-0-3-3-3-3-4-3-3. Maxilla 2 broad, outer plate broader than inner; inner plate, terminal spines short, strong, slightly longer at each end of row, plumose seta large; outer plate slightly longer than inner, with row of 7 short spinules on distal outer margin, two large and three smaller spines near apex, other spines in the row being sharp, longer than inner plate spines.

Maxilliped, inner plate slender, apex truncate, with 3 fairly large unequal spine-teeth and a blunt spine,

medial surface with row of 4 short plumose setae near inner margin, lateral surface with 2 large plumose setae subapically. Outer plate just exceeding spine-teeth of inner plate, outer margin arcuate, apex acute, with group of sharp spines; inner margin armed with 10 spines in 5 evenly spaced pairs. Palp segments 2 and 3 fairly broad, with narrow lateral lobes, both with several small groups of spines; segment 4 projecting well beyond lobe of segment 3, strong, with 2 apical spines; medial spines of segment 3 large.

Gnathopod 1, coxa deep, distally rounded, spinose. Segment 2 sublinear, slightly broadening distally, both margins spinulose. Segment 5 as long as 6, medial surface with a group of long spines, posterior tumid lobe shallow, broad. Segment 6 swollen, forming strong subchelate hand, spinose on and near undulating hind margin; dactyl strong, terminal spine long, curved, poorly defined oblique palm; dactyl closes between 2 strong spines at posterior end of palm.

Gnathopod 2, coxa deep, rounded and spinulose below, posterior process large, acute. Gill large, broad proximally, anterior extension long, slender; oostegite broad, long, narrowing distally, with 10 short marginal setae near apex and along anterior margin. Segment 2 linear, spinulose in front, slightly broader distally; segment 4 with very small posterior lobe, spinose behind. Segments 5–6 subequal, segment 5 slender, hind lobe broad and shallow. Segment 6 long and slender, medial spine row composed of small spines, dactyl small, distal lobe narrow, subacute.

Peraeopod 3 long, coxal plate fairly broad, spinulose below, posterior process small, rounded. Gill elongate, sac-like, oostegite long, slender, 8 setae near apex. Segment 2 long, segments 4–6 quite long, slender, dactyl small, terminal spine long, distally curved.

Peraeopod 4 similar to 3 but coxal plate straighter below, posterior process larger, with blunt apex, gill smaller. Segments 2, 4 and 6 shorter.

Peraeopod 5, relatively long, reaching halfway down segment 5 of peraeopod 6, anterior coxal lobe large, anterodistally oblique, straight, spinulose, posterior lobe just shallower but much smaller, concave behind. Gill bilobate, oostegite half as long

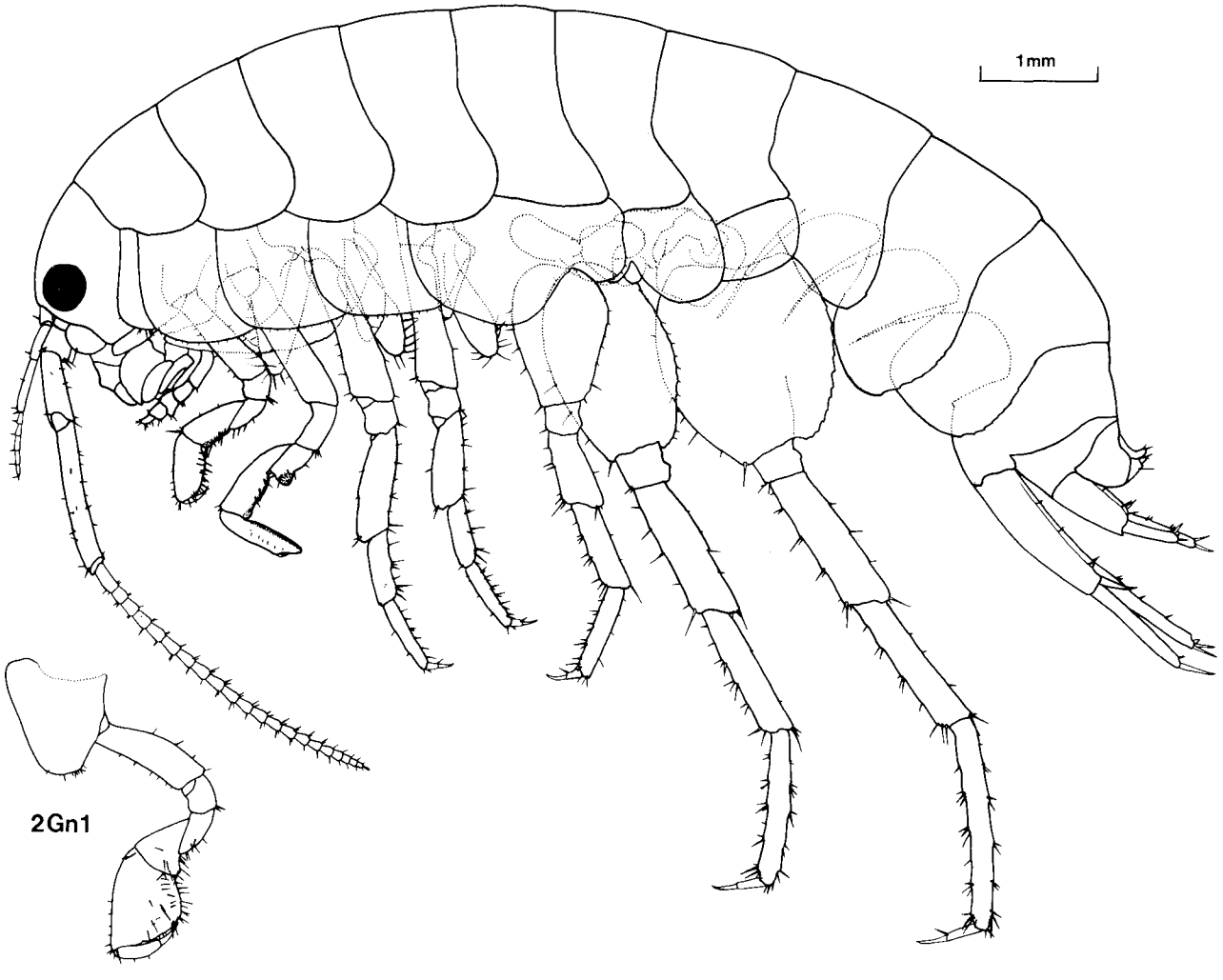

Fig. 20. *Mysticotalitrus tasmaniae* (Ruffo), female, 13.0 mm; 2, male, 11.8 mm; Fern Tree, southern Tasmania.

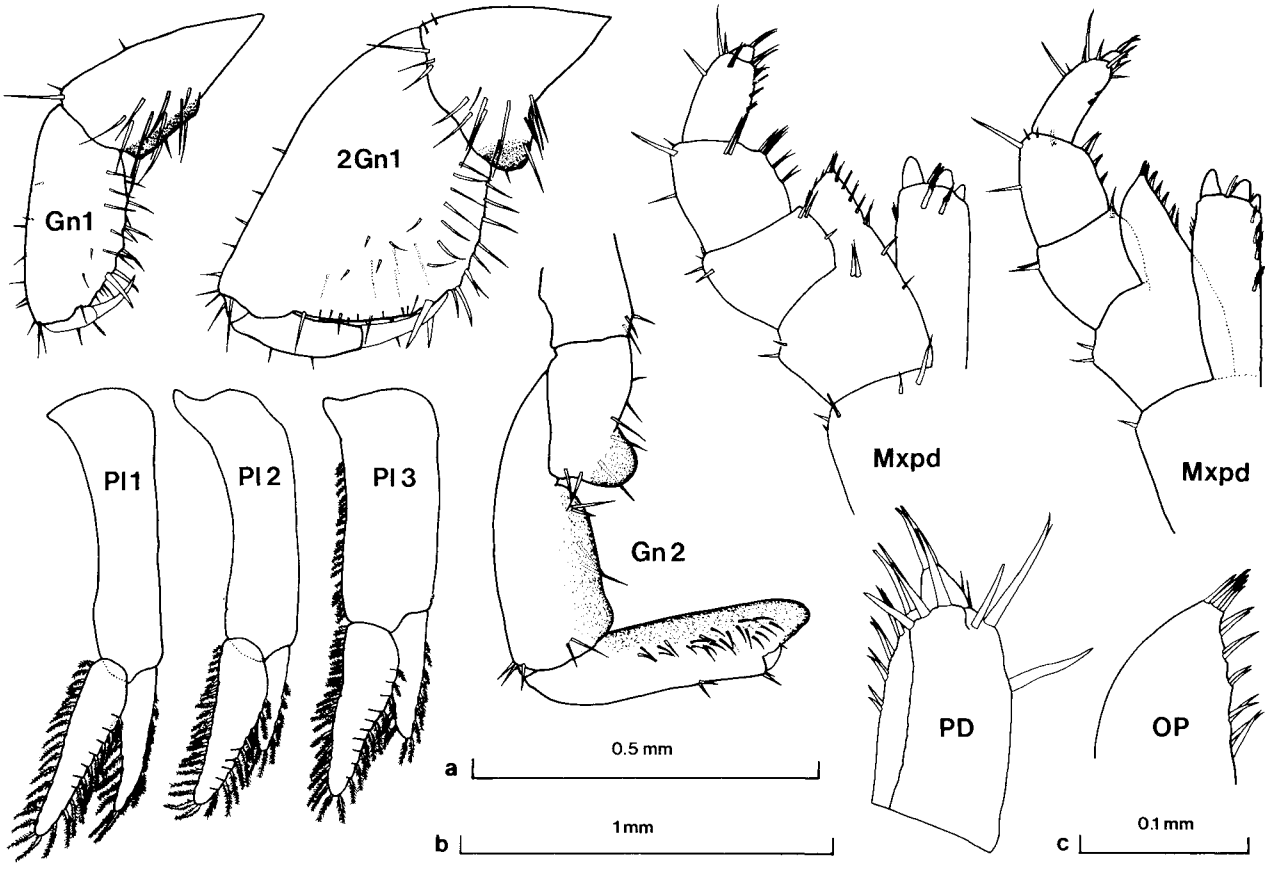

Fig. 21. *Mysticotalitrus tasmaniae* (Ruffo), female, 13.0 mm; 2, male, 11.8 mm; Fern Tree, southern Tasmania. Scale a: Mxpd; scale b: Gn1, 2Gn1, P11-3; scale c: OP, PD.

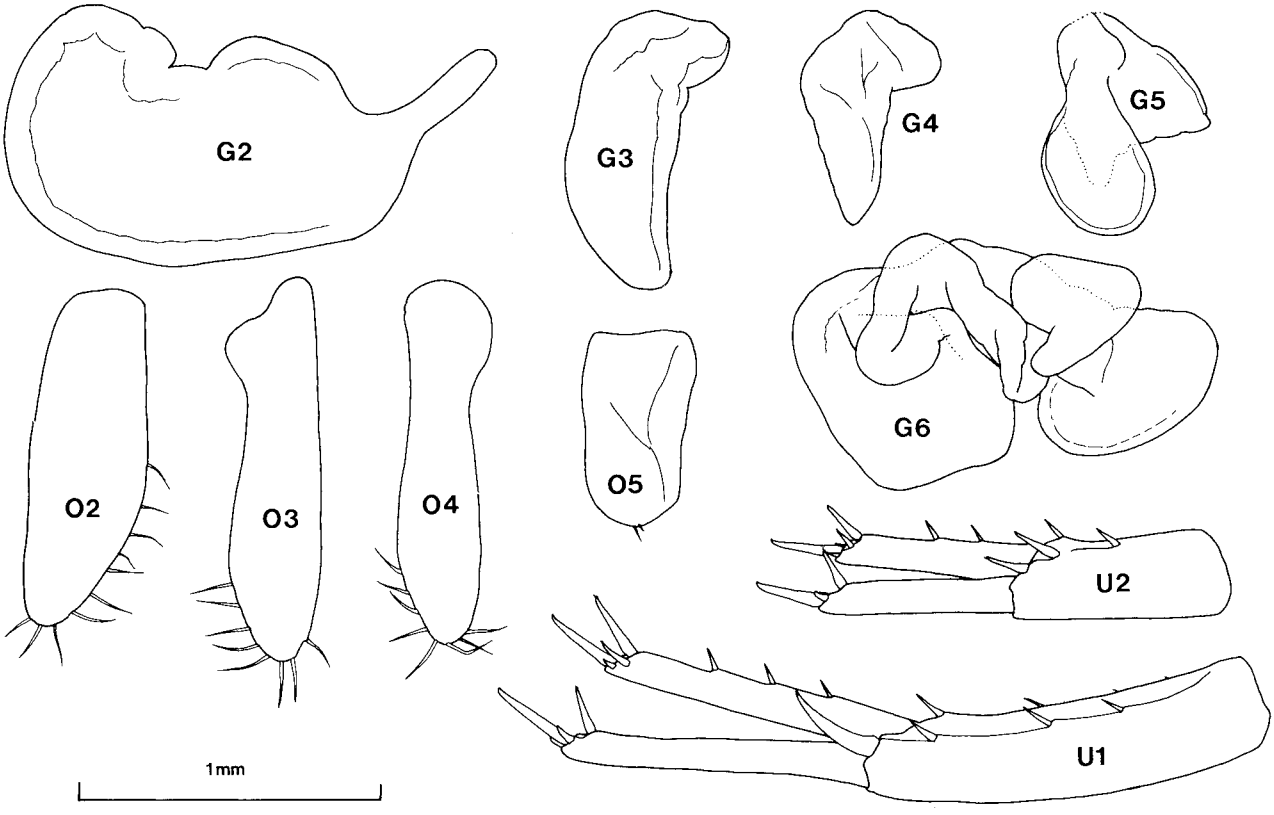

Fig. 22. *Mysticotalitrus tasmaniae* (Ruffo), female, 13.0 mm, Fern Tree, southern Tasmania.

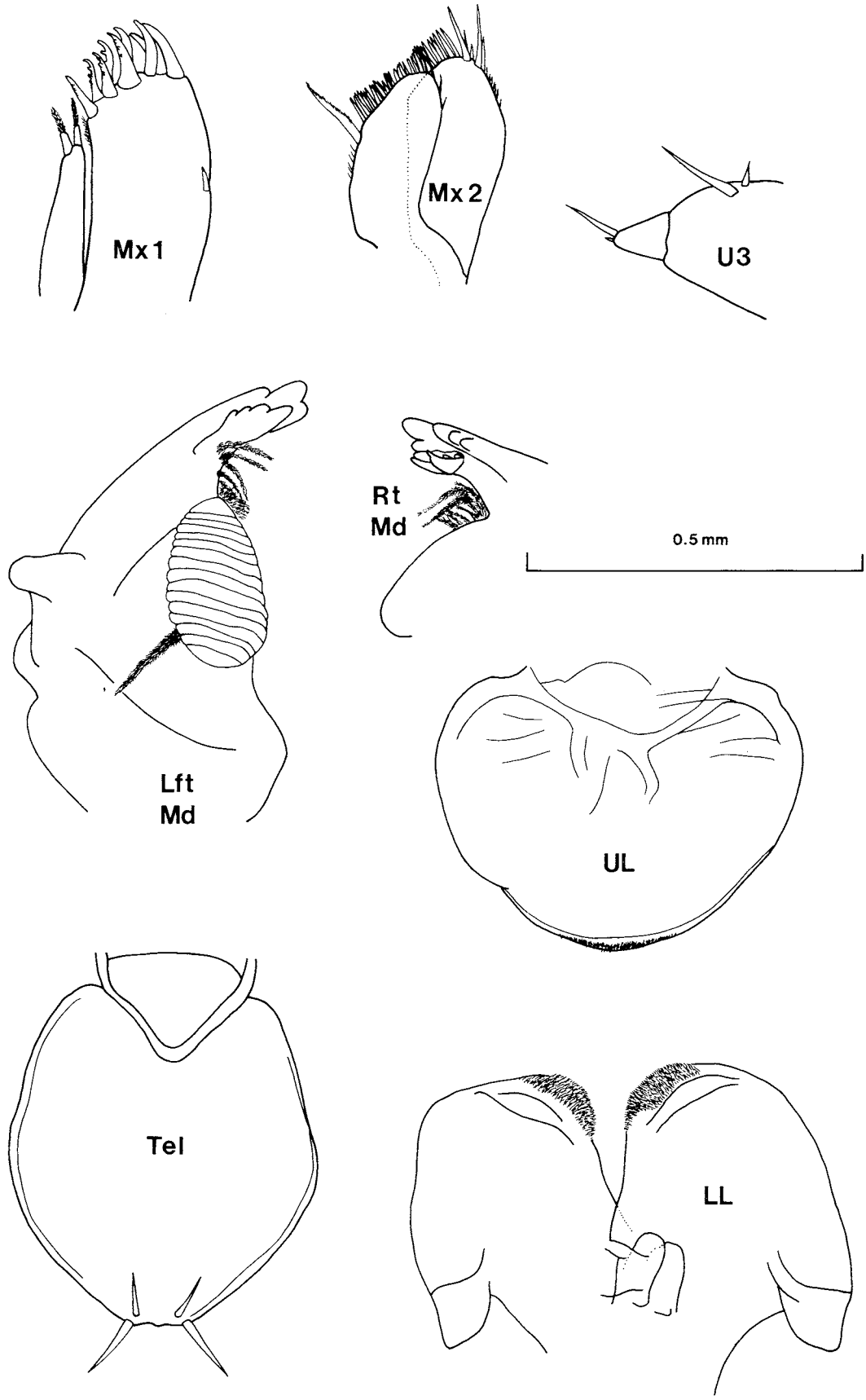

Fig. 23. *Mysticotalitrus tasmaniae* (Ruffo), female, 13.0 mm, Fern Tree, southern Tasmania.

as others but much broader, with 2 spinules on rounded apex. Segment 2 narrowing distally, hind margin straight, spinulose. Segments 4–6 slender, 6 quite long, dactyl small but terminal spine rather long, curved.

Peraeopod 6, anterior coxal lobe shallow, posterior lobe shallow, small, rounded below. Gill large, complex, folded, lobate. Segment 2, large, long, ovate, spinulose behind. Segments 4–6 long, fairly spinose, dactyl long, terminal spine long, distally curved.

Peraeopod 7 longest, coxal plate broad, shallow, smoothly rounded below. Segment 2 large, expanded behind, serrulate hind margin with distinct, small distal lobe. Segments 4–6 long, dactyl long, about ⅓ length of segment 6, terminal spine long, curved.

Epimeral plate 1 shallow, gently rounded below and behind, where margin weakly serrulate. Plate 2 distinctly longer than 3, gently rounded anterodistally, posterodistally cut away, serrulate convex hind margin curving forward to meet distal margin near middle of plate. Epimeral plate 3 with strongly rounded front corner, gently convex below, hind corner rounded, serrulate, merging into convex hind margin.

Pleopods all biramous, setose, reduced, decreasing slightly in size posteriorly; each with 2 coupling spines, rami shorter than peduncles, outer ramus longer than inner, segmentation indistinct, fringing plumose setae short. First 2 peduncles subequal, third shorter, broader, outer margin with many very short plumose setae.

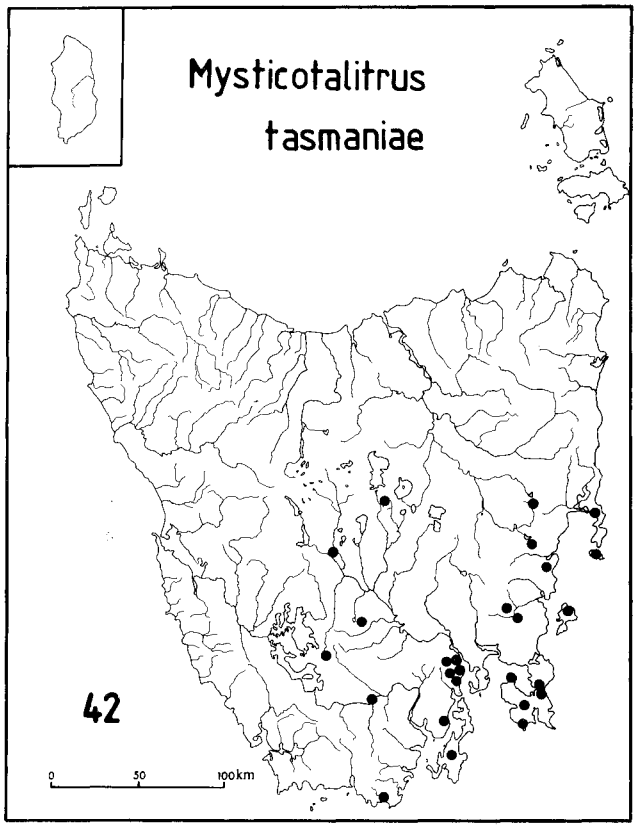

Fig. 24. Distribution of *Mysticotalitrus tasmaniae*. Total number of records is shown at lower left.

Uropod 1, peduncle slender with 2 inner and 4 outer marginal spines, distolateral spine strong, curved, simple; rami shorter than peduncle, subequal, outer lacking marginal spines, inner with 3; 1 or 2 terminal spines on each ramus long, slender. Uropod 2, peduncle slender, with 1 inner and 2 outer marginal spines and 1 apical spine; rami subequal, shorter, outer with no marginal spines, inner with 2. Uropod 3 small, peduncle short, with 1 long and 1 short spine; ramus very short, conical, with 2 unequal apical spines.

Telson broad, apex blunt, not cleft, 1 large and 1 small spine on each side of the apex.

Male: length 11.8 mm. Antenna 1, flagellum 6-segmented [3–6]; antenna 2, flagellum 26-segmented [8–26].

Gnathopod 1, segment 2 strong, convex behind, segments 5 and 6 swollen to form very powerful subchelate hand, segment 5 short, very deep, medially spinose with prominent tumid lobe behind, segment 6 broadening distally, as long as segment 2, width ⅔ breadth, hind margin with row of spines, medial submarginal spine row present; palm as long as hind margin, convex, with 2 strong spines between which long, strong dactyl closes, dactyl not quite reaching end of palm, distinct palmar corner with 2 spines. Dactyl ⅔ as long as segment 6, terminal spine extremely strong, curved.

Otherwise similar to ♀.

Remarks. The male of *M. tasmaniae* has not been described before. Mature males are smaller than females and have the hand of the first gnathopod greatly enlarged, a feature also developed in *Austrotroides maritimus* and several undescribed species of *Keratroides* from the eastern Bass Strait islands. In *M. tasmaniae,* gnathopod 1 is used in male-male encounters and perhaps also in mating.

Specimens of *M. tasmaniae* found in all areas north of the Derwent River have gnathopod 1 less swollen in both sexes than those at the type locality.

Distribution. (Fig. 24) While this species is most strongly distributed in the south-east and on islands off the east coast, there are a number of records in central Tasmania and on the borders of the western high rainfall areas.

Mysticotalitrus cryptus n. sp.

Figs 25–28

Talitrus sylvaticus.—Thomson, 1893 (part): 59, pl. iv, figs 8, 9.

Talitrus (Mysticotalitrus) sp. Richardson & Devitt, 1984: 144.

Type material. HOLOTYPE ♀, AM P37347; ALLOTYPE ♂, AM P37348; 16 PARATYPES [4♂♂, 11♀♀(5 ovig.), 1 juv.], AM P37349; 17 PARATYPES [4♂♂, 11♀♀(6 ovig.), 1 juv.], BMNH;

16 PARATYPES [4♂♂, 11♀♀(5 ovig.)], NMNS; south-east Tasmania, near Brown's Rd, Fern Tree, Mt Wellington, in litter in eucalypt forest unburnt in 1967 bushfires, above Pipe Track, map ref. 8312-197470, 2 Feb 1979.

Other material examined. Tasmania: 3♂♂, 3♀♀(1 ovig.) 3 juv., MV; Kingston, leaf mould, coll. C. Oke, 14 May 1948. 949 further specimens in 104 collections listed in Friend (1980).

Diagnosis. Gnathopod 1, hand not swollen in either sex. Epimeral plates 2–3, posterodistal corners obtuse, angular, not rounded. Telson with 2 marginal spines and 1 apical spine on each side.

Description. Female: length 11.6 mm, ovigerous, 8 eggs [1–8]. Head short, deeper than long, eye large, round, width almost half head length. Antenna 1 reaching ⅓ along last peduncular segment, flagellum shorter than peduncle, 6-segmented [3–6]. Antenna 2 fairly long, as long as head and first 4 peraeon segments; peduncular segment 5 long, longer than rest of peduncle; flagellum longer than peduncle, [range of segment numbers in other specimens 8–17+] each segment long, with 4 groups of 3 slender setae. Upper lip broad, lightly pilose apically, indentation of right margin prominent. Lower lip broad, lateral lobes short, pilosity present on parts of inner shoulders only, central cleft margins bare. Left mandible, incisor 5-cuspate, lacinia mobilis 4-dentate, molar 15-striate; right mandible, incisor with 5 cusps, lacinia 3-dentate. Maxilla 1, inner plate stout, short, apical setae short; outer plate broad, palp tiny, 2-segmented, terminal spine-teeth mostly long, slender, well separated, sparingly dentate, innermost spine-tooth leaning inwards, dentition formula 0-0-3-4-2-2-2-2-3. Maxilla 2 short, broad, outer plate wider and just longer than inner; inner plate inner margin pilose in parts, plumose seta large, distal spines short, strong, and fairly sparse; outer plate with row of 6 spinules distally on outer margin, 2 long sharp spines near the broad apex, rest of spine-row comprising fairly short sharp spines.

Maxilliped, inner plate broad, distally truncate, apex with 2 very large spine-teeth, 2 unequal small ones, and 1 stout blunt spine; 2 large submarginal plumes borne on the medial surface near inner margin. Outer plate shorter than inner plate and spine-teeth; outer margin arcuate, sharp apex with group of 6 sharp spines; inner margin with 2 single spines and a group of 3 spines. Palp segments 2 and 3 with narrow lateral lobes, each with several pairs, or single inner marginal spines; segment 4 quite broad, prominent, with a large distal spine, not masked by lobe of segment 3; medial spines of segment 3 large.

Gnathopod 1, coxa deep, spinose below. Segment 2 slender, spinulose in front, broadening distally. Segment 5 longer than 6, with slender medial and posterior spines, posterior tumescence extremely shallow. Segment 6 sublinear, slender, hind margin gently convex, corrugated and spinose; posterior

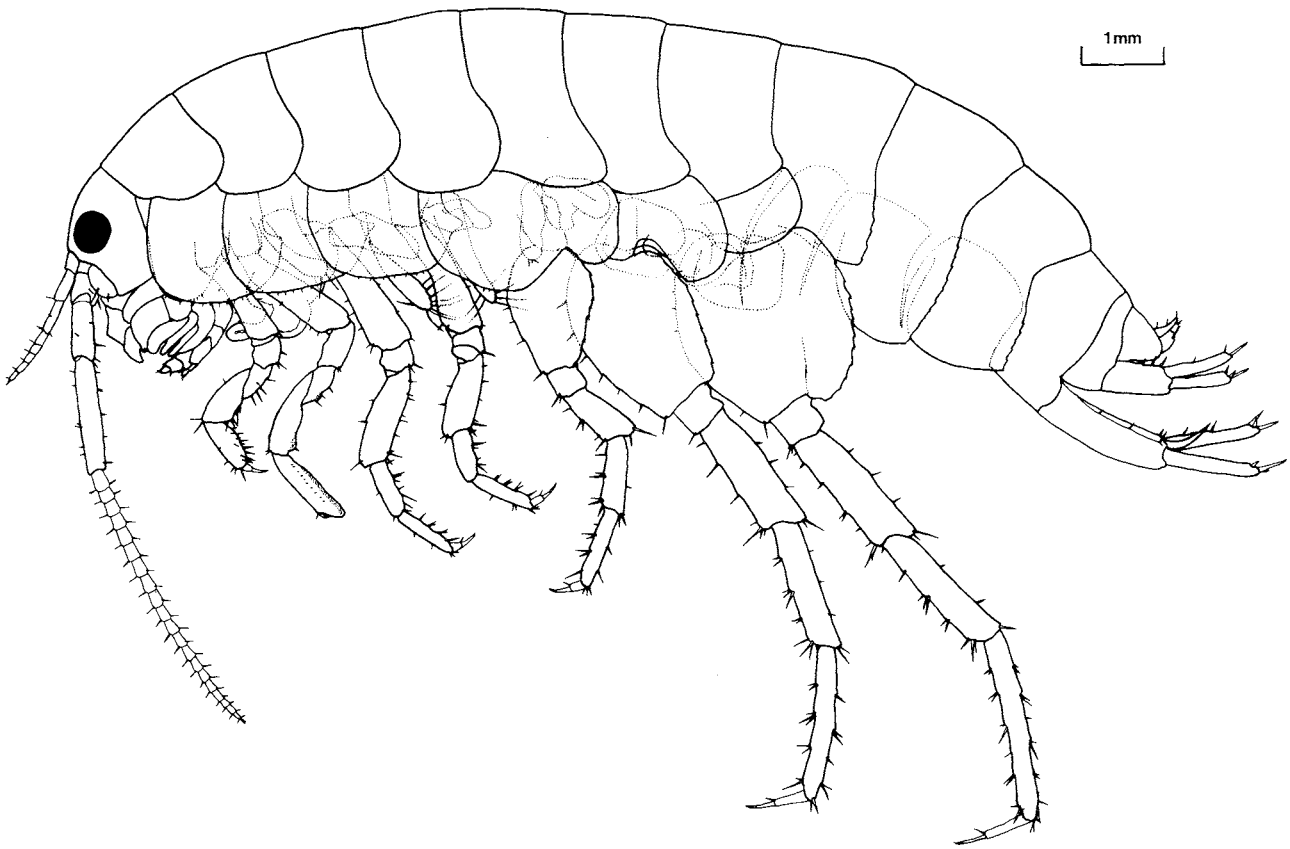

Fig. 25. *Mysticotalitrus cryptus* n. sp., holotype, female, 11.6 mm, Fern Tree, southern Tasmania.

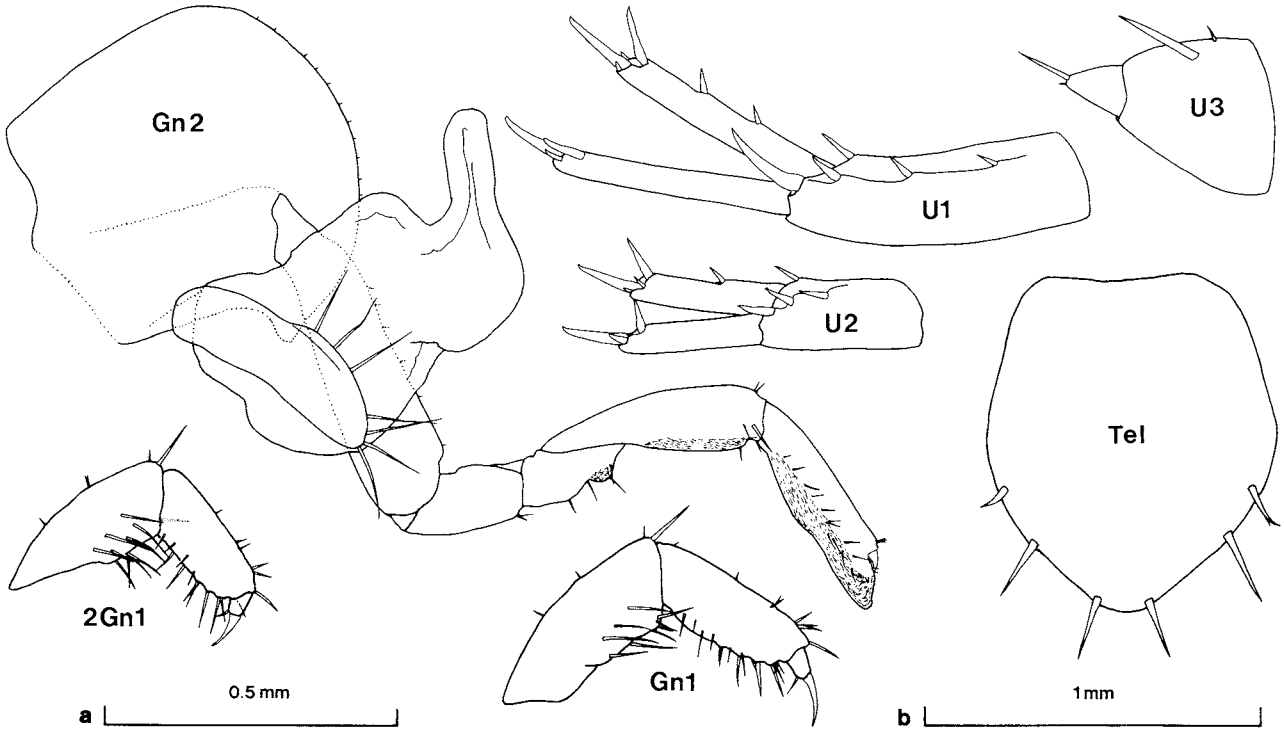

Fig. 26. *Mysticotalitrus cryptus* n. sp., holotype, female, 11.6 mm; 2, allotype, male, 7.6 mm; Fern Tree, southern Tasmania. Scale a: Gn1&2, 2Gn1, U1&2; scale b: Tel, U3.

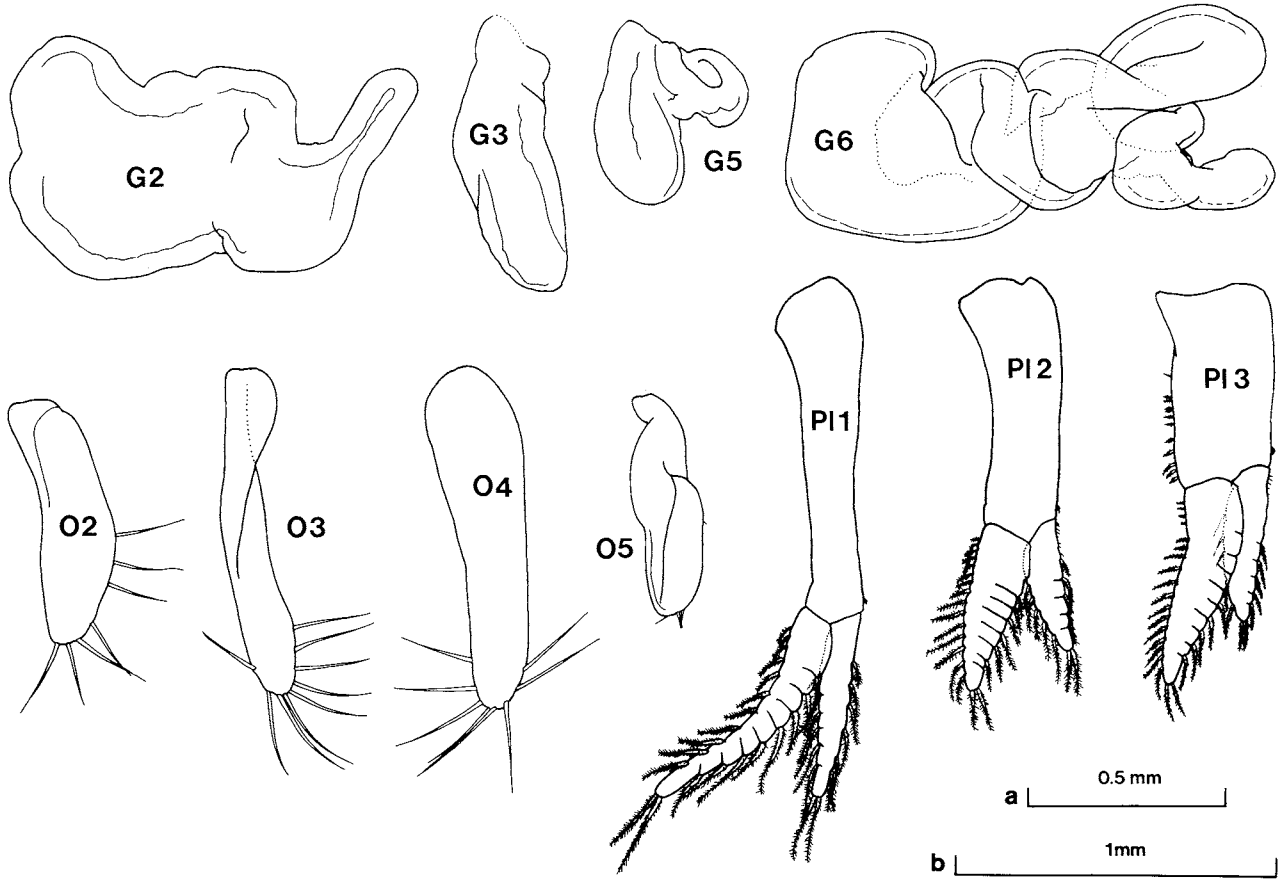

Fig. 27. *Mysticotalitrus cryptus* n. sp., holotype, female, 11.6 mm, Fern Tree, southern Tasmania. Scale a: P11-3; scale b: G2,3,5,6, O2-5.

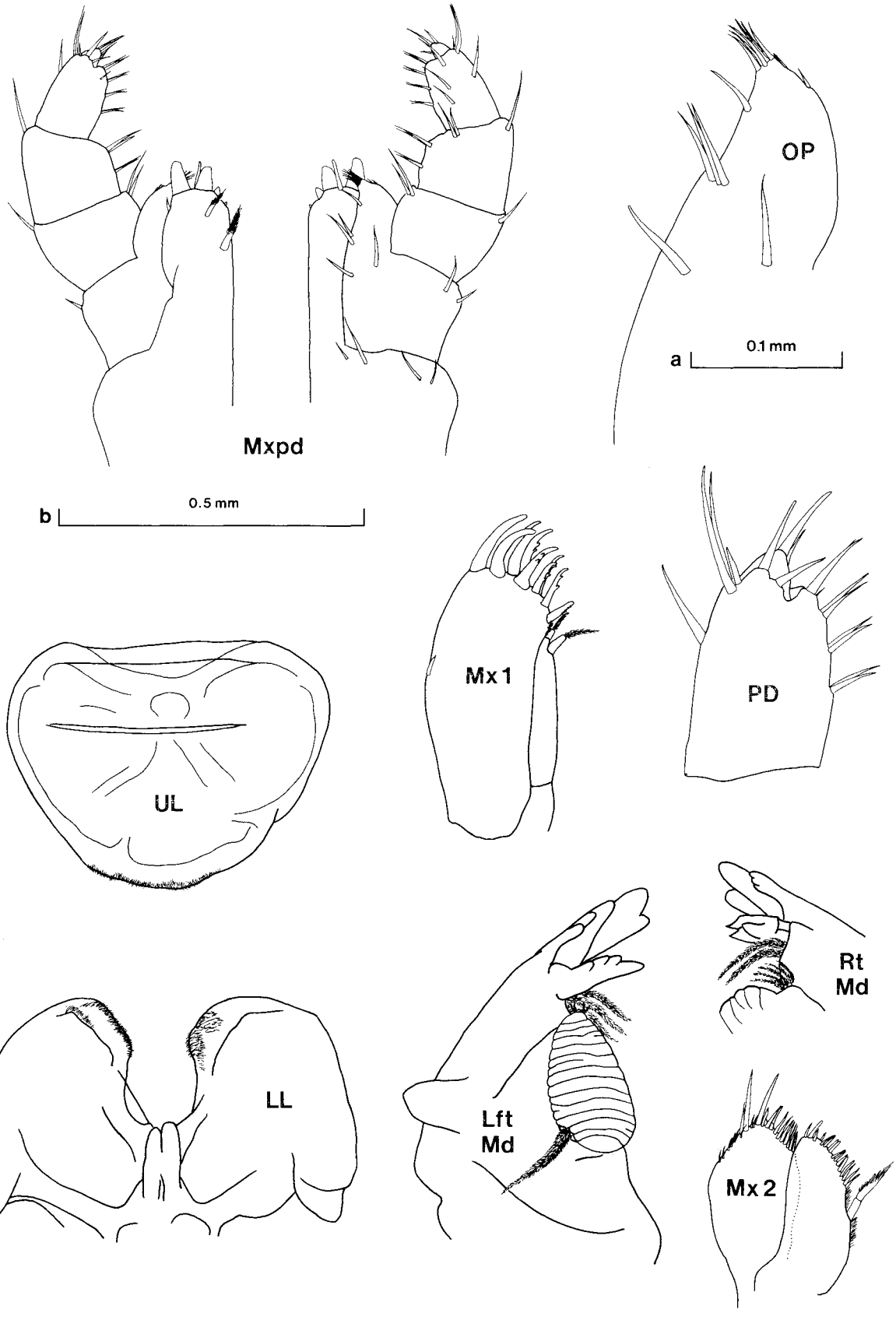

Fig. 28. *Mysticotalitrus cryptus* n. sp., holotype, female, 11.6 mm, Fern Tree, southern Tasmania. Scale a: OP, PD; scale b: Mxpd, Mx1&2, UL, LL, Lft Md, Rt Md.

distal narrowing of segment hardly constituting a palm, greatly exceeded by stout dactyl with long, slender, terminal spine.

Gnathopod 2, coxa broad, posterior process almost a right angle, sharply rounded, lower margin smoothly curving and lightly spinulose. Gill large, broad proximally, anterior extension long and slender; oostegite short with 7 long, slender setae on apex and along anterior margin. Segment 2 long, broadening distally, front margin spinulose. Segments 3 and 4 subequal, 4 with small tumid lobe behind. Segment 5 long, narrow, poorly spinose, with very shallow, broad posterior lobe. Segment 6 long, linear, narrow, just longer than 5, medial spine-row of small spines, dactyl small and longitudinal, terminal lobe acutely rounded.

Peraeopod 3, coxa shallow, spinulose below, posterior process acutely rounded. Gill sac-like, more than half as long as segment 2; oostegite slender, longer than that of gnathopod 2, with 9 long setae near apex and along anterior margin. Segment 2 narrow proximally, broadening distally, segments 4–6 quite slender, dactyl short, terminal spine long, almost straight.

Peraeopod 4 similar, but gill shorter, oostegite with 8 setae near apex, segments 2, 4 and 5 shorter.

Peraeopod 5, anterior coxal lobe large, anterodistally oblique, straight and spinose, hind lobe much smaller, concave behind. Gill small, bilobate, oostegite about ⅔ as long as those of peraeopods 3 and 4, thick, with gill-like texture, apically with 3 tiny setae. Segment 2 narrowing distally, hind margin slightly concave, serrulate. Dactyl slender, terminal spine long, just curved.

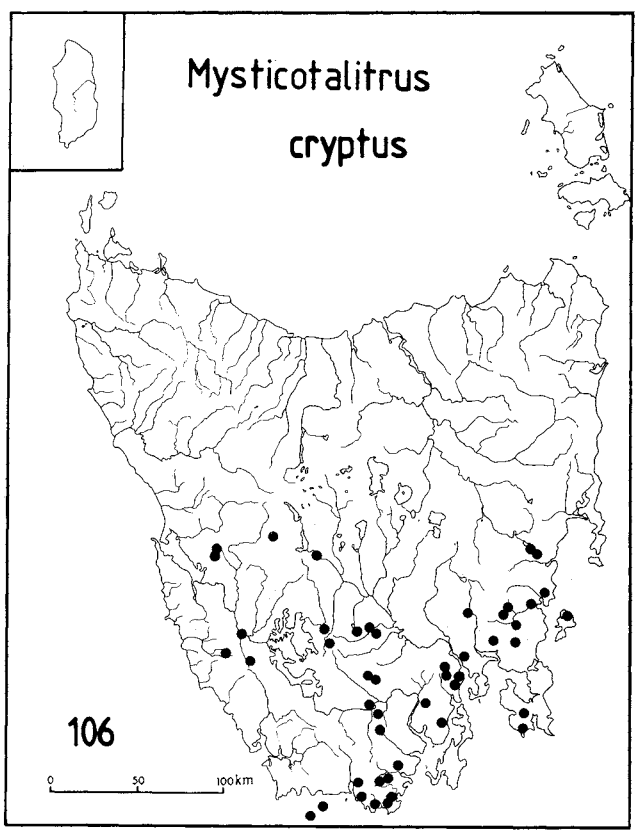

Fig. 29. Distribution of *Mysticotalitrus cryptus*. Total number of records is shown at lower left.

Peraeopod 6, anterior coxal lobe very shallow, posterior lobe narrow, distally rounded. Gill large, complex, folded and lobate. Segment 2 long-ovate, almost straight behind, minute distal lobe present. Segments 4–6 slender, dactyl long, slender, long terminal spine almost straight.

Peraeopod 7 the longest, coxa small, shallow. Segment 2 large, much expanded behind, hind margin serrulate, distal lobe prominent. Segments 4–6 long, slender. Dactyl elongate, slender; together with long, slightly curving dactyl, over ⅖ as long as segment 6.

Epimeral plate 1 shallow, lower margin slightly oblique, hind corner sharp, hind margin serrulate. Plate 2 deepest, front corner and lower margin forms one sweeping curve; hind corner sharp, obtuse, crenulate hind margin distally straight. Plate 3, front corner more sharply rounded than second, more gently curving below; hind corner sharp, hind margin straight, serrulate.

Pleopods all reduced, biramous, setose, first longest, second and third subequal; peduncles progressively shorter and stouter posteriorly, all with 2 coupling spines; outer rami longer, segmentation indistinct. Inner and outer rami of pleopod 3 respectively, intermediate in length between those of pleopods 1 (longer) and 2. Marginal plumose setae small, peduncle of pleopod 3 with row of tiny plumose setae on outer margin.

Uropod 1, peduncle with 1 inner and 3 outer marginal spines, distolateral spine strong and curved; rami subequal, shorter than peduncle, outer ramal margins bare, inner ramus with 2 marginal spines, apical spines long, longitudinal. Uropod 2, peduncle just longer than rami, with 1 inner marginal spine, 3 outer (1 apical); rami subequal, outer ramus with margins bare, inner ramus with 1 spine halfway along; apical spines long, 1 on each ramus longitudinal, almost half ramal length. Uropod 3, peduncle short, stout, with 1 large spine and 1 spinule; ramus short, conical, with 2 unequal spines on apex.

Telson broad, apex entire, gently rounded, 1 apical spine and 2 marginal spines on each side.

Male: length 7.6 mm. Antenna 1, flagellum 5-segmented [3–6]; that of antenna 2, 16-segmented [8–20+]. Otherwise like ♀.

Etymology. Specimens are often hidden (Latin *cryptus)* in collections of the very similar *M. tasmaniae.*

Remarks. *Mysticotalitrus cryptus* is very close to *M. tasmaniae,* but is distinguished from it by epimeral plates 1 and 2, which both have the hind corner sharp, not rounded as in *M. tasmaniae,* and by the telson which has marginal spines as well as the

apical spines found in the other species. *Mysticotalitrus cryptus* lacks the distally swollen first gnathopod of *M. tasmaniae,* although this difference is hard to detect in immature specimens and in the northern part of the range of *M. tasmaniae.*

Thomson's (1893) illustrations of material from the Springs, Mt Wellington, show at least two species, including *M. cryptus* (pleopod 1, telson), *M. tasmaniae* or *M. cryptus* (gills) and *Keratroides vulgaris* (most other parts).

Females of this species are larger than males and carry up to 8 eggs. The reference in Friend (1979) to a female landhopper with a sperm mass held against the ventral surface beneath the reduced oostegites of peraeopod 5 was to an individual of *M. cryptus.*

Distribution. (Fig. 29) Like *M. tasmaniae,* this species is centred in the south-east, but is more strongly represented in the west and south. It is also found on Maatsuyker and De Witt Islands, off the south coast.

Arcitalitrus Hurley, 1975 (new status)

Talitrus (Arcitalitrus) Hurley, 1975: 161.

Diagnosis. Large, apomorphic landhoppers with non sexually dimorphic gnathopods, characterised by the following. Antenna 1 reaching at least halfway along last peduncular segment of antenna 2. Maxilliped, outer plate arcuate, acute apex with 1 group of spines, palp slender, lateral lobes narrow, fourth segment unmasked. Gnathopod 1, hand simple, segment 6 long, narrowing distally. Gnathopod 2, hand mitten-shaped, apical lobe sharp. Oostegites short, slender, with few simple setae, distally placed. Anterior and posterior gills much larger than others, peraeopod 6 gill anseriform. Pleopods 1 and 2 biramous, pleopod 3 smaller, biramous, reduced or vestigial. Epimeral plate 2 the longest, rounded below; epimeral plate 3 subsquare, convex below. Uropods 1 and 2 non sexually dimorphic, outer rami lacking marginal spines; uropod 3 small, ramus very short with apical spines only. Telson entire.

Type species. *Talitrus sylvaticus* Haswell, 1879 (designated by Hurley, 1975).

Additional species. *Talitrus dorrieni* Hunt, 1925; *Arcitalitrus bassianus* n. sp.

Remarks. *Arcitalitrus* was originally established by Hurley (1975) as a monotypic subgenus for *Talitrus sylvaticus* Haswell, characterised by its arcuate maxilliped outer plate. At least eight species in eastern Australia (mostly undescribed) possess this distinctive maxilliped form and share other characteristic features; only one of these species, *A. bassianus* n. sp., is found in Tasmania.

Arcitalitrus has a number of apomorphic characters, including the slender, poorly spinose maxilliped palp, specialised outer plate, enlarged anterior and posterior gills, small oostegites with apical setae only, reduced pleopods and small third uropods.

Arcitalitrus bassianus n. sp.

Figs 30–33

Talitrus sylvaticus.—Chevreux, 1901: 392, fig. 7.

Type material. HOLOTYPE ♀, AM P37350; ALLOTYPE ♂, AM P37351; 4 PARATYPES [3♀♀ (1 ovig.), 1 juv.], AM P37352; 4 PARATYPES (♂, 2♀♀, 1 juv.), BMNH; 4 PARATYPES (♂, 2♀♀, 1 juv.), NMNS; north-west Tasmania, Robbins Island, 1.5 km north-north-east of Kate's Point, in swampy area beside creek, map ref. 7816-238894, 10 Feb 1979.

Other material examined. Tasmania: 159 specimens in 11 collections listed in Friend (1980). Victoria: 5 specimens, AM P28179; Mt Donna Buang, 1060 m, wet sclerophyll, ANIC berlesate 299, coll. R.W. Taylor & R.J. Bartell, 5 Nov 1970. 2 specimens, AM P28183; Mt Arnold Rd, east of Marysville, wet sclerophyll, 600 m, ANIC berlesate 301, coll. R.W. Taylor & R.J. Bartell, 4 Nov 1970. 3 specimens, AM P29340; Cement Creek, 5 km north of Warburton, leaf/log litter, ANIC berlesate 591, coll. J. Lawrence & T. Weir, 10 Jan 1978. 34 specimens, AM P29342; Cement Creek, 5 km west of Warburton, leaf and log litter, ANIC berlesate 592, coll. J. Lawrence & T. Weir, 19 Jan 1978. 21 specimens AM P29344; Cumberland Creek, 13 km east-south-east of Marysville, leaf and log litter, ANIC berlesate 593, coll. J. Lawrence & T. Weir, 18 Jan 1978. 39 specimens; near picnic area 11 km east of Nelson (west of Mt Richmond N.P.), 18 Dec 1975. 11 specimens; 3 km north of Peterborough, low eucalypt scrub, under leaf litter and bracken on sandy soil, quite dry, 22 Dec 1975. 9 specimens; under stones near west shore of Lake Purrumbete, near Camperdown, coll. P.S. Lake, 26 Sept 1977. 1 specimen; Snobs Creek above falls, eucalypt regrowth, coll A.M.M. Richardson, 17 May 1979. 3 specimens, MV J972; Cement Creek, Mt Donna Buang, coll. A. Neboiss, April 1976.

Diagnosis. Pleopods biramous, setose, progressively shorter towards posterior, with outer rami longer than inner rami; peraeopod 6, gill elongate, anseriform, subdistally broadly incised, distally narrowing to subacute apex.

Description. Female: length 8.5 mm, no eggs [1–5]. Head deeper than long, eye almost round, large, width about ⅓ head length. Antenna 1 reaching midpoint of last peduncular segment of antenna 2, flagellum 5-segmented [3–6], shorter than peduncle. Antenna 2 almost as long as head and first 5 peraeon segments, last peduncular segment slender, as long as rest of peduncle; flagellum longer than peduncle, 20-segmented [8–26], most segments with 4 groups of 3 slender setae, longer than the width of each segment.

Upper lip broad, apex lightly pilose, indentation of right margin masked. Lower lip fairly deep, outer margin naked, inner shoulders moderately pilose, margins of central trough lightly pilose. Left mandible, incisor 5-cuspate, lacinia mobilis 4-toothed, molar process strong, triturating surface

with 14 ridges; right mandible, incisor 5-toothed, lacinia with 2 major cusps, distal field covered in tiny bumps. Maxilla 1 broad, inner plate short and broad; outer plate broadening subdistally, palp small, slender, segment 2 minute, distal spines large, innermost leaning inwards at 135° to inner margin, dentition formula 0-0-0-4-3-3-3-2-3. Maxilla 2 broad, inner plate much narrower than outer, plumose seta long, apical spines longer towards inner margin; outer plate, apex rounded but somewhat excavate on outer side, 3 long spines near apex, other spines well separated, blunt-ended.

Maxilliped (♀ paratype used for maxilliped description), inner plate narrowing distally to truncate apex, with 1 small and 2 large spine-teeth and 1 longer, stout, blunt spine; 1 short spine on outer margin, medial face with 2 small subapical plumose setae and 3 longer ones on inner margin, lateral surface with 1 subapical plumose seta. Outer plate arcuate, acute apex with 1 group of spines, inner margin with 1 pair of spines distal of midway, and 2 single spines in proximal half. Palp slender, with a few long, slender spines, segments 2 and 3 with vestigial lateral lobes, each with a group of 2–3 spines distally on each lobe; segment 4 prominent, fused with third, conical, with 2 apical spines.

Gnathopod 1, coxa deep, broad, lightly spinose below. Segment 2 slender, broadening slightly distally, hind margin with 1 single spine near middle. Segment 4 with a very small posterior blister, surrounded by several spines. Segment 5 short, with a subdistal group of 4 long spines on medial surface. Segment 6 shorter than segment 5, slender hind margin convex and spinose, with several stout spines, no palm present. Dactyl strong, half as long as segment 6, terminal spine long.

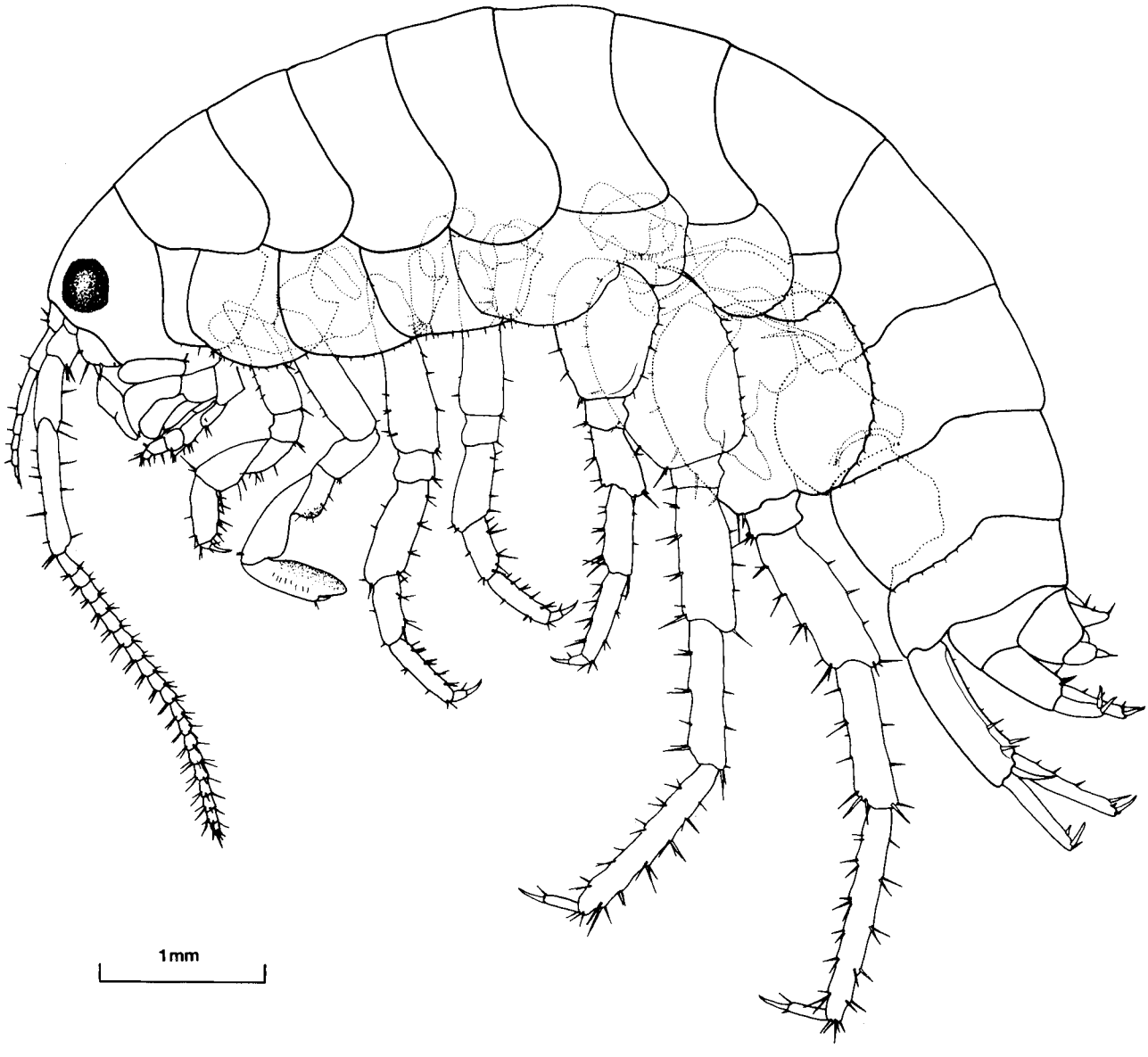

Fig. 30. *Arcitalitrus bassianus* n. sp., holotype, female, 8.5 mm, Robbins Island, north-western Tasmania.

Gnathopod 2, coxa deep, posterior process prominent, acute. Gill large, anterior extension ⅔ length of entire gill, moderately slender and apically rounded. Oostegite narrow, smaller than those of peraeopods 3 and 4, with 4 slender setae near apex. Segment 2, front margin slightly convex, with 4 small spines. Segment 3 longer than 4, which bears several slender spines and a prominent scabrous lobe on hind margin. Segment 5 poorly spinose, posterior lobe ⅓ as deep as segment length. Segment 6 shorter than 5, ⅓ as deep as long, medial spine-row of 7 small spines. Dactyl small.

Peraeopod 3, coxa broader than deep, spinulose below, posterior process acutely rounded. Gill small, slender, twisted; oostegite 3 smaller than 4, ⅓ as broad as long, with 5 slender distal setae. Segment 2 long, with several small spines on hind margin. Segments 4–6 strong, spinose behind. Dactyl strong, terminal spine curved.

Peraeopod 4 broader than deep, posterior process almost a right angle, apex sharply rounded. Gill 4 shorter than 3, oostegite broad, over half as long as segment 2, with 7 slender setae near apex. Segments 2–6 shorter than in peraeopod 3.

Peraeopod 5, anterior coxal lobe deeper than posterior, which is slightly convex behind. Gill small, bilobed; oostegite largest, narrowing slightly distally, with 7 short setae on anterodistal margin. Segment 2, central part of hind margin almost straight. Dactyl slender.

Peraeopod 6, posterior coxal lobe with anterodistal margin straight, smoothly rounded posteriorly. Gill anseriform, twisted and lobate proximally, connected to distal half by narrow neck; distal section with 2 strong posterior lobes, rounded subdistal lobe separated by 2 deep clefts in posterior margin from acutely rounded apical lobe. Segment 2 large, long, ovate, with strong rounded posterodistal lobe. Segments 4–6 long, dactyl ¼ as long as segment 6.

Peraeopod 7, coxa very shallow, deeper posteriorly, posterodistal margin spinulose. Segment 2 very large, as broad as long, distal lobe strong. Segments 4–6 strong, spinose, dactyl long.

Epimeral plate 1, lower margin oblique, hind margin convex and crenulate. Plate 2, lower margin exceeding that of third, smoothly rounded in front and below, hind corner obtuse, minutely produced, posterior margin straight, serrulate. Plate 3

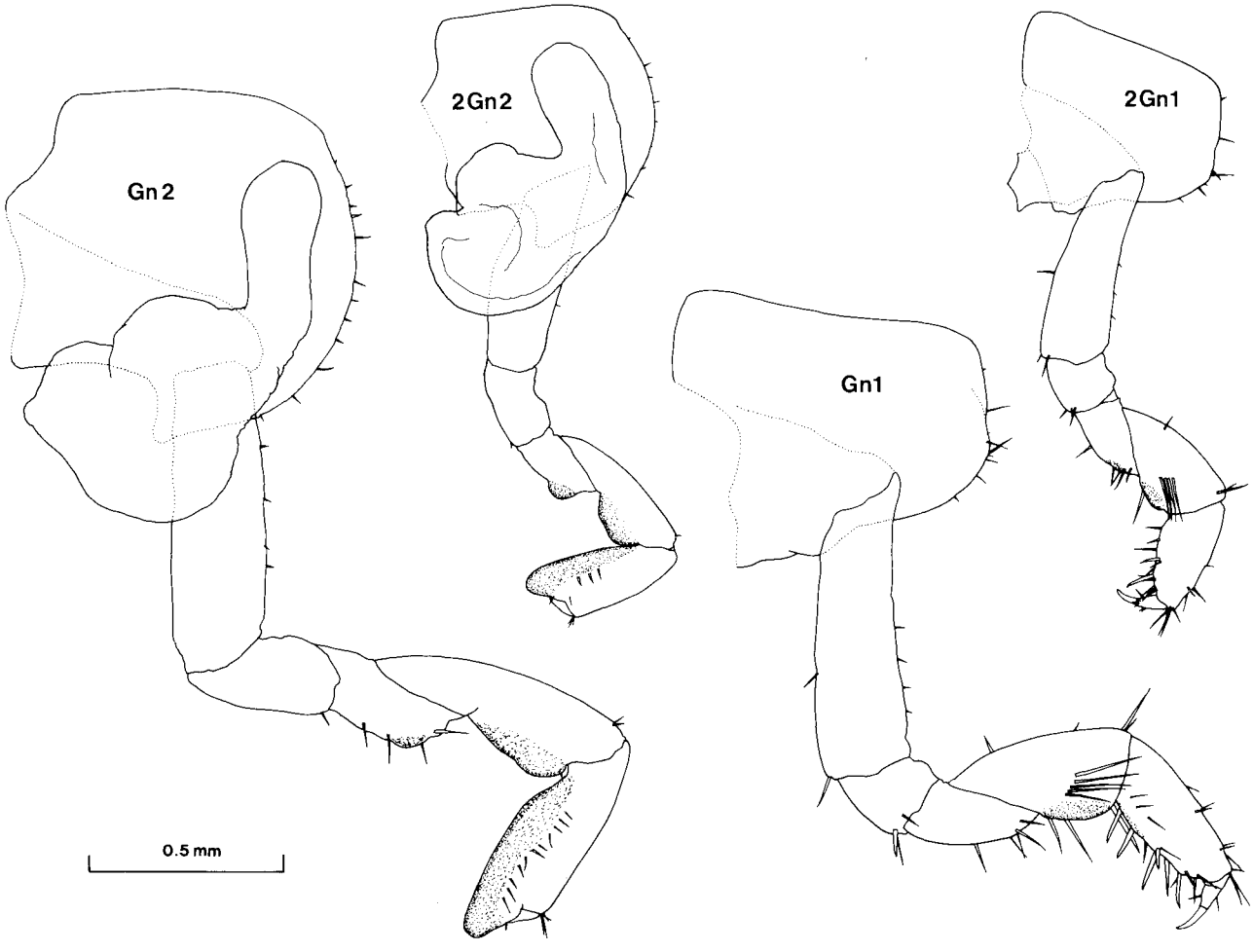

Fig. 31. *Arcitalitrus bassianus* n. sp., holotype, female, 8.5 mm; 2, allotype, male, 5.5 mm; Robbins Island, north-western Tasmania.

subsquare, lower margin rounded but with central straight section, hind corner obtuse, hind margin gently concave, serrulate.

Pleopods all biramous and setose but reduced and slender, progressively smaller posteriorly, inner rami shorter than outer rami, peduncles with 2 coupling spines. Ramal segmentation distinct distally, indistinct proximally. Pleopod 1, peduncle narrowest near midpoint, subequal in length to outer (longer) ramus, and to entire pleopod 3.

Uropod 1 long, peduncle slender, inner margin lined with tiny spinules, 2 strong outer marginal spines, apical spine slender, curved and simple; rami subequal, shorter than peduncle, margins of outer ramus smooth, inner with 3 marginal spines. Uropod 2 peduncle longer than rami, 2 large distal spines on inner margin, 1 on outer margin; outer ramus with margins naked, inner with 2 marginal spines. Uropod 3 short, peduncle broad, with a large lateral spine; ramus fairly short, slender, with 2 unequal apical spines.

Telson broad, with a small apical re-entrant, with 2 marginal and 1 apical spine on each side.

Male: length 5.5 mm. Antenna 1, flagellum 4-segmented [3–5]. Antenna 2, flagellum 16-segmented [5–23]. Otherwise like ♀.

Remarks. This is the only mainland Australian landhopper species also found on the main island of Tasmania today. It has been found only in one Tasmanian locality, in the far north-west. These specimens are morphologically very close to Victorian material examined.

The drawing of the first pleopod of an Australian landhopper by Chevreux (1901) very closely resembles that appendage in *Arcitalitrus bassianus;* Chevreux noted that the specimens, sent to him by Chilton, possessed pleopods which were all biramous, the third pair being smaller than the first and second pairs, as in this species. Chilton (1916) pointed out that the specimens he sent Chevreux were from Mt Kosciusko, which is in the Snowy Mts. in New South Wales, near the Victorian border.

Arcitalitrus bassianus differs from both *A. sylvaticus* and *A. dorrieni* in possessing biramous, setose pleopod 3. *Arcitalitrus dorrieni* can be distinguished from both *A. bassianus* and *A. sylvaticus* by its possession of an apical cleft on the gill of peraeopod 6.

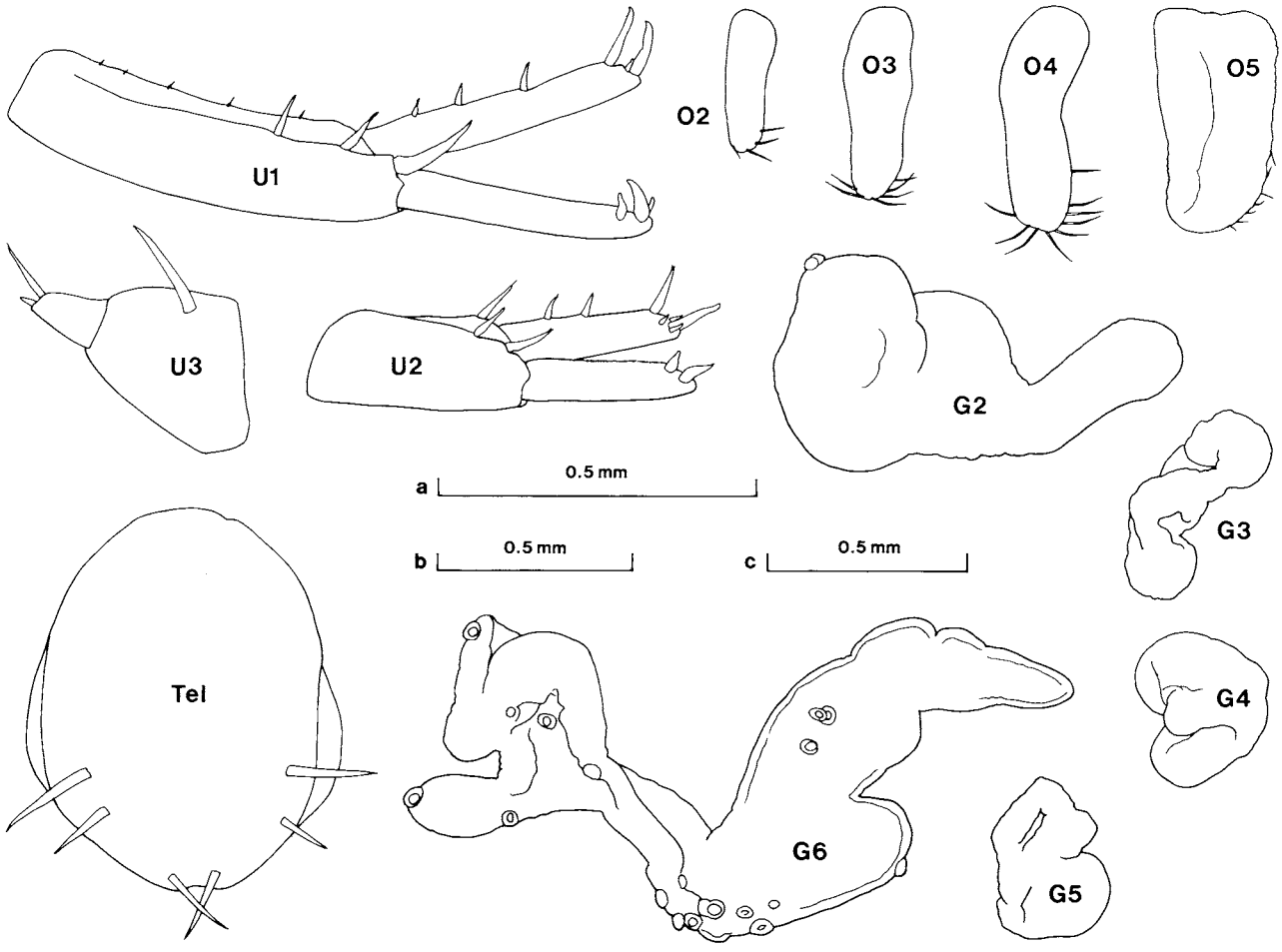

Fig. 32. *Arcitalitrus bassianus* n. sp., holotype, female, 8.5 mm, Robbins Island, north-western Tasmania. Scale a: Tel, U3; scale b: U1&2; scale c: G2-6, O2-5.

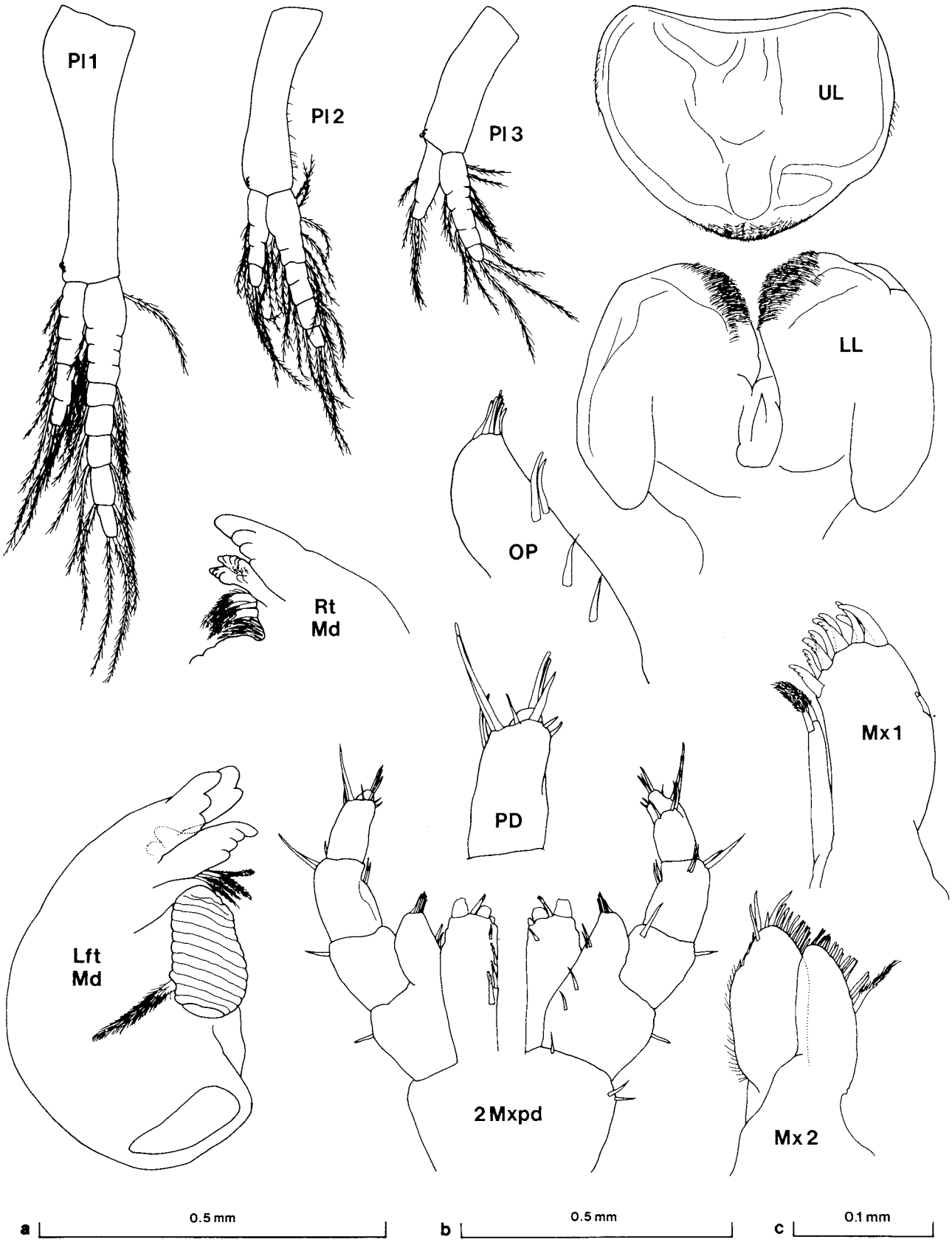

Fig. 33. *Arcitalitrus bassianus* n. sp., holotype, female, 8.5 mm; 2 paratype, female, 7.0 mm; Robbins Island, north-western Tasmania. Scale a: 2Mxpd, Mx1&2, UL, LL, Lft Md, Rt Md; scale b: P11-3; scale c: OP, PD.

Distribution. (Fig. 34) *Arcitalitrus bassianus* is distributed widely across Victoria and is common on King, Hunter and Robbins Islands, north-west of the Tasmanian mainland. The single recorded occurrence of the species in Tasmania is from teatree swamp near Togari.

Etymology. The name refers to its implied former distribution across the Bassian Plain, which linked Tasmania and mainland Australia during the most recent period of low sea-level (22 500 to 12 750 y BP).

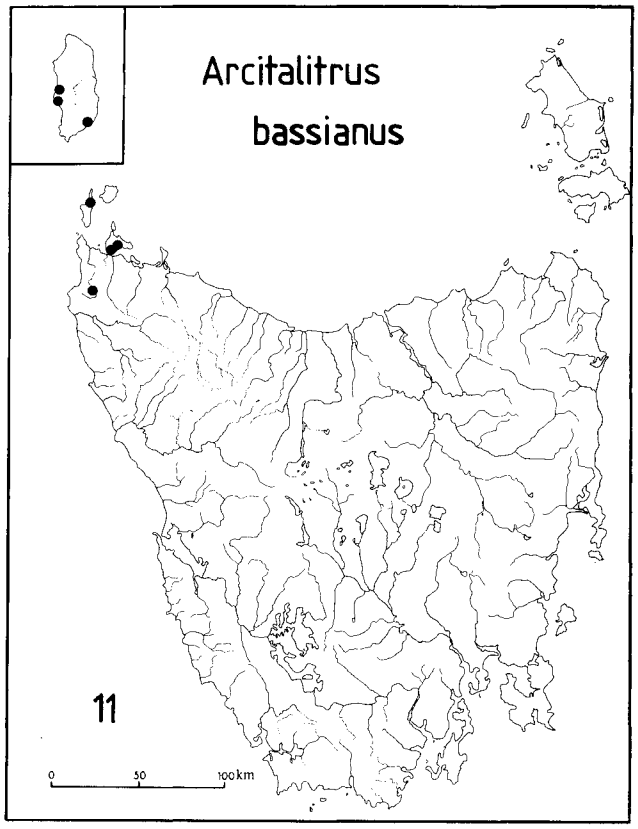

Fig. 34. Tasmanian distribution of *Arcitalitrus bassianus*. This species is also found in Victoria. Total number of Tasmanian records is shown at lower left.

Keratroides Hurley, 1975 (new status)

Talitrus (Keratroides) Hurley, 1975: 162.
Talitrus (Keratroides).—Friend, 1979: 95.

Diagnosis. Apomorphic, non sexually dimorphic landhoppers with the following characteristics. Antenna 1, short, broad; upper and lower lips shallow. Maxilla 1 broad, spine-teeth strong, innermost inclined far more medially than adjacent spine-teeth. Maxilla 2, inner plate spines short, strong and well separated. Maxilliped inner plate poorly setose; outer plate distally truncate, with spine groups at each corner (except in *K. albidus),* palp slender, lateral lobes vestigial or absent. Gnathopod 1 non palmate, distal segments short, strong, segment 6 proximally expanded. Gnathopod 2, hand mitten-shaped, segment 2 anterior margin with several long spines, distal segments short, strong, segment 2 anteroproximally expanded. Oostegite of ♀ gnathopod 2 lacking. Peraeopods 3–7 simplidactylate. Anterior and posterior gills large, others small, lobate; peraeopod 6 gill anseriform. Pleopods reduced, usually vestigial, pleopod 3 reduced to a vestigial stump. Epimeral plate 3 with distal margin concave. Uropods 1 and 2 with margins of outer ramus bare, distolateral spine of uropod 1 peduncle strong and simple; uropod 3 very small, ramus without lateral spines. Telson distally broad, marginally spinose.

Type species. *Talitrus kershawi* Sayce, 1909 (designated by Hurley, 1975).

Additional species. *Talitrus (Keratroides) vulgaris* Friend, 1979; *Talitrus (Keratroides) angulosus* Friend, 1979; *K. albidus* n. sp.; *K. rex* n. sp.; *K. pyrensis* n. sp.

Remarks. Hurley (1975) thought the morphology of the Victorian species *Talitrus kershawi* Sayce distinctive enough to warrant separation from the other landhoppers, and placed it in a monotypic subgenus, *Talitrus (Keratroides).* Two new Tasmanian species were placed into Hurley's subgenus by Friend (1979) who slightly expanded the definition of the taxon.

Keratroides is a large group of apomorphic landhoppers which includes at least 15 species from Tasmania, the Bass Strait islands and Victoria, and which is raised herein to generic status.

Its component species share the features listed by Friend (1979) (diagnosis expanded above) except that the pleopods are usually, but not always vestigial (i.e. in *K. albidus).* This diagnosis disagrees with the following points in Hurley's original definition: maxilliped outer plate distally truncate, with a spine group at each of the 2 corners; pleopods 1 and 2 reduced or vestigial, pleopod 3 a vestigial stump; epimeral plate 3 slightly or strongly concave distally; telson with 2–6 marginal spines.

Apomorphic character states of the genus include the strong, simple first gnathopod and slender mitten-shaped second gnathopod in both sexes, the poorly spinose, narrow maxilliped palp and distally modified outer plate, the short, broad upper and lower lips and maxillae, the narrow oostegites with apical setae only, the absence of an oostegite on gnathopod 2, large anterior and posterior gills, and modified epimeral plates.

Keratroides is most closely related to *Arcitalitrus* which it generally resembles in the form of antennae, mouthparts, gnathopods, peraeopods, uropods and telson. *Keratroides* is distinguished from *Arcitalitrus* by its possession of a truncate maxilliped outer plate with 2 distal spine-groups, distally concave epimeral plate 3 and its lack of an oostegite on ♀ gnathopod 2.

Keratroides superficially resembles *Austrotroides* in its tendency for pleopods to be vestigial, its simple

Table 2. Characters which distinguish *Keratroides* from *Austrotroides*.

Keratroides	*Austrotroides*
Antenna 1 just exceeding penultimate segment of antenna 2 peduncle.	Antenna 1 reaching over halfway along last segment of antenna 2 peduncle.
Maxilliped, outer plate distally truncate, with 2 apical spine-groups (except in *K. albidus*).	Maxilliped, outer plate distally rounded with a submarginal spine-row or group.
Maxilliped, palp poorly spinose, lateral lobes vestigial, segment 4 obvious.	Maxilliped, palp spinose, lateral lobes well developed, segment 4 masked.
Maxillae short and broad; maxilla 1, inner spines leaning inward.	Maxillae long, narrow; maxilla 1, spines parallel, longitudinally oriented.
Hand of gnathopod 1 short, proximally broad, lacking any palm (except in *K. albidus*).	Hand of gnathopod 1 long, slender, with a short, oblique palm.
♀ gnathopod 2 lacking oostegite.	♀ gnathopod 2 with oostegite.
Uropod 3 very small, ramus short, without lateral spines.	Uropod 3 relatively long, slender, ramus elongate, usually with lateral spines.
Telson large, entire, with several marginal spines each side.	Telson small, apically cleft, with 1 or no marginal spines each side.

first gnathopods and its laterally flattened 6th peraeopod gills. However, these similarities are due to convergence; the two genera are not closely related and may be distinguished from each other by the features shown in Table 2.

Keratroides albidus n. sp.

Figs 35–38

Type material. HOLOTYPE ♀, AM P37353; ALLOTYPE ♂, AM P37354; 6 PARATYPES (♂, 3♀♀, 2 juv.), AM P37355; 5 PARATYPES (♂, 3♀♀, 1 juv.), BMNH; 5 PARATYPES [♂, 3♀♀ (1 ovig.), 1 juv.], NMNS; north-west Tasmania, APPM reserve, West Downs, near Surrey Hills, in distinct burrows in clay, beneath logs in *Nothofagus* forest, map ref. 8015-863229, coll. A.M.M. Richardson, 16 Dec 1978.

Other material examined. Tasmania: 119 specimens in 32 collections listed in Friend (1980).

Diagnosis. Antenna 2 shorter than head and first 3 peraeon segments. Dorsal surface of head strongly rounded. Eye small, diameter about ⅕ of head length. Body pigmentation lacking. Gnathopod 1, anterior and posterior margins of segment 6 straight and parallel, palm well defined, dactyl about ⅘ as long as segment 6. Peraeopod 6, gill terminally subacute, posterior margin deeply incised near distal end. Pleopods 1 and 2, peduncles broad, with broad rami with long plumose setae. Pleopod 3 a small stump. Epimeral plate 3 deeper than 2, anterior corner

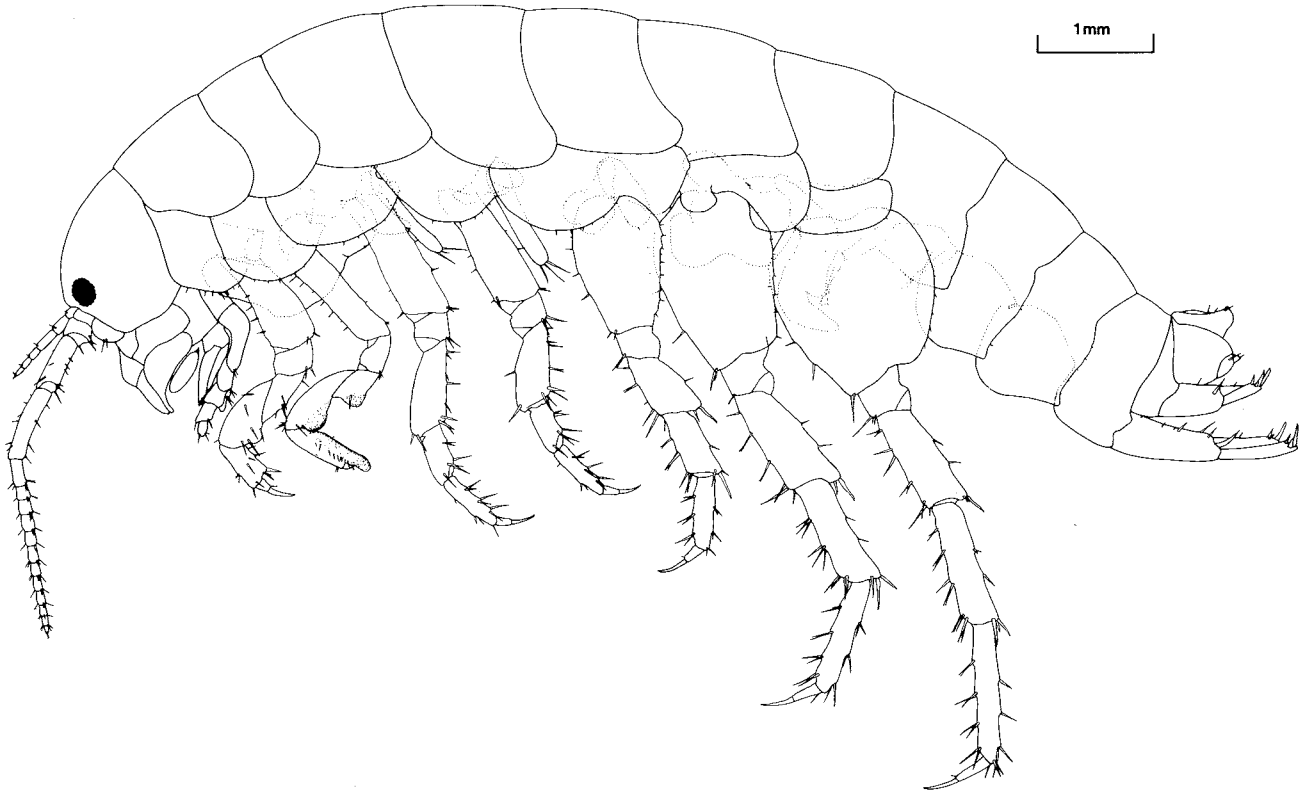

Fig. 35. *Keratroides albidus* n. sp., holotype, female, 12.5 mm, near Surrey Hills, north-western Tasmania.

smoothly rounded, lower margin concave, oblique, posterior margin sinuous, hind corner acutely produced posteriorly.

Description. Female: length 12.5 mm, no eggs [4]. Head as long as deep, dorsal surface strongly rounded. Eye small, round, width about ⅕ head length. Antenna 1 very short, reaching just past distal end of penultimate peduncular segment of antenna 2; flagellum 4-segmented [3–4], shorter than peduncle. Antenna 2 short, shorter than head and first 3 peraeon segments, flagellum 13-segmented [7–14], most segments with 4 groups of 2 long spines; peduncle shorter than flagellum, distal segment short, no longer than penultimate 2 segments together.

Upper lip broad, shallow, apically pilose; lower lip, lobes broad, inner shoulders pilose, sides of central trough lightly pilose. Left mandible, incisor elongate, 4-cuspate, lacinia mobilis 3-cuspate, molar process well developed, triturating surface with 20 ridges, anterodistal margin raised; right mandible, incisor broad, blade-like, 4-cuspate, lacinia with 1 cusp.

Maxilla 1, inner plate short, inner margin lightly pilose, apical plumose setae large; outer plate not narrowing distally, apical spines simple or poorly dentate, inner spines leaning inwards, innermost almost laterally oriented, dentition formula 0-0-0–3-2-1-2-1; palp slender, small, set proximally of midpoint, inner margin pilose. Maxilla 2, inner plate narrow, about half width of outer plate, apical spines relatively sparse, stout and sharp, plumose seta strong; outer plate lacking large spines near apex, outer margin pilose, spinose distally, rest of spine-row comprising well separated, slender spines.

Maxilliped, inner plate with 3 subterminal plumose spines on medial surface, 3 on lateral surface, 2 on inner margin; 3 terminal teeth, inner very small, outer 2 tall, all with inner margin concave. Outer plate slender, narrowing distally to a small rounded apical projection obscured by subterminal group of spines. Palp very slender, with a few long spines, lateral lobes of segments 2 and 3 absent, segment 4 with 2 apical spines, delimited proximally

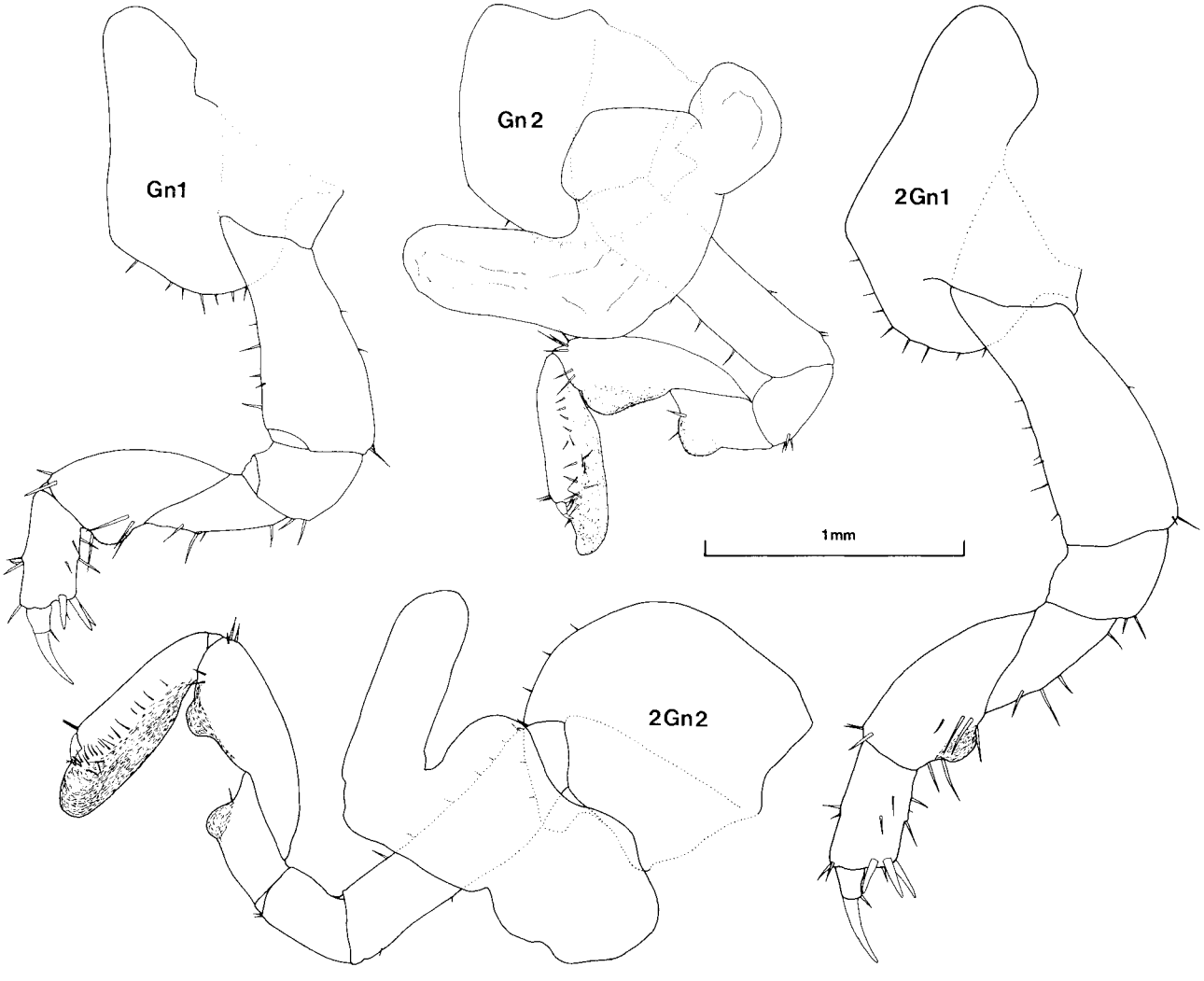

Fig. 36. *Keratroides albidus* n. sp., holotype, female, 12.5 mm; 2, allotype, male 12.5 mm; near Surrey Hills, north-western Tasmania.

by a slight shoulder.

Gnathopod 1, coxa broad, very shallow. Segment 2 stout, broadening distally with several spines on anterior margin. Segment 3 broader than long, shorter than 4, which bears a very small posterior lobe. Segment 5 longer than 6, expanded posteriorly into short scabrous lobe. Segment 6 small, subrectangular, posterior margin with few spines. Short straight palm defined by 2 very stout spines between which the dactyl closes, with another stout spine midway along palm. Dactyl strong, ¾ length of segment 6, greatly exceeding palm, terminal spine curved.

Gnathopod 2, coxa shallow, distal margin gently rounded, posterior process small, sharply rounded. Gill large, anterior extension long and broad, oostegite absent. Segment 2 slender, anterior margin spinose, slightly concave; segment 4 with large posterodistal tumid lobe. Segment 5 as long as 6, distally spinose, hind margin deeply expanded into broad scabrous lobe. Segment 6 long, posterior swelling distal, lobe elongate, fairly sharp; medial spine-row comprising numerous small spines, dactyl small.

Peraeopod 3, coxa small, very shallow, slight corner in front, posterior process bluntly rounded. Gill very small, sac-like, twisted, oostegite very slender, apically with 3 slender setae. Segment 2 strong, segments 4–6 with long spines behind; dactyl slender, terminal spine long, together well over half the length of segment 6.

Peraeopod 4 similar, but coxa smaller, posterior process smaller, acute, oostegite with 4 apical setae, segment 2 shorter.

Peraeopod 5, anterior coxal lobe very shallow, smoothly rounded in front and below, hind lobe small, straight posteriorly. Gill small, bilobate, oostegite ⅔ as long as anterior pairs, fleshy, with 1 spinule and some pilosity on broad apex. Segment 2 narrowing distally, segments 4 and 5 short, heavy; dactyl long, slender, terminal spine very long, curved; whole segment ¾ length of segment 6.

Peraeopod 6, coxa small, both lobes shallow. Gill large, anseriform; proximally lobate, very broad, posterior margin distally strongly indented near 'head', terminally subacute. Segment 2 subovate, narrowing distally, hind margin almost straight, serrulate. Segments 4–6 strong, spines long; dactyl very long, slender, half as long as segment 6.

Peraeopod 7, coxa very shallow. Segment 2 broadly subovate, weakly spinulose, serrulate behind, distal lobe very shallow. Segments 4–6 strong, spinose. Dactyl very long and slender, half as long as segment 6, terminal spine almost straight.

Epimeral plate 1 very shallow, lower margin almost horizontal, hind corner sharp, hind margin gently convex. Epimeral plates 2 and 3 rounded in front, lower margin posteriorly concave, hind corner slightly produced behind, hind margin sinuous, lightly spinulose.

Pleopod 1 reduced, biramous, peduncle almost as broad as long, inner margin expanded proximally, pilose, with 2 coupling spines; outer ramus longer, shorter than peduncle, 6-segmented, inner broader, segmentation indistinct; both rami with strong plumose setae marginally, apical setae very long. Pleopod 2 shorter, peduncle much narrower, expanded proximally on inner side, with 4 coupling

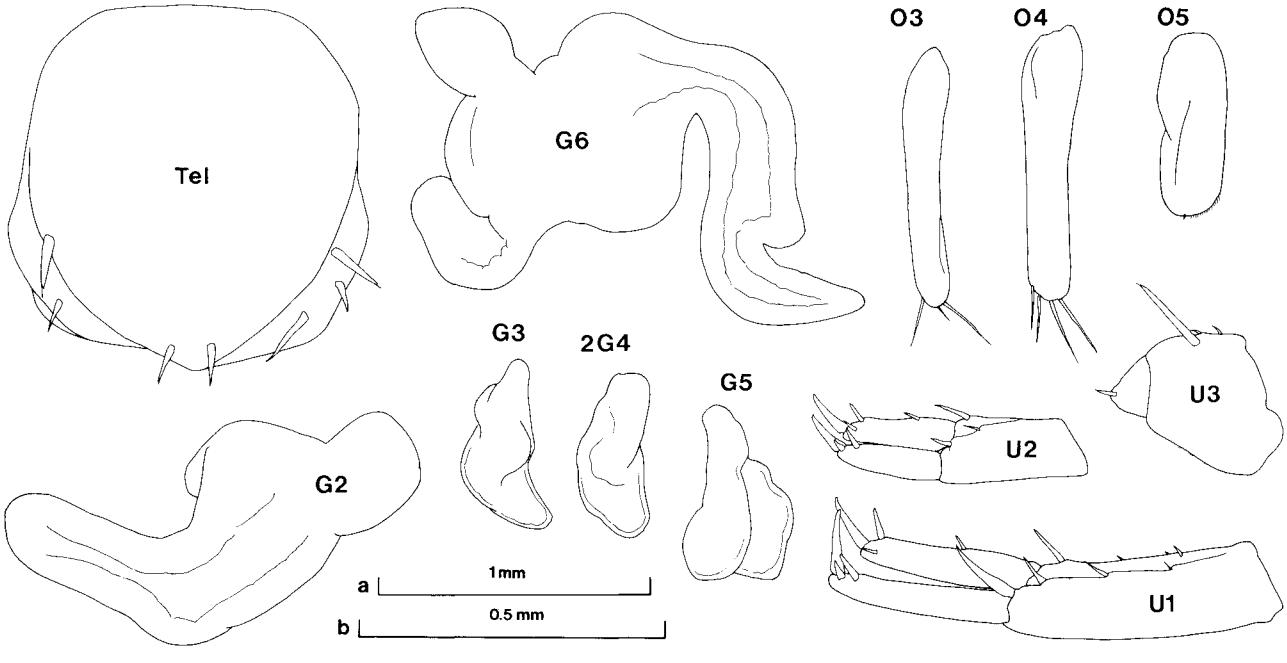

Fig. 37. *Keratroides albidus* n. sp., holotype, female, 12.5 mm; 2, allotype, male, 12.5 mm; near Surrey Hills, north-western Tasmania. Scale a: G2,3,5,6, 2G4, O3-5, U1&2; scale b: Tel, U3.

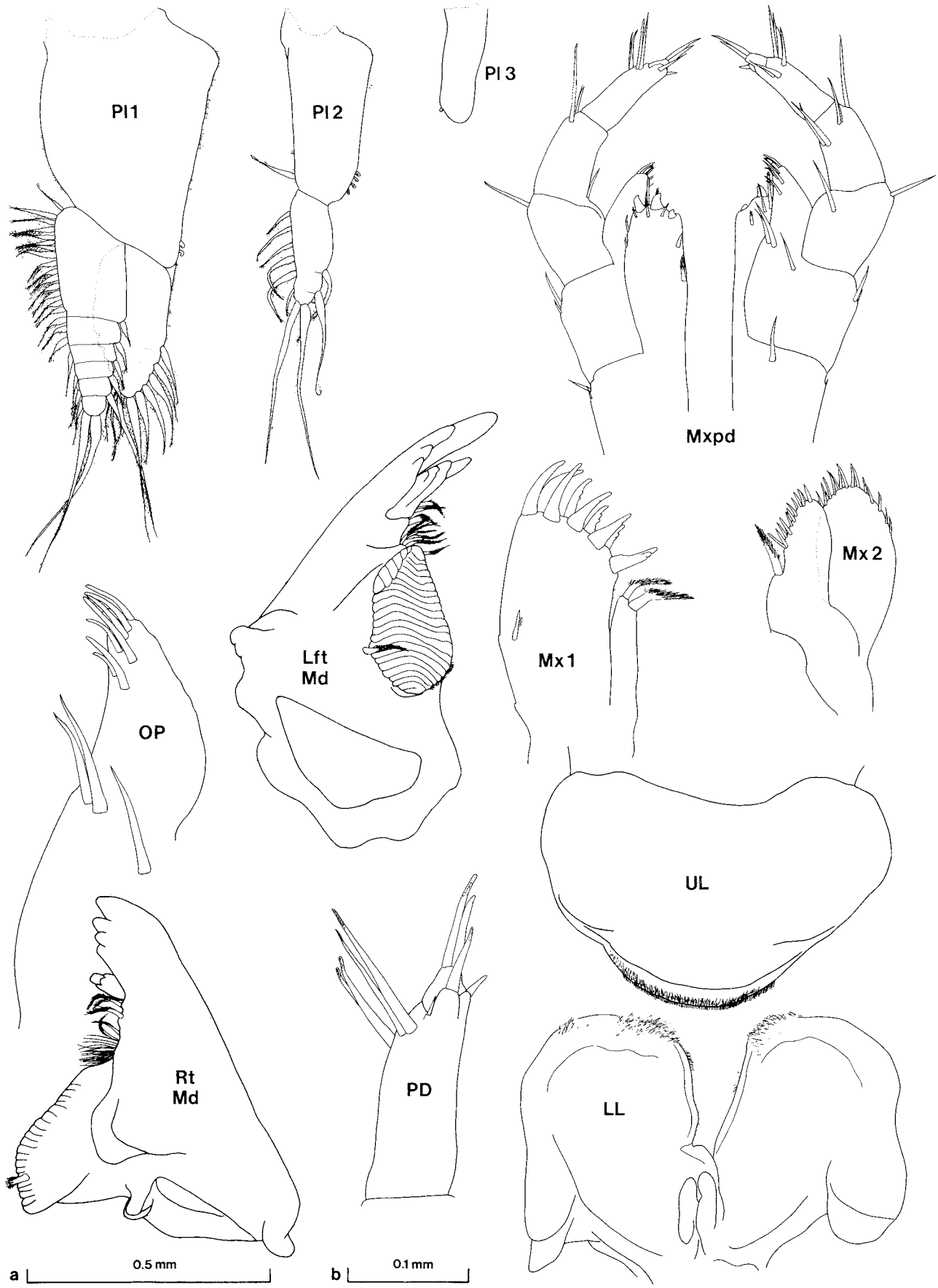

Fig. 38. *Keratroides albidus* n. sp., holotype, female, 12.5 mm, near Surrey Hills, north-western Tasmania. Scale a: P11-3, Mxpd, Mx1&2, UL, LL, Lft Md, Rt Md; scale b: OP, PD.

spines, both margins pilose; outer margin with 1 plumose seta distally; only 1 ramus present, shorter and narrower than peduncle, segmentation indistinct, terminal setae long. Pleopod 3 a subrectangular stump, shorter than peduncle of second, rami absent, 1 subapical coupling spine present.

Uropod 1 quite short, peduncle longer than rami, with 3 outer and 3 inner marginal spines, distolateral spine straight and slender; outer rami just longer than inner, margins bare, 1 apical spine as long as peduncular apical spine; inner ramus with 1 marginal spine. Uropod 2, peduncle longer than rami, 2 outer and 1 inner marginal spine; rami subequal, inner strong, with 1 marginal spine. Uropod 3 very short, peduncle as broad as long, with 1 long and 2 very small spines; ramus broader than long, with a small subapical spine.

Telson broad, entire, with 2–3 marginal spines and 1 apical spine on each side.

Male: length 12.5 mm. Antenna 1, flagellum 4-segmented [3–4]; antenna 2, flagellum 15-segmented [7–15]. Gnathopod 2, hind lobes of segments 4 and 5 smaller, distal lobe of segment 6 broader than in ♀.

Etymology. The name *albidus,* meaning 'whitish' (Latin), alludes to the lack of body pigmentation displayed by this species.

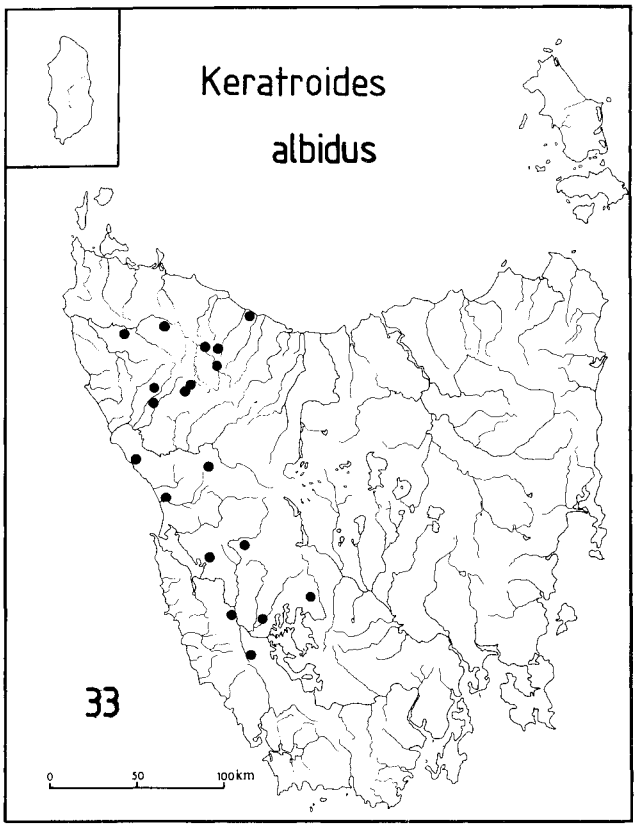

Fig. 39. Distribution of *Keratroides albidus.* Total number of records is shown at lower left.

Remarks. This aberrant species is a specialised burrower found in western Tasmania. Specimens were found in distinct burrows in clay beside the Magnet Mine road, near Waratah, and in the same situation at the type locality. In other areas, *K. albidus* was collected at depths to 20 cm in the soil, but burrows were not detected (although they may have been disturbed by digging).

Many of the unusual features displayed by this amphipod may be related to the burrowing habit, and several are also found in *K. angulosus* (q.v.). These features include short, strong peraeopods and (especially) gnathopod 1, short antennae, lack of body pigment, small eyes and rounded cephalon. Peraeopod 6 gill is very large proximally, and pleopods 1 and to a lesser extent 2 very broad, due to secondary broadening of peduncle, forming a movable septum across the ventral tunnel; these features may facilitate aeration of the gills in burrows. Mouthparts are different from the usual *Keratroides* morphology, indicating a different diet, perhaps incorporating plant roots. These differences are especially noticeable in the mandibles, maxilla 2 and the maxillipeds (palps are very slender, the outer plate is pointed, not truncate, with only one group of apical spines). The body of *K. albidus* is broad and shallow, almost dorsoventrally compressed and the coxae are very small; strength and a circular body section are apparently more important than the ability to slip between leaves (to which the laterally flattened shape of other landhoppers has been attributed).

These animals move slowly when disturbed, not jumping effectively. Amphipods of an unrelated species from New Caledonia display the same general facies as *K. albidus* indicating that this morphology has resulted from adaptation to a particular niche.

Adult *K. albidus* are fairly large animals (some over 15 mm long), and there is no size difference between the sexes. Large size may be an advantage to a burrowing amphipod, bestowing more strength, and this would apply equally to both sexes; in other species females are large, allowing more eggs to be brooded, but males are smaller, apparently at an ideal size for a non-brooding existence.

This species is difficult to place in the generic structure used in this work and there is some justification for erecting another genus to receive it. This is because the radical morphological changes caused by adaptation to the burrowing habit have affected several of the features used for generic definition.

The maxilliped outer plate, mandible, maxilla 2, gnathopod 1, pleopods and elongate terminal spines of the dactyls are unlike those of any other species in either *Keratroides* or *Arcitalitrus,* although this species is otherwise close to both genera. The species is here placed in *Keratroides* because of the following features: its lack of oostegites on the ♀ second gnathopods; the presence of a long spine proximally on the anterior margin of segment 2, gnathopod 2; the

concave distal margin of epimeral plate 3.

Distribution. (Fig. 39) This burrowing species is mainly distributed in inland forests and woodlands of the western high rainfall area, but does not occur in the far south or in the extreme north-west. It is not often found in coastal situations.

Keratroides vulgaris (Friend)
Fig. 40

Talitrus sylvaticus.—Thomson, 1893: 59, pl. iv, figs 1,2,4,7,9,10 (part).
Talitrus (Talitroides) sylvaticus.— Ruffo, 1949a: 206 (part).
Talitrus kershawi.—Hurley, 1955: 155, fig. 4.
Talitrus (Keratroides) vulgaris Friend, 1979: 85, figs 1a,2,3.

Material examined. Tasmania: HOLOTYPE, TMAG G1945; ALLOTYPE, TMAG G1946; 26 PARATYPES, TMAG G1947-8; south-east Tasmania, foothills of Mt Wellington, near Hobart, under leaf litter, *Atherosperma moschatum* stand in gully near Strickland Avenue, map ref. 8312-213485, 20 Nov 1977. 1 specimen, MCSN; Mt Wellington, coll. E. d'Albertis & O. Beccari, 12 Feb 1878. 4♀♀ (4 ovig.), AM G5422; "Tasmania, old colln.". 2 specimens, SAM TC902; Lady Barron Falls, National Park, pres. G.P. Whitley, 19 Jan 1928. 2♂♂, 7♀♀, MV; Kingston, coll. C. Oke, 14 May 1948. 7069 further specimens in 373 collections listed in Friend (1980).

Diagnosis. Antenna 2 longer than head and first 4 peraeon segments. Dorsal surface of head gently rounded. Diameter of eye about ⅓ length of head. Body pigmentation normal. Gnathopod 1, segment 6 gently narrowing distally, posterior margin convex, dactyl about half as long as segment 6. Peraeopod 6, gill narrowing distally, with slender distal extension. Pleopods vestigial, but first instar specimens sometimes with long, plumose setae on rami of pleopod 1. Epimeral plate 3 deeper than 2, anterior corner smoothly rounded, lower margin concave, posterior margin sinuous, posterior corner subacutely produced.

Remarks. *Keratroides vulgaris* is the most common species in Tasmania, and is distinguished from other *Keratroides* species by its long second antennae, its distinctive gill shape and the shape and relative depth of its epimeral plates.

Individuals of both sexes grow to a large size (15 mm), and breeding apparently occurs only during the warmer months (unpublished data) when broods of up to 12 eggs are produced. This is an active species living in the upper litter/soil layers (Friend & Richardson, 1977); when disturbed, *K. vulgaris* hop and flip vigorously to a place of shelter.

Keratroides vulgaris includes several forms which may warrant specific recognition. For instance, a proportion of specimens from north-west Tasmania have 2 equal slender rami on pleopod 1, while others in the same sample have only one relatively long

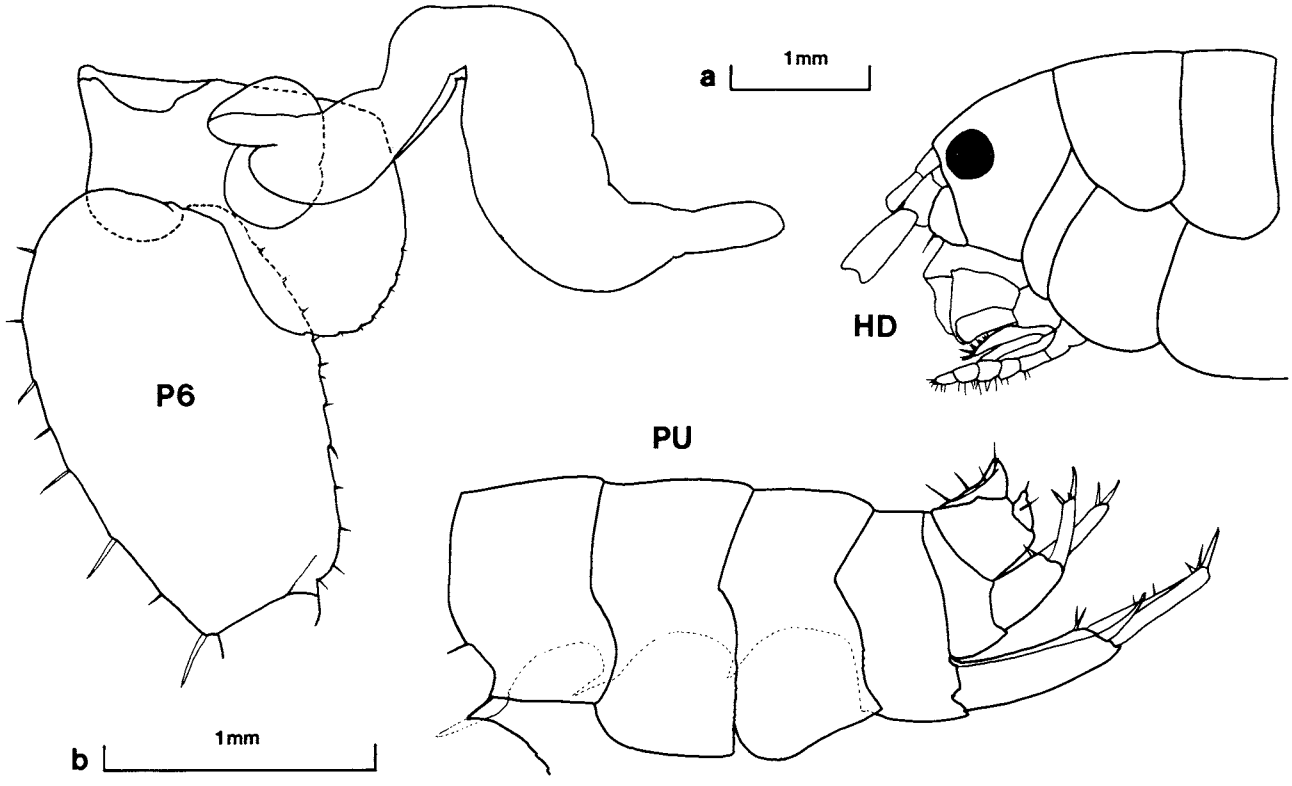

Fig. 40. *Keratroides vulgaris* (Friend), holotype, female, 11.5 mm, foothills of Mt Wellington, south-eastern Tasmania. Scale a: HD, PU; scale b: P6.

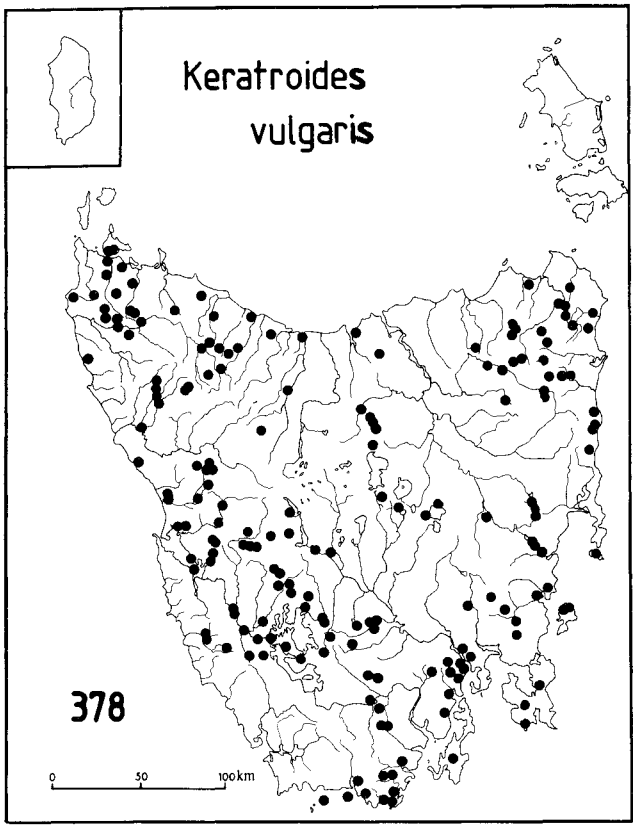

Fig. 41. Distribution of *Keratroides vulgaris*. Total number of records is shown at lower left.

ramus on pleopod 1, and some have a long curved distal lobe on the gill of peraeopod 6.

The synonymies listed above have been explained previously (Friend, 1979).

Distribution. (Fig. 41) If this proves to be a single species, it has the most ubiquitous distribution of any Tasmanian landhopper, being found in litter all over the island. It also occurs off the east coast on Schouten, Maria and Bruny Islands, on Ile du Golfe and De Witt Island off the south coast (not on Flat Witch or Maatsuyker Islands) and on Robbins Island (not on Hunter or King Islands) to the north-west. It has not been found on any eastern Bass Strait island, even Swan Island, which is a small island just off the north-east tip of the Tasmanian mainland.

Keratroides rex n. sp.

Figs 42–45

Type material. HOLOTYPE ♀, AM P37356; ALLOTYPE ♂, AM P37357; 9 PARATYPES [♂, 6♀♀ (3 ovig.), 2 juv.], AM P37358; 11 PARATYPES [♂, 7♀♀ (4 ovig.), 3 juv.], BMNH; 10 PARATYPES [♂, 6 ♀♀ (4 ovig.), 3 juv.], NMNS; Tasmania, King Island, near Currie, in scrub under 2 eucalypts, 200 m from sea, map ref. 7719-299748, coll. G. Edgar, 19 April 1976.

Other material examined. Tasmania: 641 specimens in 27 collections listed in Friend (1980).

Diagnosis. Antenna 2 longer than head and first 3 peraeon segments. Dorsal surface of head gently rounded. Diameter of eye greater than ¼ head length. Body pigmentation normal. Gnathopod 1, segment 6 narrowing distally, posterior margin convex, dactyl less than half as long as segment 6. Peraeopod 6, gill with distal indentation, forming broad distal lobe. Pleopods vestigial. Epimeral plate 3 strongly exceeded by 2, anterior corner smoothly rounded, lower margin almost straight, posterior margin convex, posterior corner almost a right angle.

Description. Female: length 8.3 mm, no eggs [1+]. Head longer than broad, dorsal surface gently curving. Eye medium, round, width less than ⅓ head length. Antenna 1 short, just exceeding distal end of peduncular segment 4 of antenna 2; flagellum shorter than peduncle, 5-segmented [3–5]. Antenna 2 longer than head and first 3 peraeon segments, peduncular segment 5 just shorter than rest of peduncle; flagellum longer than peduncle, comprising 20 short segments [8–20], each with 4 groups of 2–3 bristles.

Upper lip broad, apex lightly pilose, indentation of right margin marked. Lower lip broad, lateral lobes shallow, inner shoulders moderately pilose, margins of central cleft almost naked. Left mandible, incisor 5-cuspate, lacinia mobilis 4-toothed, molar process strong, triturating surface with 15 ridges, upper edge raised in a low rim; right mandible, incisor 5-toothed, lacinia 3-cuspate, with distal field covered in tiny bumps. Maxilla 1 broad, inner plate short, wide, terminal plumes slender; outer plate broad distally, 2-segmented palp near midpoint of outer margin, apical spines strong, toothed, innermost leaning inwards, almost lateral; dentition formula 0-0-0-4-3-4-2-4-2. Maxilla 2 broad, inner plate almost as broad and as long as outer plate, with well separated blunt spines, all short except innermost 2, plumose seta long, inner margin of plate setose; outer plate apex broadly rounded, outermost spines long and sharp, remainder of spine-row comprising fairly long blunt spines and short, oblique-tipped ones.

Maxilliped, inner plate fairly broad, apex truncate, outer spine-tooth large, rounded, middle spine-tooth smaller, inner spine-tooth tiny, apex with 1 long blunt spine; no plumose spines on lateral face, medial face with 2 inner marginal plumes and 1 subapically. Outer plate, apex truncate, with 2 stout sharp spines on outer corner, a group of 6 slender spines at inner corner, which is extended in a rounded projection; inner margin with a group of 2 spines, and 2 single proximal spines. Palp slender, segments 2 and 3 with narrow remnants of lateral lobes, with 1 small group of spines distally on each lobe; segment 4 prominent, distinct, unmasked by segment 3, conical with 1 apical group of 3 spines.

Gnathopod 1 coxa broad, distally truncate, inner shelf absent. Segment 2 fairly short, with spines on both margins. Segment 4 with very small scabrous blister, moderately spinose behind. Segment 5 short, deep, with several spines and a prominent broad

posterior tumescence. Segment 6 shorter than 5, gently narrowing distally, palm absent, posterior margin equipped with numerous strong spines, powerful dactyl with 1 strong curved terminal spine.

Gnathopod 2, coxa deeper than broad, lower margin rounded, spinulose; posterior process small, obtuse. Gill large, proximal lobe broad, anterior extension short, relatively broad; oostegite completely absent. Segment 2, anterior margin expanded, with an even row of strong spines. Segment 4 with a weak posterior blister. Segment 5 elongate, with a few spinules only, posterior scabrous lobe long, deep, deeper distally. Segment 6 elongate, just shorter, medial spine-row consisting of spinules, apical lobe subacute, strongly exceeding small dactyl.

Peraeopod 3, coxal plate as deep as broad, spinulose below, posterior process small, subacute. Gill club-shaped, slender distally, proximally lobate, held laterally across ventral surface; oostegite rudimentary, short and slender, without apical setae. Segment 2 strong, broadening distally. Segments 4–6 strongly spinose behind. Dactyl small, terminal spine short.

Peraeopod 4 shorter than 3, coxal plate broader than long, gently concave, spinulose below; posterior process long, slender, apically rounded, hooked downwards. Gill and oostegite like those of peraeopod 3. Segments 2–6 similar but shorter than in 3, dactyl small, terminal spine short.

Peraeopod 5, anterior coxal lobe deep, posterior lobe shallower, distally truncate. Gill small, bilobate, oostegite basally broad, narrowing to acutely rounded apex, texture gill-like. Segment 2 long, ovate, posteriorly indented, spinose. Segments 4–6 strong, spinose in front, dactyl slender, terminal spine short, curved.

Peraeopod 6, anterior coxal lobe shallow, anterior margin of hind lobe oblique, distally strongly rounded, expanded behind. Gill large, anseriform, subdistally broad, with a small, broad distal posterior lobe. Segment 2, long-ovate, serrulate behind, flat distal lobe present. Segments 4–6 strong, very spinose. Dactyl elongate, terminal spine slender.

Peraeopod 7, coxa broad, shallow. Segment 2 large, longer than broad, expanded behind, distal lobe shallow. Segments 4–6 strong, spinose. Dactyl slender, elongate, terminal spine slender.

Epimeral plate 1 shallow, lower margin slightly oblique, hind corner rounded, posterior margin convex. Plate 2 the deepest, front corner gently rounded, lower margin oblique, higher in front, hind corner rounded, hind margin weakly crenate, almost straight. Plate 3 subsquare, front corner strongly rounded, lower margin slightly concave, hind corner fairly sharp, posterior margin convex, serrulate and spinulose.

Pleopods vestigial, second and third very small. Pleopod 1 uniramous, peduncle narrowing distally, curving outwards, no coupling spines present, distally

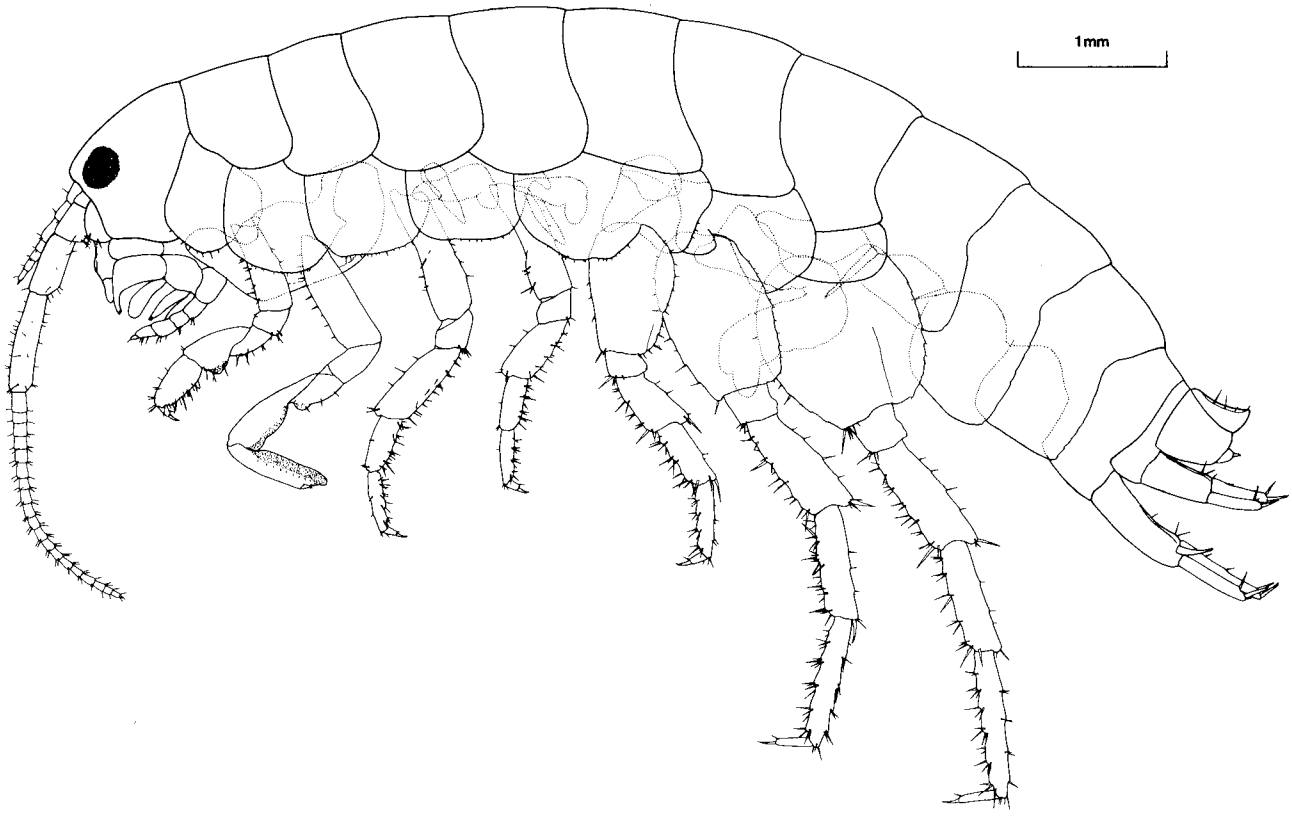

Fig. 42. *Keratroides rex* n. sp., holotype, female, 8.3 mm, near Currie, King Island.

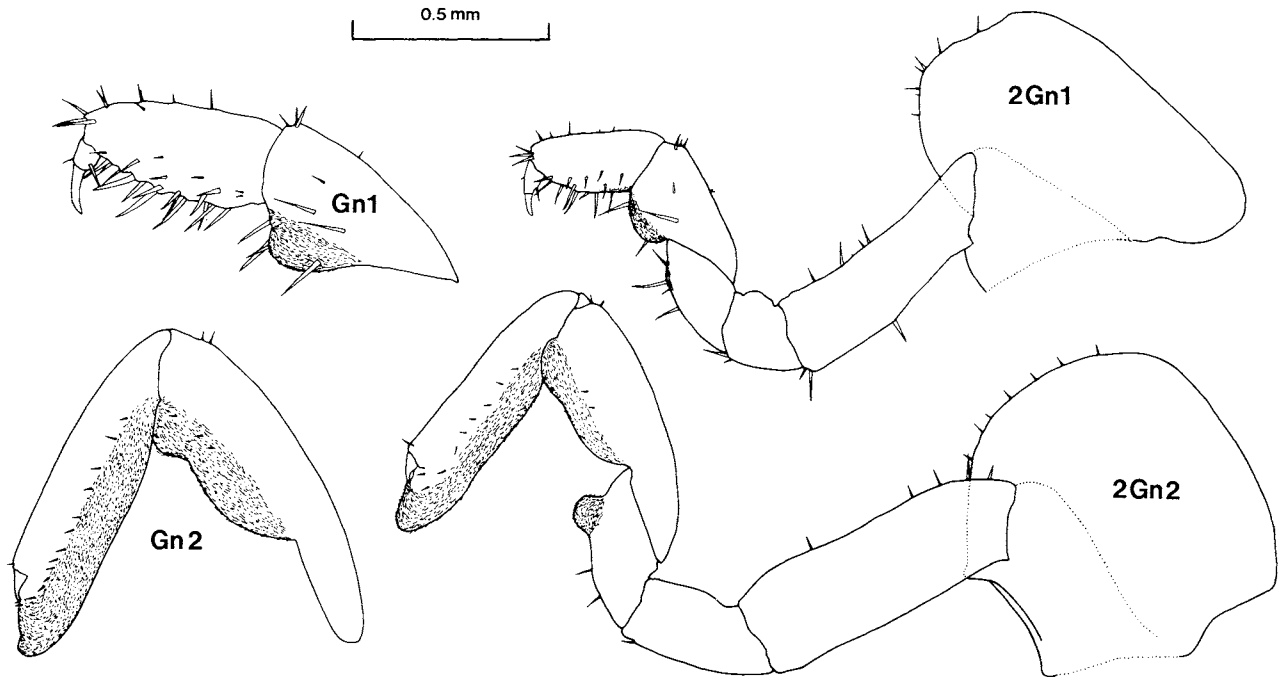

Fig. 43. *Keratroides rex* n. sp., holotype, female, 8.3 mm; 2, allotype, male, 5.5 mm; near Currie, King Island.

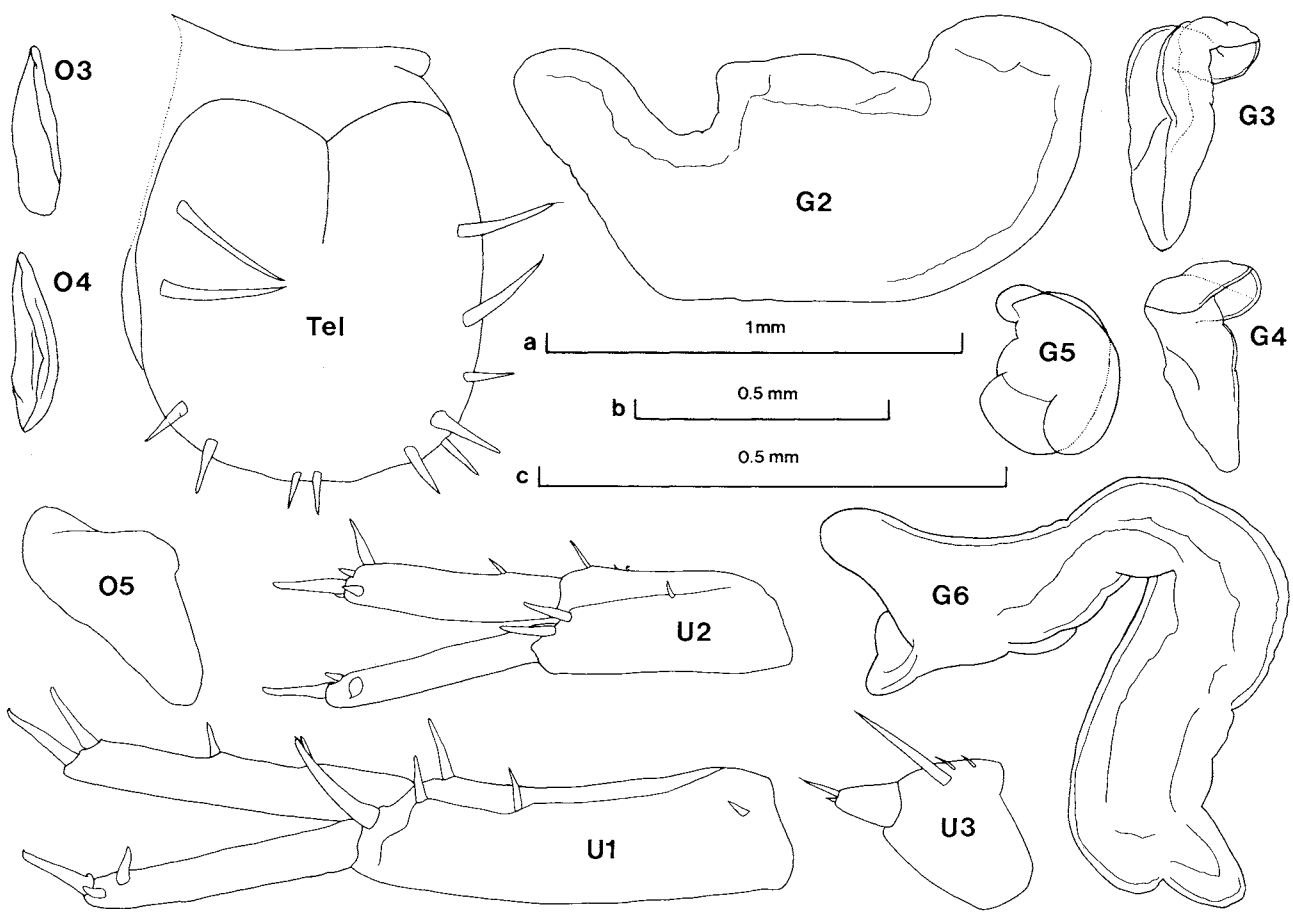

Fig. 44. *Keratroides rex* n. sp., holotype, female, 8.3 mm, near Currie, King Island. Scale a: G2-6, O3-5; scale b: U1&2; scale c: Tel, U3.

produced into a rounded projection beside the single (outer) ramus, which is 1-segmented and papillate. Pleopod 2 a stump, ⅓ as long as pleopod 1, with 1 subapical spinule. Pleopod 3, ¼ as long as second, as broad as long, with 2 marginal spinules.

Uropod 1, peduncle strong, with 2 outer and 1 inner marginal spine, distolateral spine slender, slightly curved; rami subequal, shorter than peduncle, outer more slender, margins bare; inner ramus with 2 marginal spines. Uropod 2, peduncle with 1 inner marginal spine, outer margin with 1 short proximal spine and 2 distal spines close together; outer ramus slightly longer, margins naked, inner ramus with 1 proximal marginal spine. Uropod 3 small, peduncle short and broad with 1 large spine and 2 spinules close together; peduncle short with 2 unequal spines at apex.

Telson broad, apex broadly rounded, almost truncate, entire each side, with 1 small apical spine and 4–6 marginal spines, including 2 long bifid spines mid marginally.

Male: length 5.5 mm. Antenna 1, flagellum 4-segmented [3–5]. Antenna 2, flagellum 18-segmented [8–19].

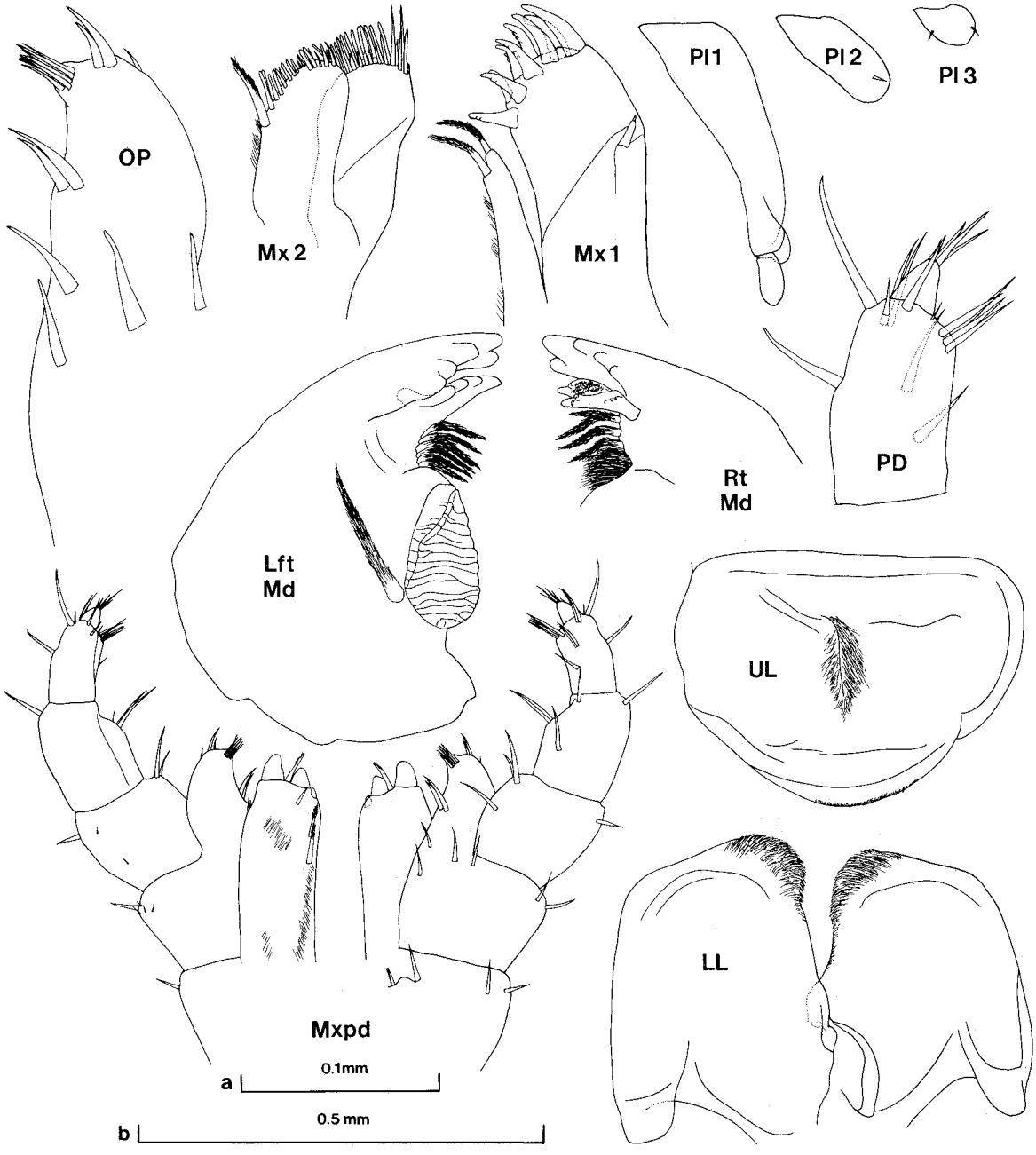

Fig. 45. *Keratroides rex* n. sp., holotype, female, 8.3 mm, near Currie, King Island. Scale a: OP, PD; scale b: P11-3, Mxpd, Mx1&2, UL, LL, Lft Md, Rt Md.

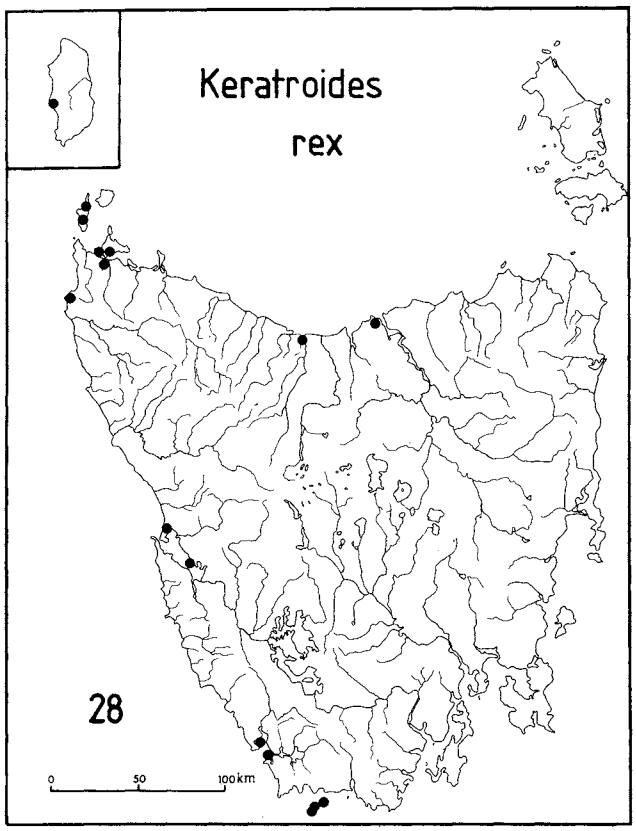

Fig. 46. Distribution of *Keratroides rex*. Total number of records is shown at lower left.

Etymology. *Keratroides rex* is named for its occurrence on King Island, the site of its discovery, where it is common.

Remarks. *Keratroides rex* is morphologically close to *K. vulgaris* but is distinguished from it by the possession of second epimeral plates which are longer than the third pair, and distally broad peraeopod 6 gills indented at the distal end, forming a short posterior lobe. It is found only near the coast on the mainland of Tasmania, and on offshore islands, occurring as far north as King Island.

Females of *K. rex* are larger than males; their oostegites are short and lack setae, allowing eggs to fall out easily during preservation.

Distribution. (Fig. 46) This species is restricted to coastal situations in the western half of Tasmania, and on all sampled islands off those coasts, including the Maatsuyker and Hunter Groups and King Island. It occurs only very close to the supralittoral zone, except on small islands, where it is also found further inland.

Keratroides pyrensis n. sp.

Figs 47–50

Type material. HOLOTYPE ♀, AM P37359; ALLOTYPE ♂, AM P37360; 4 PARATYPES (2 ♂♂, 2 Juv.), AM P37361; 4 PARATYPES (2 ♂♂, 1♀, 1 Juv.), BMNH; 4 PARATYPES [2♂♂, 1♀(ovig.), 1 juv.), NMNS; north-east Tasmania, The Bottleneck, Ansons River, right bank of small tributary on south side, in damp mud under stones on bank, map ref. 8515-035538, coll. A.M.M. Richardson, 8 Nov 1977.

Other material examined. Tasmania: 184 specimens in 9 collections listed in Friend (1980).

Diagnosis. Antenna 2 longer than head and first 5 peraeon segments. Dorsal surface of head gently rounded. Diameter of eye about ⅖ head length. Body pigmentation normal. Gnathopod 1, segment 6 narrowing distally, dactyl about half as long as segment 6. Peraeopod 6, gill tapering smoothly towards apex, margins distally crenulate. Pleopods vestigial. Epimeral plate 3 just exceeded by 2, anterior corner smoothly rounded, lower margin slightly concave, posterior margin sinuous, posterior corner subacute.

Description. Female: length 9.0 mm, ovigerous, 1 egg [2]. Head deeper than long, dorsal surface gently curving, eye large, width about ⅖ head length. Antenna 1 reaching about ⅓ distance along last peduncular segment of antenna 2; flagellum shorter than peduncle, 6-segmented [3–6]. Antenna 2 long, longer than head and first 5 peraeon segments, last peduncular segment as long as rest of peduncle; flagellum longer than peduncle, comprising 26 slender segments [8–28], most of which bear 4 groups of 3 long bristles.

Upper lip broad, apically pilose, indentation of right margin prominent. Lower lip broad, lateral lobes fairly small, inner shoulders with long pilosity, margins of central cleft very lightly pilose. Left mandible, incisor 5-cuspate, lacinia mobilis 4-cuspate, molar process strong, triturating surface with 15 striae; right mandible, incisor 5-toothed, lacinia 3-cuspate, with distal field of tiny bumps, proximal ridge with a number of larger rounded denticles. Maxilla 1, inner plate short, terminal setae small; outer plate broadening distally, palp small, slender, segment 2 minute, distal spines large, innermost leaning inwards, almost laterally oriented, dentition formula 0-0-0-3-2-3-2-2-2. Maxilla 2, broad, inner plate much narrower than outer, plumose seta long; apical spines longer towards inner margin; outer plate apex broadly rounded, 2 long spines near apex, other spines well separated, blunt-ended.

Maxilliped, inner plate quite broad, apex truncate, with 2 large and 1 small spine-tooth and 1 longer stout blunt spine; 2 short spines on outer margin, medial face with 1 small subapical plumose seta and 2 larger setae on inner margin, lateral surface with 2 plumose setae subapically. Outer plate, apex truncate, with 1 spine-group at each corner, 2 on outer and 5 on the inner corner; inner margin with 1 pair of spines more proximally. Palp slender, with a few long, slender spines, segments 2 and 3 with vestigial lateral lobes, each with 2 long slender spines on inner margin; segment 4 laterally fused with third, basally broad, conical, with 2 apical spines.

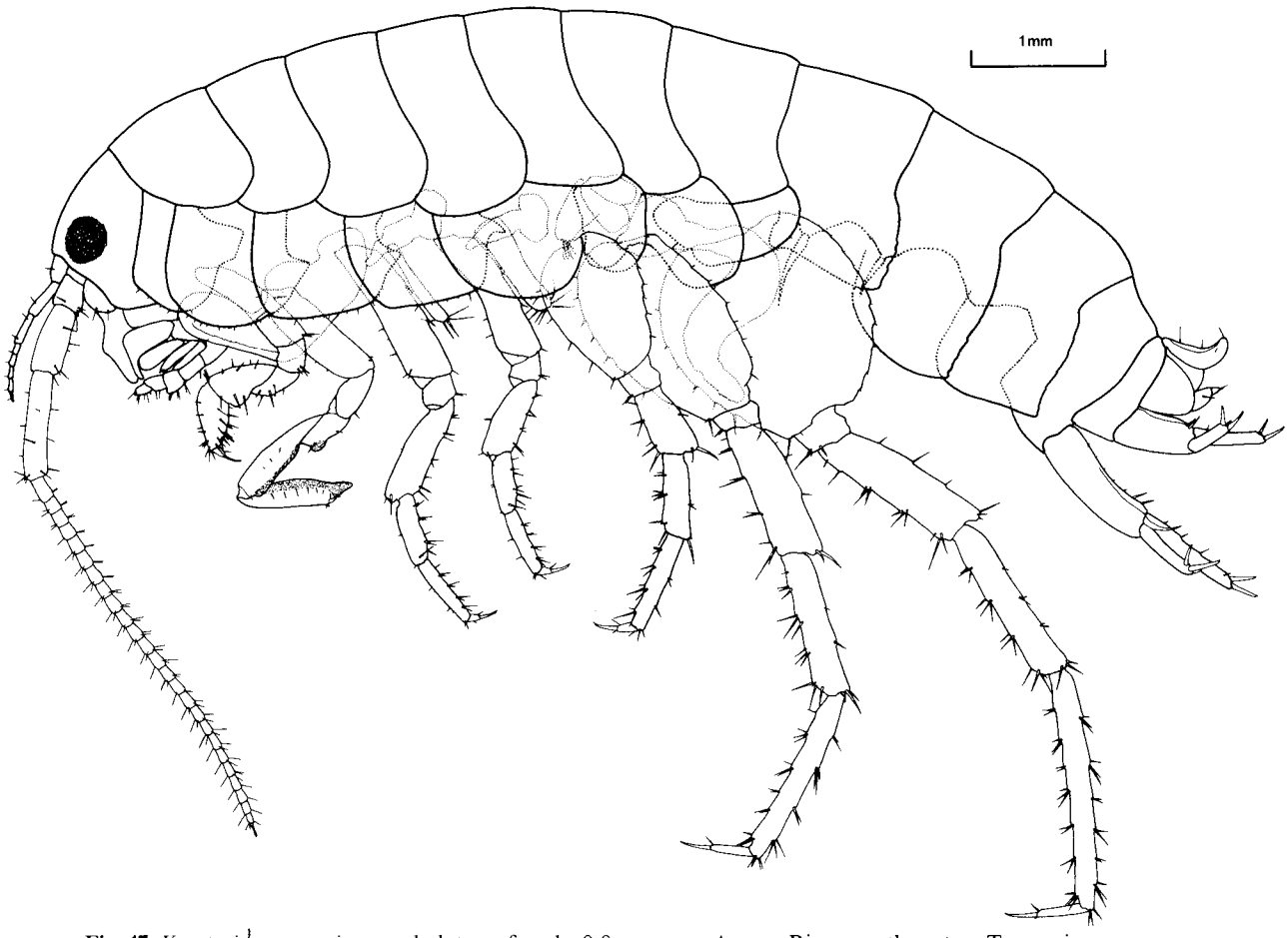

Fig. 47. *Keratroides pyrensis* n. sp., holotype, female, 9.0 mm, near Ansons River, north-eastern Tasmania.

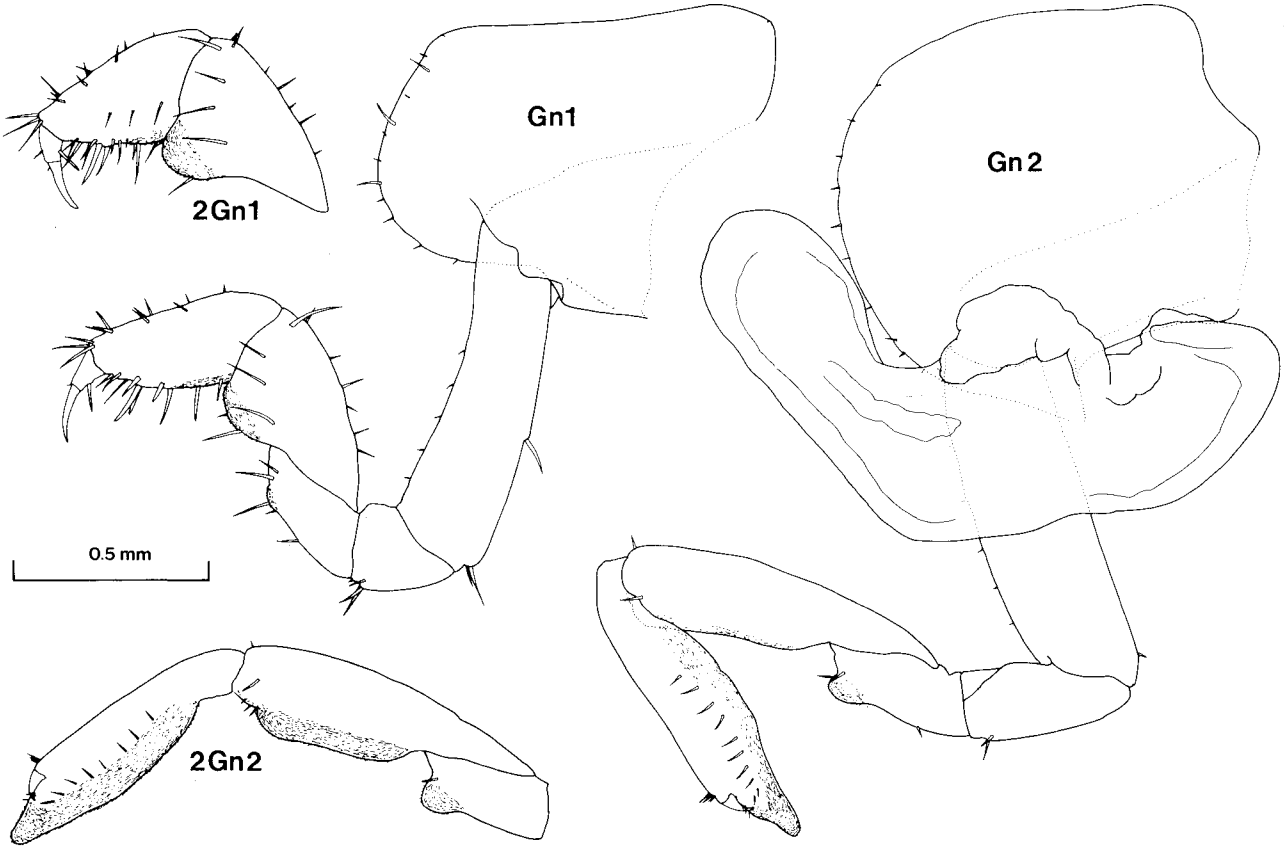

Fig. 48. *Keratroides pyrensis* n. sp., holotype, female, 9.0 mm; 2, allotype, male, 7.7 mm; near Ansons River, north-eastern Tasmania.

Gnathopod 1, coxa deep, broad, lower margin sparingly spinose, inner shelf vestigial. Segment 2 slender, curving anteriorly, with 1 large spine near middle of hind margin. Segment 4 with 1 small posterior blister, spinose behind. Segment 5 short, deep, moderately spinose, hind lobe substantial, rounded. Segment 6 short, not as long as 5, proximally broad, but narrowing distally to base of dactyl, no palm present, spinose posteriorly with several stout spines. Dactyl very strong, half as long as segment 6, terminal spine long, curving.

Gnathopod 2, coxa deep, posterior process prominent, acute. Gill large, anterior extension long, broad, apically rounded, oostegite absent. Segment 2 slightly expanded and spinulose in front, with 1 large spine proximally on front margin. Segment 3 longer than 4 which is poorly spinose, with a small prominent scabrous lobe behind. Segment 5 elongate, posterior lobe shallow, over half as long as segment, almost free of spines. Segment 6 as long as 5, slender, distal lobe long, acutely rounded, medial spine-row comprising 10 evenly spaced small spines. Dactyl small.

Peraeopod 3, coxa large, subsquare, posterior process subacute, lower margin spinulose. Gill club-shaped, slender proximally, distally lobate, held across ventral surface; oostegite narrow, with 4 slender apical setae. Segment 2 long, heavy, 1 large spine on posterior margin. Segments 4–6 slender, moderately spinose. Dactyl slender.

Peraeopod 4, coxa broader than deep, lower margin straight, posterior process sharp, hooked. Gill like that of peraeopod 3, oostegite with 7 apical setae. Segments 2–6 shorter than in 3.

Peraeopod 5, coxal lobes of similar depth, posterior lobe slightly concave behind. Gill very small, bilobed; oostegite broad proximally, short, a tuft of long hairs apically. Segment 2 narrowing distally, serrulate but almost straight behind. Dactyl slender, long.

Peraeopod 6, anterior coxal lobe shallow, posterior lobe smoothly rounded. Gill anseriform, tapering smoothly towards apex, margins distally crenulate.

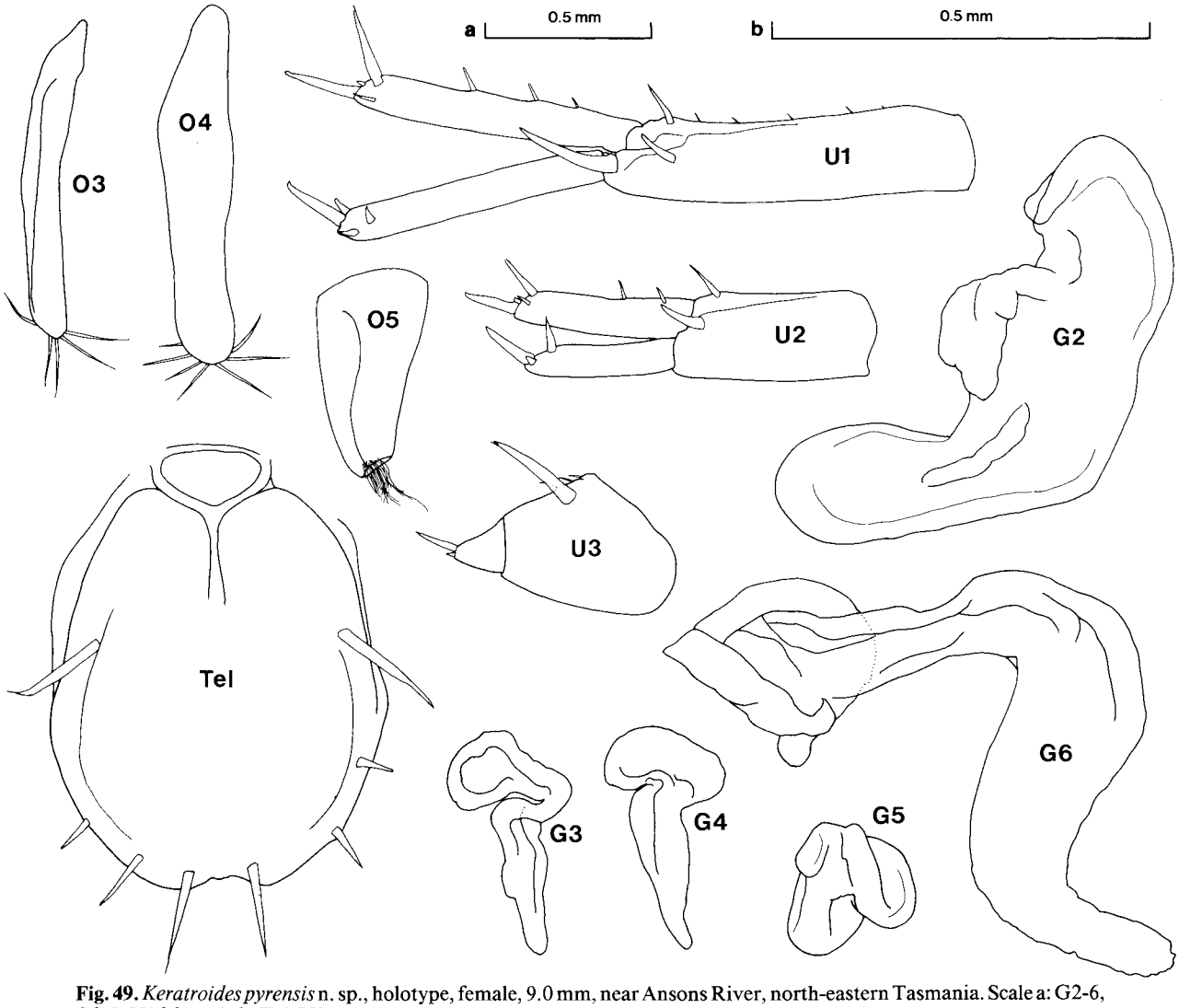

Fig. 49. *Keratroides pyrensis* n. sp., holotype, female, 9.0 mm, near Ansons River, north-eastern Tasmania. Scale a: G2-6, O3-5, U1&2; scale b: Tel, U3.

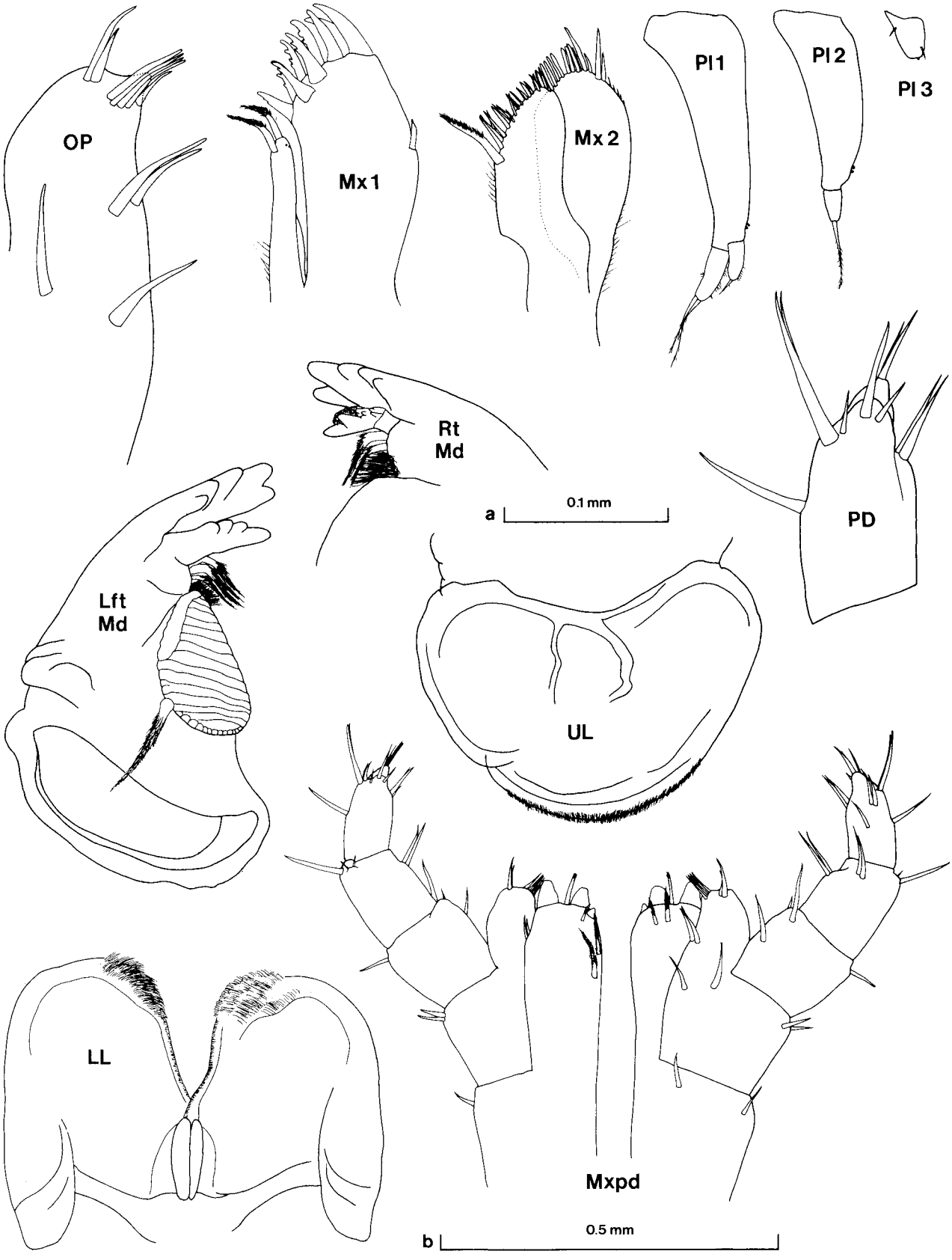

Fig. 50. *Keratroides pyrensis* n. sp., holotype, female, 9.0 mm, near Ansons River, north-eastern Tasmania. Scale a: OP, PD; scale b: P11-3, Mxpd, Mx1&2, UL, LL, Lft Md, Rt Md.

Segment 2 large, slender, ovate, hind margin meeting trunk of segment subdistally. Segments 4–6 long, slender, spines quite long, dactyl very long, slender, terminal spine almost straight.

Peraeopod 7, coxa very shallow, spinulose posterodistally. Segment 2 large, broadly ovate, distal lobe shallow. Segments 4–6 slender, spinose, dactyl very long.

Epimeral plate 1 shallow, lower margin slightly oblique, convex and serrulate behind. Plate 2 the longest, smoothly rounded in front and below, hind corner obtuse, minutely produced; posterior margin almost straight, serrulate. Plate 3 subsquare, anterior corner rounded, lower margin oblique, gently convex, hind corner quite sharp, margin gently sinuous, serrulate.

Pleopods all vestigial, progressively smaller posteriorly. Pleopod 1, peduncle narrowing distally, with 2 coupling spines; biramous, both rami single-segmented, outer longer, with 2 apical plumose setae, inner with 1 apical seta. Pleopod 2 similar, but with 1 ramus, with 1 apical seta. Pleopod 3 a minute peduncular vestige with 2 small spines.

Uropod 1 long, peduncle slender, inner margin lined with tiny spinules, 1 distal spine on each margin, distolateral spine long, slender, curved; rami subequal, shorter than peduncle, margins of outer ramus smooth, inner with 3 marginal spines. Uropod 2, peduncle longer than rami, with 1 spine distally on each margin; outer ramus marginally naked, inner with 2 spines near proximal end. Uropod 3 short, peduncle broad, with 1 large lateral spine and 3 spinules; ramus short, conical, 2 small unequal spines apically.

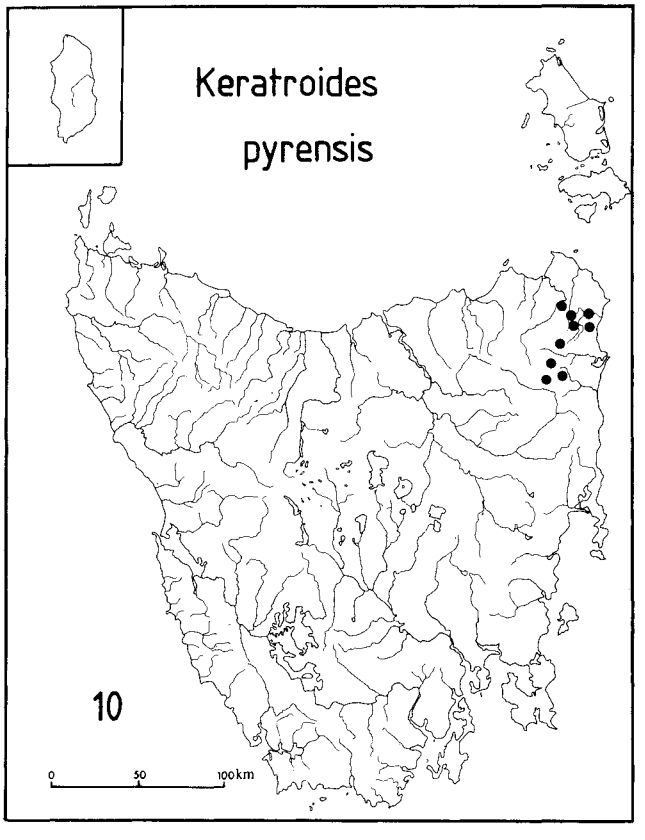

Fig. 51. Distribution of *Keratroides pyrensis*. Total number of records is shown at lower left.

Telson large, quite broad, apex broadly re-entrant, 3 marginal and 1 apical spine on each side.

Male: length 7.7 mm. Antenna 1, flagellum 6-segmented [3–6]. Antenna 2, flagellum 27-segmented [8–27]. Gnathopod 1, segments 5 and 6 heavier than those of ♀.

Etymology. The name *pyrensis* refers to the type locality of this species, on the Bay of Fires.

Remarks. Like *K. vulgaris* and *K. rex,* this species is distinguished by the particular shape of its epimeral plates and sixth peraeopod gills. Males are significantly smaller than females in this species also. Cysts are commonly found on the gills of *K. pyrensis* in this area, similar to those reported on *Orchestiella neambulans* (q.v).

Keratroides vulgaris, K. rex and *K. pyrensis* form a group of similar species (the '*vulgaris*-group') distinguished by their vestigial pleopods and anteriorly rounded third epimeral plates. Other species belonging to this group occur on Cape Barren, Flinders and Craggy Islands, in the Hogan Group, and in Victoria.

Distribution. (Fig. 51) This species occurs in a small area in north-eastern Tasmania, where it is found in wetter microhabitats than *K. vulgaris,* the only sympatric species. A specimen possibly referable to this species has been found on Flinders Island.

Keratroides angulosus (Friend, 1979)
Fig. 52

Talitrus (Keratroides) angulosus Friend, 1979: 91, figs 1b, 4 and 5.

Material examined. HOLOTYPE, TMAG G1950; ALLOTYPE, TMAG G1951; 30 PARATYPES, TMAG G1952; eastern Tasmania, Tooms Lake area, under litter, *Olearia argophylla* stand near Anglers Creek, off Tower Road, map ref. 8413-702229, 12 Jan 1976. 1276 further specimens in 64 collections listed in Friend (1980).

Diagnosis. Antenna 2 shorter than head and first 3 peraeon segments. Dorsal surface of head strongly rounded. Diameter of eye about ¼ head length. Body lacking pigmentation. Gnathopod 1, segment 6 narrowing distally, posterior margin convex, dactyl more than half as long as segment 6. Peraeopod 6, gill with distal indentation, distal lobe produced to an acute apex. Pleopods vestigial, but first instar specimens sometimes with long plumose setae on rami of pleopods 1 and 2. Epimeral plate 3 longer than 2, anterior corner sharply rounded distally, lower margin excavate, oblique, posterior margin convex, posterior corner very slightly produced.

Remarks. *Keratroides angulosus* differs from other *Keratroides* species in the combination of the shape of the peraeopod 6 gills and the third epimeral plates, and the simple first gnathopod which is not swollen in male specimens. It is the southern representative of a group of *Keratroides* species (the '*kershawi*-group') including *K. kershawi* which has anteriorly sharp-cornered third epimeral plates. Other species occur in Victoria and on the Kent Group, Craggy, Flinders, Cape Barren, Inner Pasco and Swan Islands in Bass Strait. Several of the Bass Strait island species have swollen male first gnathopods, as found in *Austrotroides maritimus* and *Mysticotalitrus tasmaniae.*

This species occurs in many parts of Tasmania where it dwells deeper in the soil than *K. vulgaris* (Friend & Richardson, 1977). It is also less active and has a lower rate of oxygen consumption than that species (Richardson & Morton, 1986; unpublished data). In addition *K. angulosus* displays a number of morphological adaptations to the soil microhabitat. These include a lack of body pigmentation, smaller eyes, smaller body size, relatively shorter peraeopods and antennae than those of litter-dwelling *Keratroides* species, such as *K. vulgaris* (Friend & Richardson, 1977; Friend, 1980). The strongly rounded cephalon, like that of *K. albidus,* resembles the head and collum of the iulid millipedes which, according to Manton (1954), provides the means to push through the soil. Unlike *K. albidus,* however, *K. angulosus* appears not to form discrete burrows in the soil. *Keratroides angulosus* is a smaller species than *K. albidus* and, perhaps more significantly, males are much smaller than females. This supports the view that the larger size of *K. albidus* is advantageous to burrowing by allowing greater strength to be developed, whereas small size, as in *K. angulosus,* better fits that species for pushing through soil pore spaces and crevices.

Distribution. (Fig. 53) *Keratroides angulosus* occurs in forested areas, near but rarely beside the sea along the north, east and south coasts. This distribution is apparently continuous in a broad curve between the northern west coast and the east coast near Maria Island, but there is a major disjunction between this and another set of records on the south coast (D in Fig. 53). This southern presence includes several records on De Witt and Maatsuyker Islands.

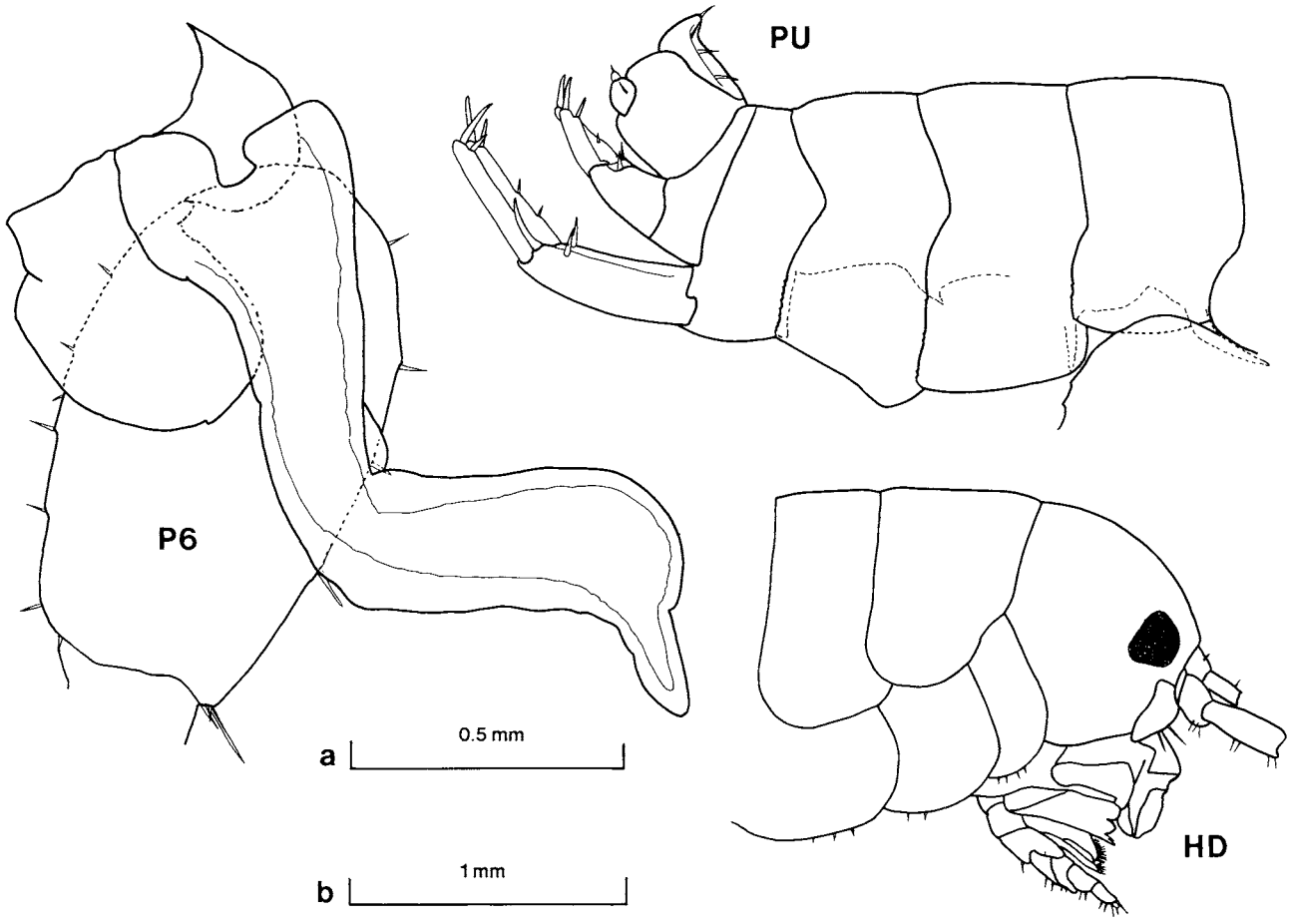

Fig. 52. *Keratroides angulosus* (Friend), holotype, female, 7.1 mm, near Anglers Creek, eastern Tasmania. Scale a: HD, PU; scale b: P6.

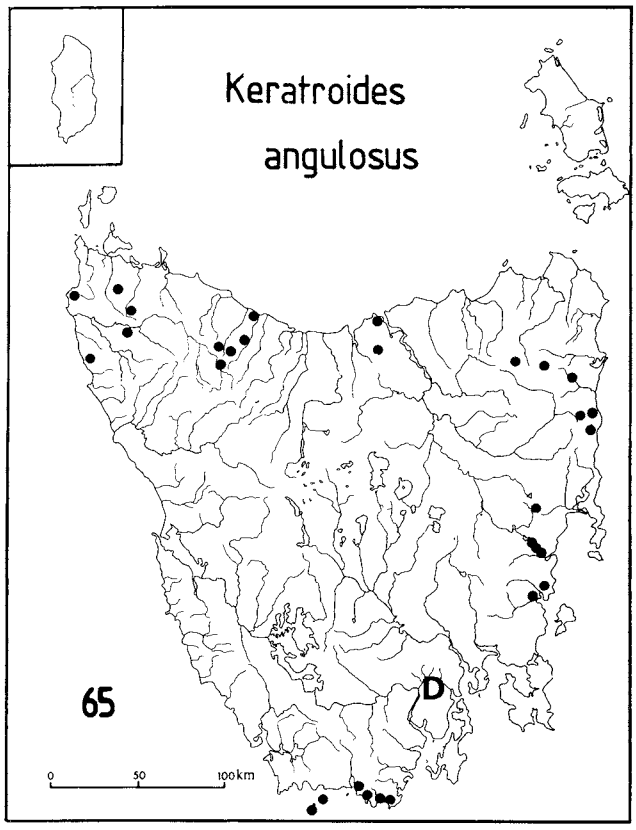

Fig. 53. Distribution of *Keratroides angulosus*. 'D' refers to an apparent disjunction in distribution. Total number of records is shown at lower left.

The Cuspidactylate Group

Orchestiella n. gen.

Diagnosis. Small, plesiomorphic, sexually dimorphic landhoppers. Antenna 1 and 2 short, antenna 1 just exceeding distal end of penultimate flagellar segment of antenna 2. Eye large, diameter equal to or greater than half head length. Maxilliped inner plate bearing many plumose setae, terminal spine-teeth small and subequal, outer plate palps stout, lateral lobes broad with strong spine-groups, segment 4 unobscured. Gnathopod 1 subchelate, segment 6 linear in ♀, distally broadening in ♂, posterior blisters better developed in ♂. Gnathopod 2 of ♀, segment 6 without anterior spine-groups, terminal lobe large, dactyl inclined across segment; hand of ♀ gnathopod 2 broad, stubby, mitten-shaped. Gnathopod 2 of ♂, hand subchelate, enlarged, segment 6 broad, ovate, palm oblique, dactyl distally curved. Oostegites narrow with long, slender, simple apical setae. Gills sac-like, subequal, peraeopods 3–7 cuspidactylate. Peraeopods 6 and 7 subequal, terminal spines of dactyls very short. Pleopods long, slender, biramous, subequal. Epimeral plates deep, converging beneath the body. Uropods 1 and 2 sexually dimorphic, uropod 2 outer ramus bearing marginal spines.

Type species. *Orchestiella neambulans* n. sp.
Additional species. *Orchestiella quasimodo* n. sp.

Etymology. The name of this genus, literally 'little *Orchestia*', refers to the small size of adults of both known species. Gender, feminine.

Remarks. The species of this genus exhibit more plesiomorphic features than any other Tasmanian landhoppers, notably in the mouthparts, gills, pleopods and gnathopods. Even so, there is significant divergence from the morphology of the shore-hoppers in the form of the maxilliped palp, with its unmasked fourth segment, the relatively poorly setose, slender oostegites and the slender antennae.

One of the apomorphic features of the genus is the presence of sexual dimorphism in the form and spination of the first and second uropods. No purpose for this is yet apparent, but this phenomenon has been recorded previously in the Talitridae, in the two New Caledonian freshwater species *Chiltonorchestia pusilla* (Chevreux) and *C. starmuhlneri* (Ruffo & Paiotta) (Ruffo & Paiotta, 1972) and in *Floresorchestia pectenispina* (Bousfield) from the Bismarck Archipelago and Rennell Island (Bousfield, 1971). Sexually dimorphic uropods in talitrids have also been reported by Friend (1982) in the terrestrial genus *Agilestia* from eastern Australia. The development of this feature has apparently occurred independently in these talitrid groups.

Orchestiella differs from *Agilestia* in having all pleopods subequal and with only 2 coupling spines on each, gills all of similar size, oostegites with apical setae only, gnathopod 2 in the female with no spine-groups on the anterior margin of segment 6 (besides at the dactylar hinge) and gnathopod 2 in the male with a short, broad, hand.

Orchestiella neambulans n. sp.

Figs 54–57

Type material. HOLOTYPE ♀, AM P37362; 37 PARATYPES [9 ♂♂, 16 ♀♀(4 ovig.), 12 juv.], AM P37363; south-west Tasmania, upper valley of Olga River, LGRSS pit 45 (right side of river), in litter under eucalypts, *Leptospermum*, rainforest understorey, map ref. 8012-058558, 18 Feb 1976. ALLOTYPE ♂, AM P37364; western Tasmania, south side of Lyell Highway, just east of King William Saddle, *ex* litter, *Nothofagus* stand, map ref. 8113-278261, coll. J.L. Hickman *et al.*, 19 Feb 1974. 9 PARATYPES (3 ♂♂, 2 ♀♀, 4 juv.), NMNS; western Tasmania, Tyndall Range, near Henty River camp, leaf litter, *Eucalyptus, Banksia, Gahnia, Bauera*, map ref. 8014-798625, 29 March 1975. 3 PARATYPES ♂, ♀, 1 juv., BMNH; western Tasmania, Frenchmans Cap area, forest below Barron Pass, north slope. King Billy pine, *Richea pandanifolia*, in litter accumulated between moss, map ref. 8013-059188, 18 March 1978.

Other material examined. Tasmania: 245 specimens in 30 collections listed in Friend (1980).

Diagnosis. Antenna 2 short, just longer than head and first 3 peraeon segments. Coxa of gnathopod 1 about ¾ obscured by coxa of gnathopod 2. Peraeopod 5, anterior lobe of coxa deeper than posterior lobe. Pleopod 1 just shorter than 2 and 3 which are subequal, inner ramus of each just longer than outer ramus. Pleopods 1 and 2, peduncular margins lacking plumose setae. Telson with 1 spine on each side of apex.

Description. Female: length 6.8 mm, no eggs [2–5]. Body moderately deep, epimeral plates converging distally, forming a narrow ventral slit through which pleopods 2 and 3 protrude.

Head deeper than long, eye large, about ⅔ head length, round, less pigmented at periphery. Antenna 1 quite short, reaching ⅕ length of segment 5 of antenna 2 peduncle, flagellum 4-segmented [3–4], shorter than peduncle. Antenna 2 short, as long as head and first 3 peraeon segments together; peduncular segment 5 not as long as segments 3 and 4 together; flagellum 8-segmented [3–8], each segment with 4 groups of 2–3 long setae; distal segment long with a terminal brush of setae.

Upper lip narrow, deep, stiffly pilose apically. Lower lip narrow, deep, strongly pilose on inner shoulders, apical hairs long, throat margins pilose. Left mandible with 6-cuspate incisor, lacinia mobilis 4-toothed, molar 18-striate. Right mandible 4-cuspate, lacinia with a distal crenulate surface. Maxilla 1, inner plate very slender, narrowing distally, outer margin pilose, terminal setae short; outer plate slender, narrowing distally, apical spine-teeth slender, dentition formula 2-0-0-2-5-2-4-5-5; palp situated at middle of outer margin, with its outer margin pilose. Maxilla 2, plates slender, apical spines tall, curved inward, inner plate with 12 spines, 5 small plumes and 2 proximal plumose setae.

Maxilliped, inner plate narrowing distally to truncate apex; outer 2 spine-teeth subequal, inner smaller, all obscured by numerous long plumose setae; inner margin with 6 plumose setae. Outer plate apex broadly rounding, with 1 outer subterminal plumose seta, submarginal spine groups fairly strong. Palp broad, short, lateral lobes of segments 2 and 3 strong, projecting inwardly, with numerous slender spines; segment 4 not masked by lobe of third, distinct, conical.

Gnathopod 1, coxa rounded below, inner shelf weak, with 2 spines; segment 2 linear, anterior margin with 2 spines. Segment 4 spinose posteriorly with a weak blister. Segment 5 longer than 6, with a very weak posterior tumescence; segment 6 narrow, linear, with a few spines, palm short, transverse, not exceeded by closed dactyl.

Gnathopod 2, coxa deeper than broad, smoothly rounded below, spinose; posterior process distal, strong, blunt. Gill broader but not longer than others, sac-like, proximally twisted; oostegite longer than segment 2, narrow, curved anteriorly with 9 long slender setae near apex. Segment 2 slightly broadening distally, with strong anterior expansion forming anterodistal lobe. Segment 4 with fairly strong posterior lobe. Segment 5 subequal to 6, posterodistally with a deep tumescence, weakly spined. Segment 6 broad, medial spine-row weak, distal lobe strong, minute dactyl steeply inclined posteriorly.

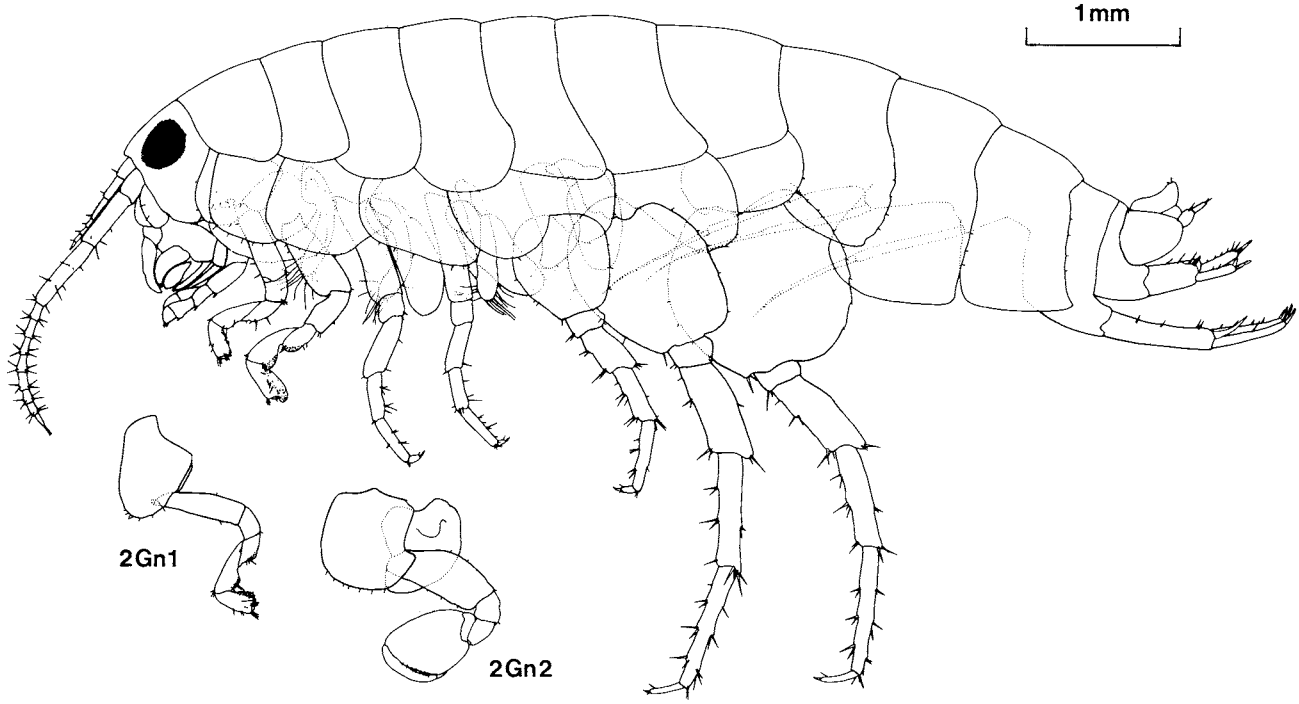

Fig. 54. *Orchestiella neambulans* n. gen., n. sp., holotype, female, 6.8 mm; 2, allotype, male, 5.9 mm; Olga River valley, south-western Tasmania.

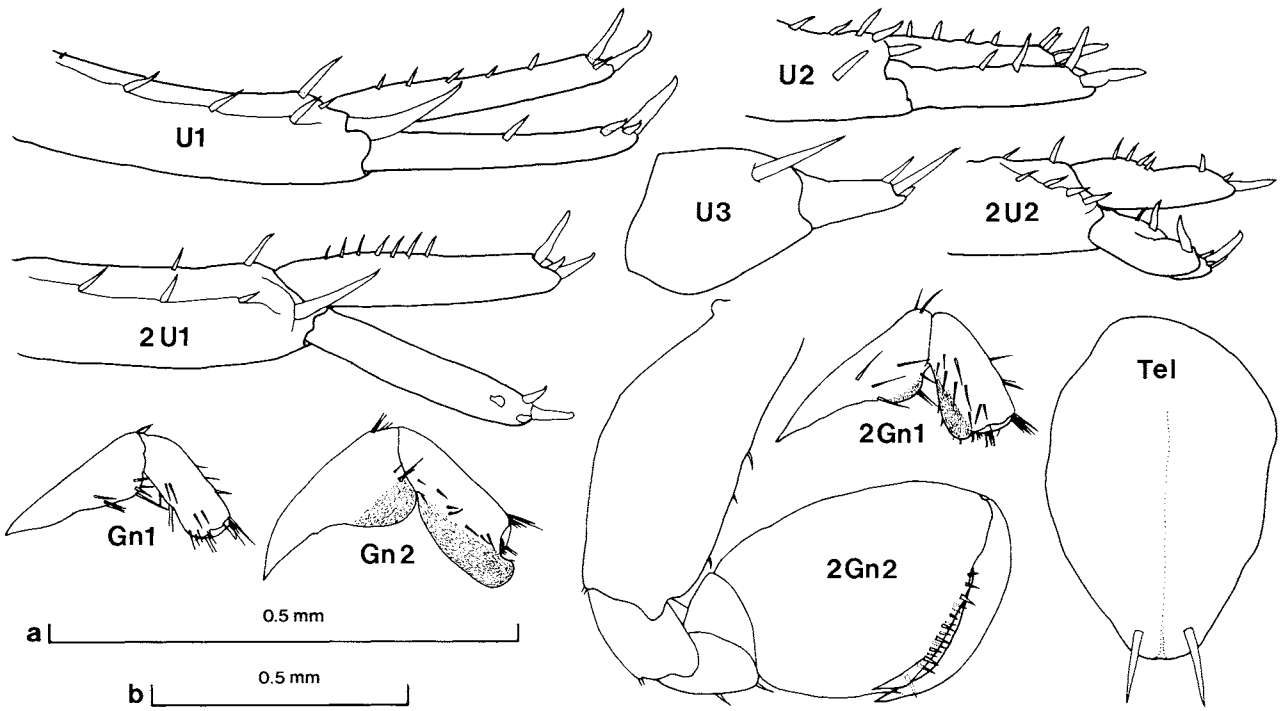

Fig. 55. *Orchestiella neambulans* n. gen., n. sp., holotype, female, 6.8 mm; 2, allotype, male, 5.9 mm; Olga River valley, south-western Tasmania. Scale a: Tel, U3; scale b: Gn1&2, 2Gn1&2, U1&2, 2U1&2.

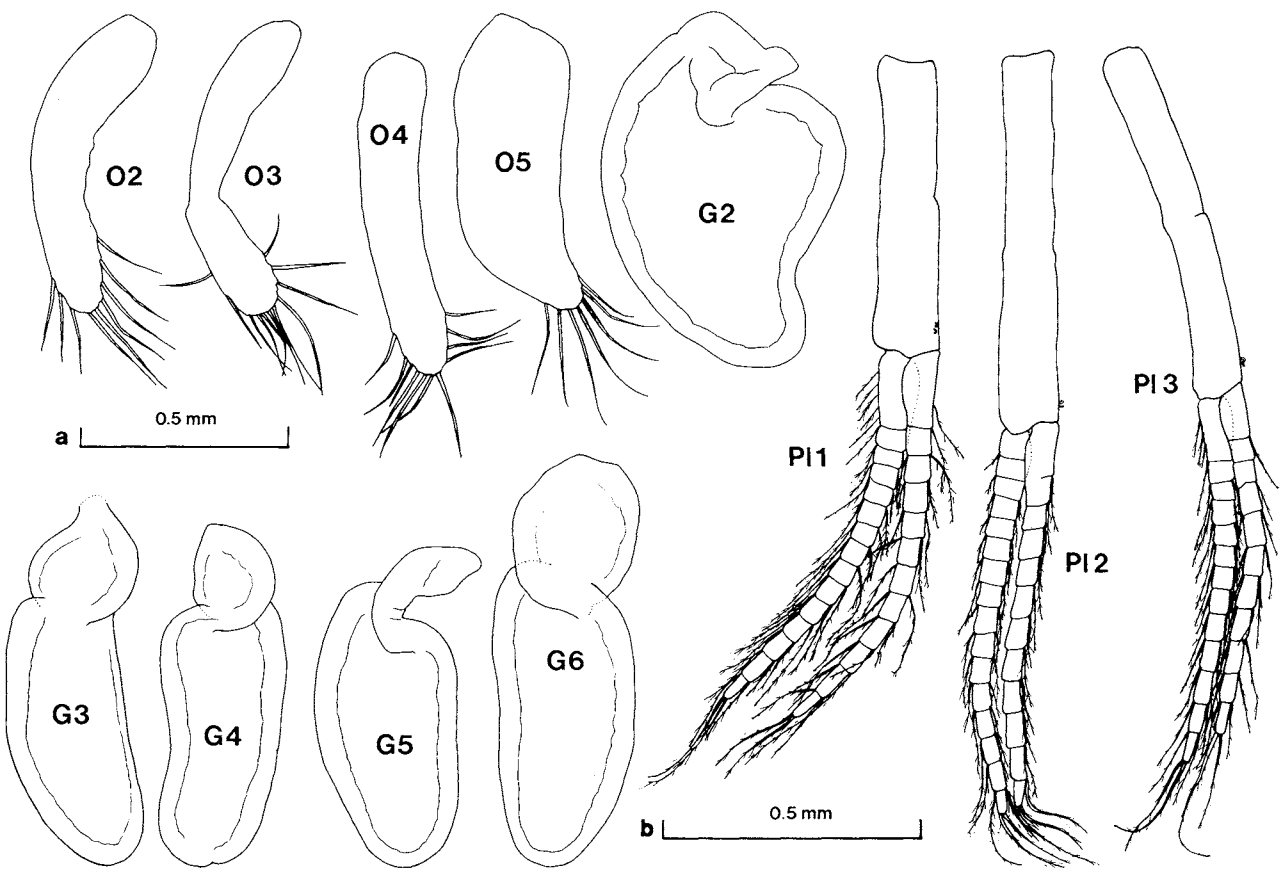

Fig. 56. *Orchestiella neambulans* n. gen., n. sp., holotype, female, 6.8 mm, Olga River valley, south-western Tasmania. Scale a:G2-6, O2-5; scale b: P11-3.

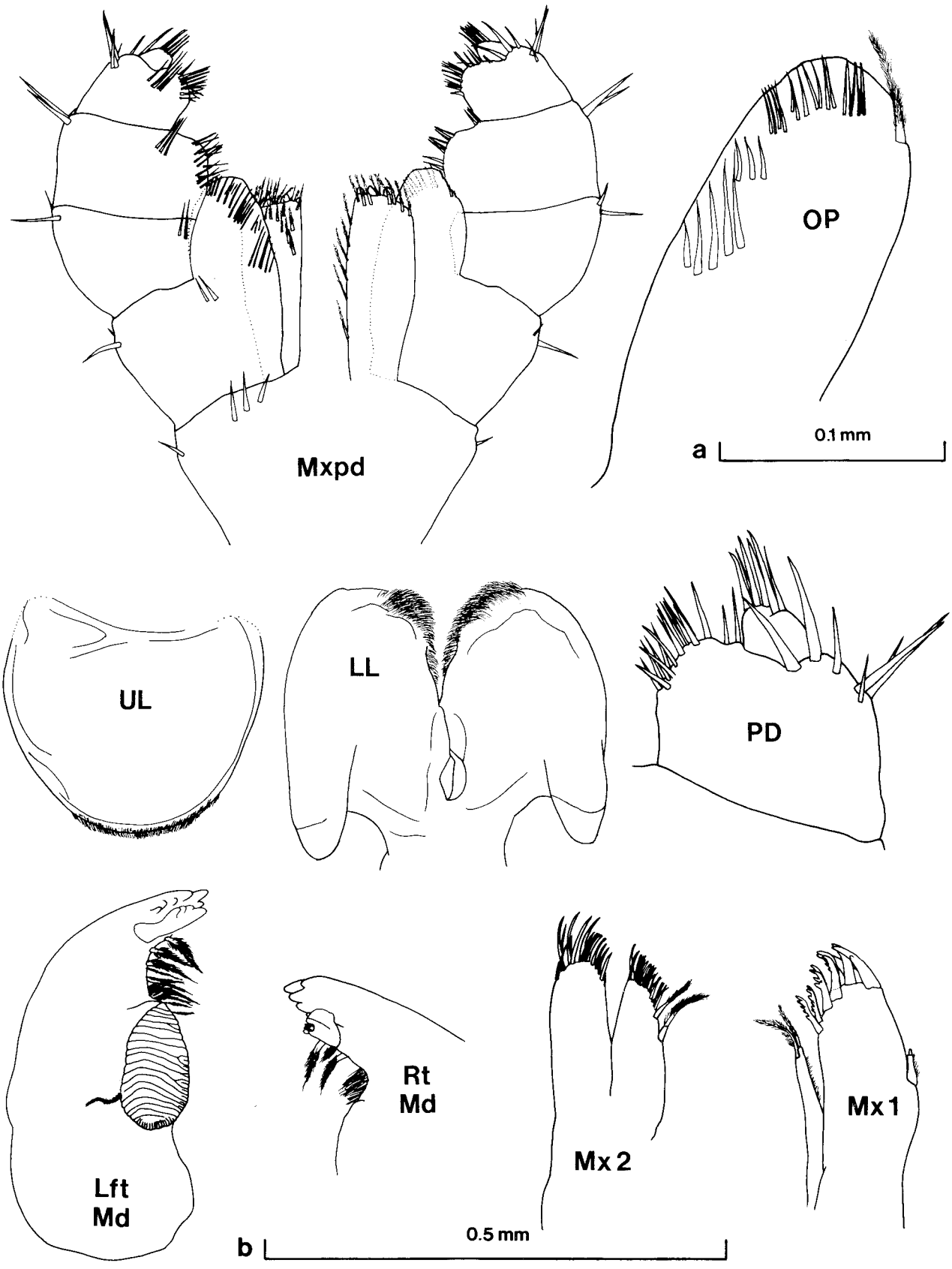

Fig. 57. *Orchestiella neambulans* n. gen., n. sp., holotype, female, 6.8 mm, Olga River valley, south-western Tasmania. Scale a: OP, PD; scale b: Mxpd, Mx1&2, UL, LL, Lft Md, Rt Md.

Peraeopod 3, coxa subsquare, posterior process very prominent, acutely rounded. Gill longer than segments 2 and 3 together, sac-like, proximally twisted; oostegite as in gnathopod 2, with 11 long slender setae near apex. Segment 2 poorly spinose, narrower in middle than at ends. Dactyl short, terminal spine small.

Peraeopod 4, coxa broader than deep, lower margin slightly convex, posteriorly extended to broadly acute corner; posterior process vestigial. Oostegite almost straight, 11 apical setae present. Otherwise like peraeopod 3.

Peraeopod 5 short, segments 2–7 just over half as long as in peraeopod 6, anterior lobe shallow, smoothly rounded, exceeding shallow posterior lobe, both very weakly spinose below. Gill as in peraeopod 3, oostegite just shorter than, but twice as broad as anterior ones, sharply narrowing distally to subacute apex with 7 long slender setae. Segment 2 broad-ovate, weakly serrulate and spinulose posteriorly. Segments 4–6 short, slender, moderately spinose; dactyl small, terminal spine short and curved.

Peraeopod 6, anterior coxal lobe very shallow, posterior lobe strongly rounded, spinulose below. Gill the longest, narrow, sac-like, twisted proximally. Segment 2 subovate, moderately expanded behind, spinulose, distal lobe present, shallow. Segments 4–6 slender, spinose. Dactyl long, slender, curved, terminal spine very short, straight.

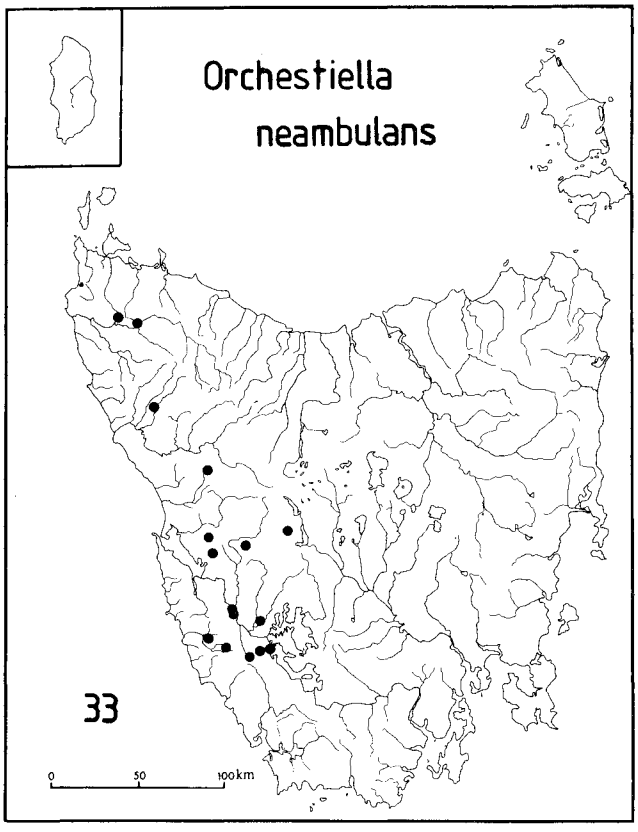

Fig. 58. Distribution of *Orchestiella neambulans*. Total number of records is shown at lower left.

Peraeopod 7 just shorter than 6, coxa shallow, smoothly rounding below, with several spinules on hind margin. Segment 2 broader than long, expanded behind to weakly serrulate and spinulose margin; distal lobe broad and shallow. Segments 4–6 slender and moderately spinose. Dactyl long, slender, curved, terminal spine short, straight.

Epimeral plate 1, lower margin oblique, hind margin serrulate and spinulose. Epimeral plate 2 large, lower margin smoothly rounded, posterior corner slightly produced, blunt, hind margin slightly sinuous, spinulose. Plate 3 smaller, hind corner more produced, sharp, hind margin sinuous, spinulose.

Pleopods long, slender, subequal, biramous, thickness of peduncles decreasing posteriorly, peduncle of first shorter than in second and third, 2 coupling hooks on each peduncle. Numbers of segments of inner and outer rami of pleopod 1, 15 and 12; of pleopod 2, 16 and 12; of pleopod 3, 13 and 11 respectively; inner rami always longer than outer.

Uropod 1, peduncle slender, with 1 large inner and 3 outer marginal spines, distolateral spine long, proximally stout. Rami slender, subequal, shorter than peduncle, outer ramus with 1 marginal spine near the midpoint, inner ramus with 5 marginal spines. Uropod 2 peduncle short, with 1 outer and 4 inner marginal spines, and 1 short apical spine. Rami slender, upper margin corrugated, outer longer than inner; outer ramus with 2 marginal spines, inner ramus with 5 spines evenly spaced along the proximal ⅔, then 2 spines very close together near distal end of margin. Uropod 3, peduncle slender, narrowing distally, with 1 large spine. Ramus slender, with 1 large and 2 small apical spines.

Telson narrow, apex entire; 1 apical spine on each side.

Male: 5–9 mm long. Antenna 1, flagellum 4-segmented [3–4]. Antenna 2, flagellum 7-segmented [3–7].

Gnathopod 1 as in ♀, but posterior lobes deeper. Segment 6 shorter than 5, broadening distally, posterodistal lobe projecting distally past closed dactyl, medial surface with numerous spines. Dactyl closing on short palm defined posteriorly by tumescent lobe, past which dactyl does not project.

Gnathopod 2, coxa, gill similar to ♀. Segment 2 strong, convex behind, expanded and spinose anteriorly. Segment 6 ovate, palm oblique, straight, lined with small spines, defined by 1 larger spine. Dactyl strong, distally curved, exceeding palm and closing in a medially placed cleft near palmar angle.

Uropod 1, peduncle like that of ♀, rami slender, subequal, outer marginally bare, inner with row of 7 evenly-spaced spines on slightly thicker part of ramus, between ⅙ of total length from proximal end and just past midway along ramus. Uropod 2, peduncle short, with 4 outer and 2 inner marginal spines, no apical spine; rami subequal, outer spined as ♀, inner with 1 short even row of 4 spines on a swelling in the upper margin just proximal of a

constriction halfway along upper surface of the ramus. Uropod 3 as in ♀ but with 2 peduncular spines.

Etymology. The name of this species means 'newly walking', in reference to its morphological similarity to the more aquatic members of the Talitridae.

Remarks. Mature males of *Orchestiella neambulans* are smaller than mature females; males with enlarged second gnathopods are rare in samples of this species, although males of earlier instars are common. Wildish (1979) has predicted sex ratios biased towards the female in 'primitive' landhopper species; however this is the only Tasmanian species which appears to demonstrate this feature to any marked extent. *Orchestiella neambulans* also possesses other characteristics anticipated by Wildish amongst the 'primitive' group, as does *O. quasimodo* (q.v.); small body size, low brood numbers and, assuming an annual life cycle, slow growth rate, although these three features are obviously very closely interrelated.

Cysts are often found on the gills of *O. neambulans*, especially along the margins. These were not investigated, but appear similar to those reported by Barnard (1960) on *'Talitrus' nesius* Barnard as due to protozoan infection.

Distribution. (Fig. 58) *Orchestiella neambulans* is fairly common in western Tasmania; it is not found in areas with less than 1800 mm annual rainfall. It does not occur in the southernmost part of Tasmania, on offshore islands or near the coast. It is common in inland teatree swamps.

Orchestiella quasimodo n.sp.

Figs 59–63

Type material. HOLOTYPE ♀, AM P37365; 10 PARATYPES [♂, 8♀♀(2 ovig.), 1 juv.], AM P37366; south-west Tasmania, south side of Gordon River valley, LGRSS transect 11A, 720 m, in litter under *Leptospermum* stand, map ref. 8102-944830, 28 Jan 1976. ALLOTYPE ♀, AM P37367; southern Tasmania, beside Old Hartz Track, at head of Arve River, west of Taylor's Ridge, *ex* litter from beneath *Richea pandanifolia*, map ref. 8211-829146, coll J.L. Hickman, A.M.M. Richardson, 24 Aug 1973. 6 PARATYPES (♂, 2♀♀, 4 juv.), BMNH; 5 PARATYPES [♂, 2♀♀(1 ovig.), 4 juv.], NMNS; south-west Tasmania, west side of Gordon River valley, near junction with Sprent River, LGRSS, near pit 31, map ref. 8012-975596, March 1976.

Other material examined. Tasmania: 129 specimens in 26 collections listed in Friend (1980).

Diagnosis. Body distinctively hunched anteriorly, cuticle unusually hard. Antenna 2 very short, just longer than head and first peraeon segment. Coxa of gnathopod 1 less than half obscured by coxa of gnathopod 2. Peraeopod 5, posterior lobe of coxa much deeper than anterior lobe. Pleopods 1 and 2 subequal, pleopod 3 shorter; inner ramus of pleopod 3 much shorter than outer ramus. Pleopods 1 and 2, outer peduncular margins distally with plumose setae. Telson with 2–3 spines on each side of apex.

Description. Female: length 5.2 mm, ovigerous, 1 egg [1–3]. Body deep, peraeon and pleon segments short. Antennae, gnathopods and peraeopods very short, cuticle relatively hard, epimeral plates converging distally, forming a narrow ventral slit through which pleopods 2 and 3 protrude.

Head as long as deep, largely masked posteriorly by coxa of gnathopod 1. Eye large, round, diameter about half head length, less pigmented at periphery. Antenna 1 short, just exceeding segment 4 of antenna 2 peduncle, flagellum 3-segmented [3], shorter than peduncle. Antenna 2 very short, just longer than head and first peraeon segment together, peduncular segment 5 short, equal to segments 3 and 4 together; flagellum 6-segmented [4–6], most segments with 4 groups of 2–3 very short bristles; distal segment long, with a brush of terminal setae.

Upper lip narrow, apex smoothly convex, strongly pilose distally, hairs relatively long. Lower lip deep, narrow, inner shoulders strongly pilose, apical hairs long, throat margins lightly pilose. Left mandible, incisor 5-cuspate, lacinia mobilis 5-cuspate, molar 17-striate. Right incisor 5-cuspate, lacinia distally crenate with 3 cusps, one a long process. Maxilla 1, inner plate slender, terminal setae long, inner longer than outer; outer plate narrow, outer apical spine-teeth broad, inner slender, dentition formula 2-2-0-3-2-4-3-4-4; palp 2-jointed, set just distal of midpoint of outer margin. Maxilla 2, plates slender, terminal spines long, curved inwards, inner plate with row of short sub-terminal plumose setae, outer margin of outer plate and inner margin of inner plate setose.

Maxilliped, inner plate narrowing slightly to truncate apex which bears short rounded spine-teeth, inner 2 subequal, well supplied with plumose setae which exceed and mask spine-teeth; inner margin with 6 plumose setae. Outer plate, apex broadly acute, submarginal spine-rows strong, outer margin with 3 distal plumose setae. Palp broad, short, segment 4 distinct, conical, lateral lobes on segments 2 and 3 strong, projecting inwards, with numerous slender spines.

Gnathopod 1, coxa rounded below, lightly spinose; inner shelf weak, with 8 spines. Segment 2 linear, with 3 anterior spines and 1 posterodistal spine. Segment 4 spinose posteriorly, with a weak blister. Segment 5 longer than 6, posterior margin tumid and spinose. Segment 6 slightly widening distally, palm short, transverse, not exceeded by closed dactyl, with groups of stiff setae posteriorly and anterodistally. Dactyl slender.

Gnathopod 2, coxa very deep, posterior process short, sharply rounding. Gill largest, sac-like, twisted proximally; oostegite absent. Segment 2 broad, slightly expanded distally with 2 small anterior

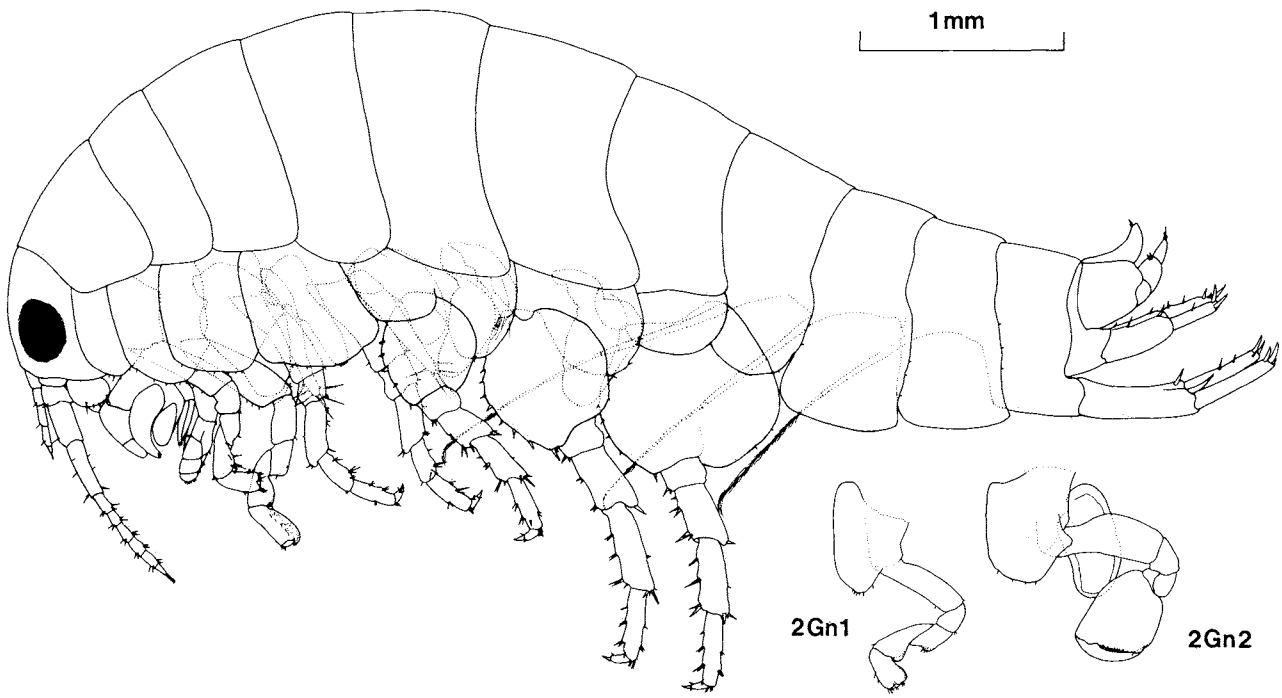

Fig. 59. *Orchestiella quasimodo* n. gen., n. sp., holotype, female, 5.2 mm, Gordon River valley, south-western Tasmania. 2, allotype, male, 4.2 mm, head of Arve River valley, southern Tasmania.

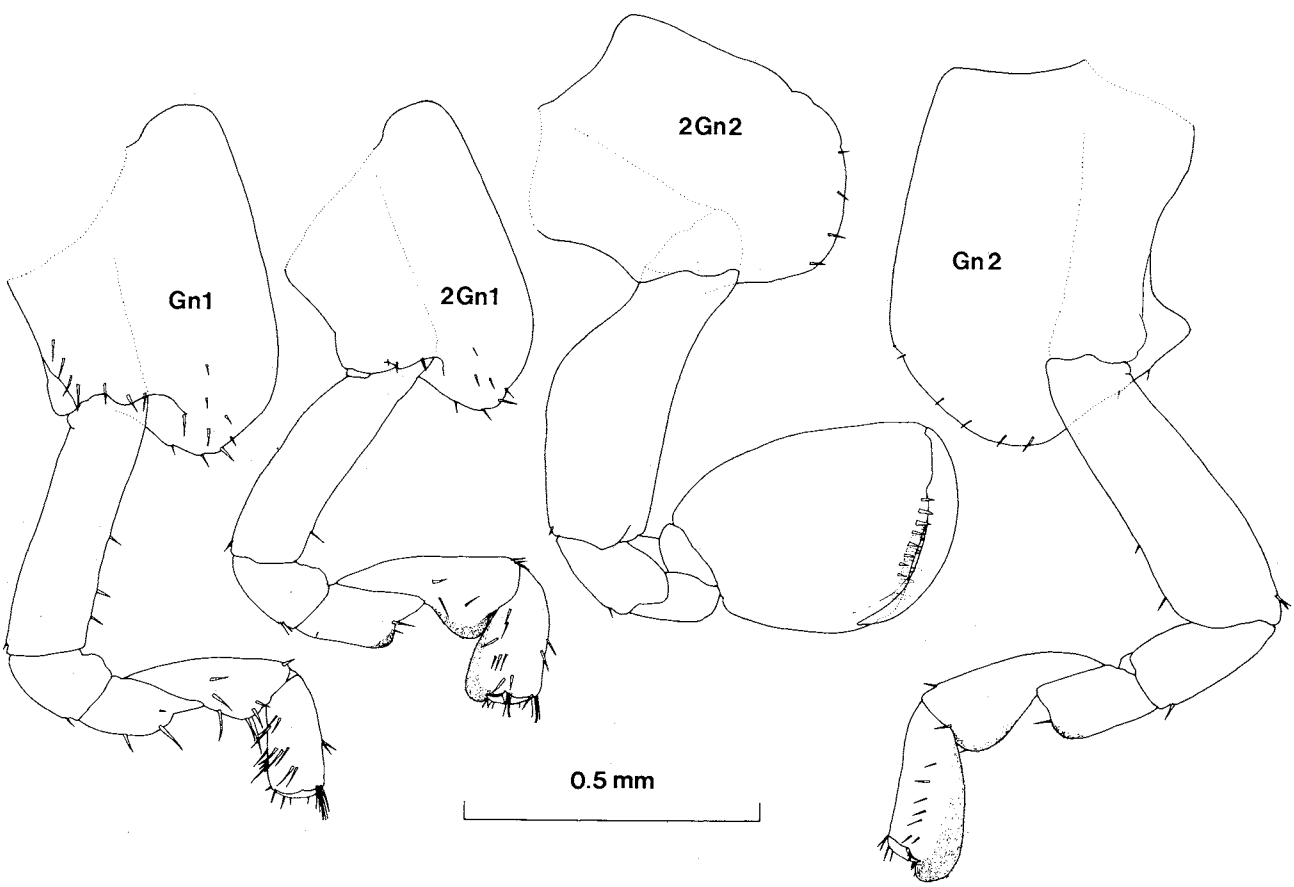

Fig. 60. *Orchestiella quasimodo* n. gen., n. sp., holotype, female, 5.2 mm, Gordon River valley, south-western Tasmania. 2, allotype, male, 4.2 mm, head of Arve River valley, southern Tasmania.

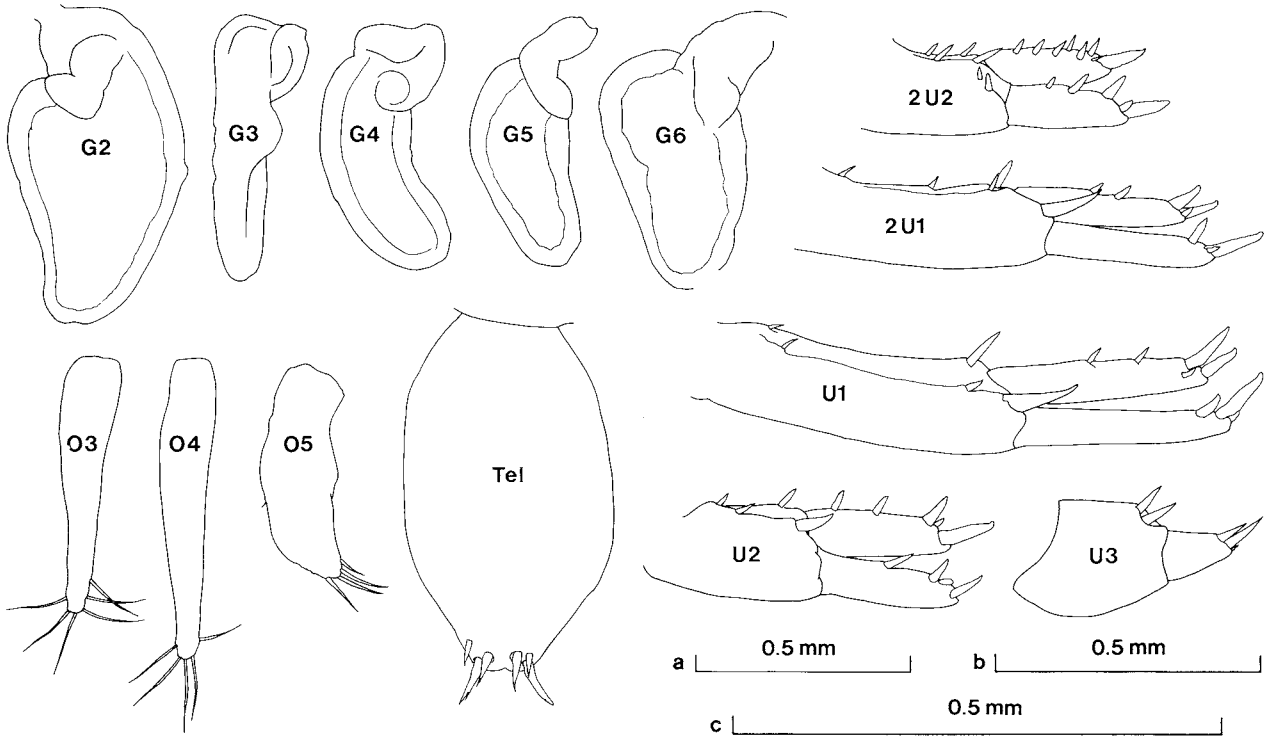

Fig. 61. *Orchestiella quasimodo* n. gen., n. sp., holotype, female, 5.2 mm, Gordon River valley, south-western Tasmania. 2, allotype, male, 4.2 mm, head of Arve River valley, southern Tasmania. Scale a: G2-6, O3-5; scale b: U1&2, 2U1&2; scale c: Tel, U3.

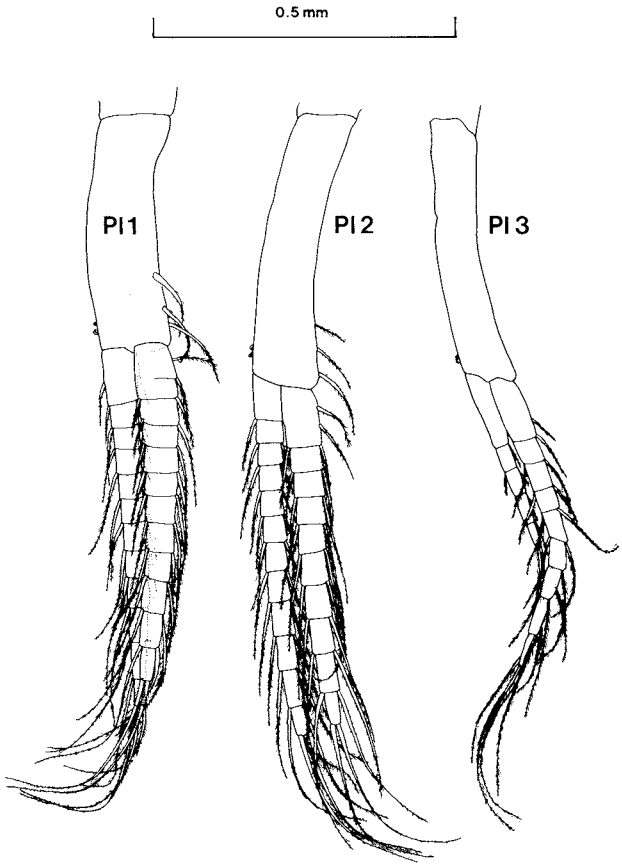

Fig. 62. *Orchestiella quasimodo* n. gen., n. sp., holotype, female, 5.2 mm, Gordon River valley, south-western Tasmania.

marginal spines, segment 4 shorter than 3, with a posterior blister. Segment 5 slightly longer than 6, posterodistally tumescent, segment 6 with a blunt apical lobe. Dactyl subapical, almost transverse.

Peraeopod 3 very short, coxa deep, posterior process prominent, sharply rounded. Gill narrow, sac-like, proximally twisted; oostegite long, tapering distally, with 6 long setae near apex. Segment 2 lightly curved anteriorly, dactyl short, stout.

Peraeopod 4 similar to 3, except coxa subrhomboid, posterior process very shallow, distal, broadly rounded; oostegite with 5 setae.

Peraeopod 5, anterior coxal lobe shallow, posterior lobe much deeper, broadly rounded distally, with 1 small spine. Gill sac-like, twisted proximally; oostegite short, broad, curved anteriorly, with 4 apical setae. Segment 2 broad, ovate, anterior margin armed with short, stout spines, posterior margin nearly smooth, dactyl short.

Peraeopod 6, posterior coxal lobe deep, distal margin smoothly rounded. Gill sac-like, proximally twisted, larger than that of peraeopod 5. Segment 2 subovate, anterior margin with short, stout spines, posterior margin smooth, with 1 spinule and no distal lobe. Segments 4–6 short, armed with short, stout spines; dactyl stout, nail short, curved.

Peraeopod 7, coxa deep, rounded below; segment 2 very broad, anterior margin broadly convex, set with short, stout spines, posterior margin greatly expanded, broadly rounded, spinulose, distal lobe shallow. Segments 4–6 short, normally spinose; dactyl short.

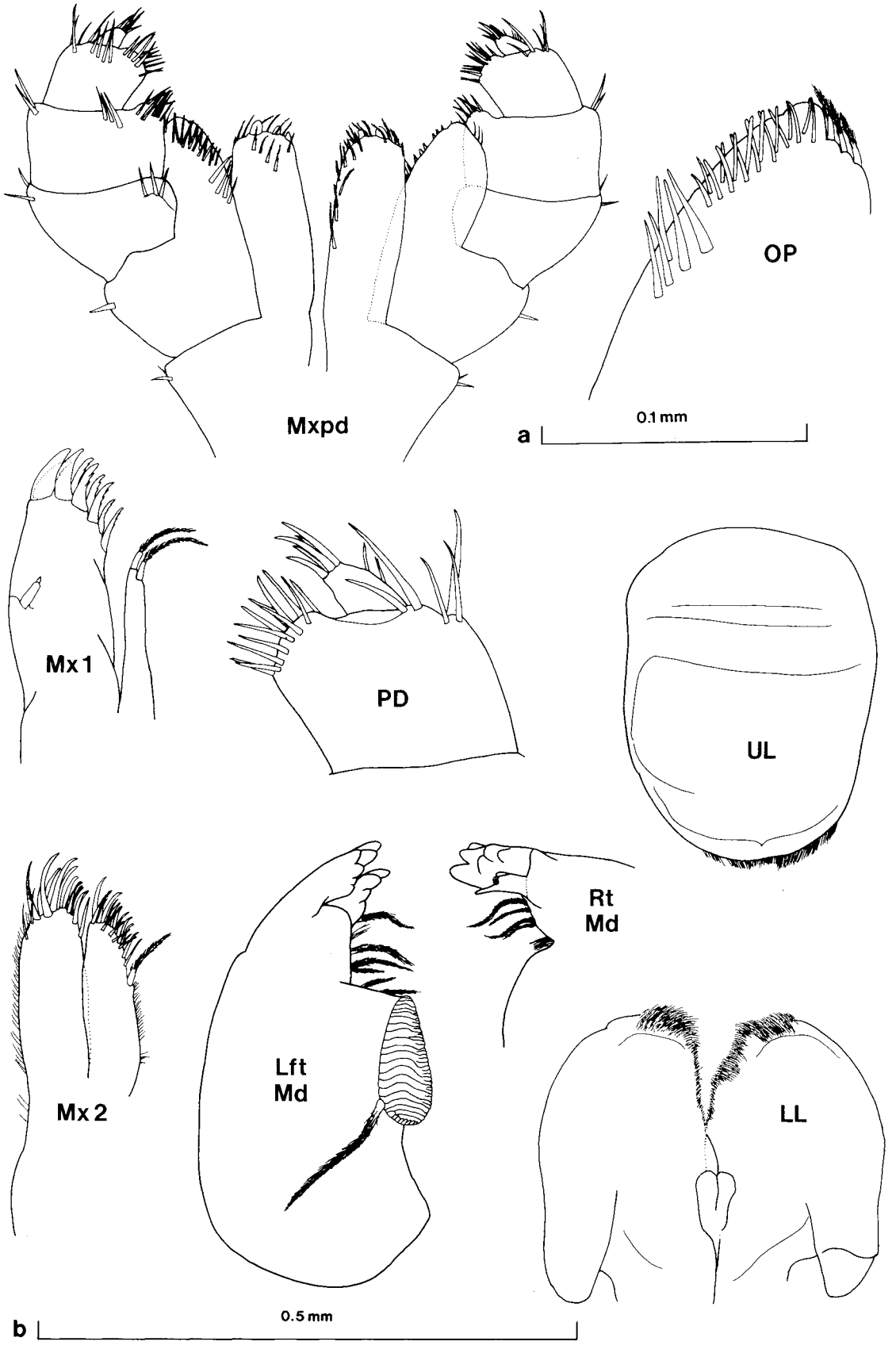

Fig. 63. *Orchestiella quasimodo* n. gen., n. sp., holotype, female, 5.2 mm, Gordon River valley, south-western Tasmania. Scale a: OP, PD; scale b: Mxpd, Mx1&2, UL, LL, Lft Md, Rt Md.

Epimeral plates deep, spinulose behind, first rounded below, second and third with smooth lower margins, corners slightly produced, subacute. Pleopods long, slender, each with 2 coupling spines and well supplied with long plumose setae, biramous. First and second with subequal, 10 and 12-segmented rami and 3 plumose setae on outer peduncular margin. Third with inner ramus about half as long as outer, rami of 5 and 9 segments respectively.

Uropod 1, rami subequal, shorter than sparsely spinose peduncle; outer ramus marginally smooth, inner ramus with 2 short marginal spines; peduncular distolateral spine simple, curve-tipped. Uropod 2, rami stout, subequal to peduncle, inner ramus with 2 marginal spines, outer with 1; peduncle with 1 strong apical spine. Uropod 3, peduncle subcylindrical, with a dorsal pair of stout spines; slender ramus shorter, with 2 large and 1 small spine apically.

Telson narrow, with a group of 3 stout spines on each side of cleft apex.

Male: length 4.2 mm. Antenna 1, flagellum 3-segmented [3]. Antenna 2, flagellum 5-segmented [4–5].

Gnathopod 1, coxa narrower than in ♀, inner shelf weak, with 3 spines, segment 2 with 1 anterior marginal spine, segment 5 with a deeper tumid lobe than in ♀. Segment 6 broadening distally, with a posterior lobe which extends distally and posteriorly behind the closed, stout dactyl.

Gnathopod 2, coxa distally rounded, segment 2 strong, posterior margin strongly convex near midpoint, segment 6 squarely ovate, palm slightly oblique, straight, evenly lined with short stout spines, posterior angle with a groove to accommodate curved tip of strong dactyl.

Uropod 2 more spinous than in ♀; peduncle with 2 more spines near apex, outer ramus with 2 marginal spines, inner with 5.

Etymology. The specific name is taken from the deformed bell-ringer in Victor Hugo's novel 'Notre Dame de Paris', in reference to the hunched appearance of this amphipod.

Remarks. This species is quite similar to *O. neambulans* but may be easily distinguished by its unusual body shape. The body segments are deep and extremely short anteriorly, resulting in a hunched appearance. The pleosome is laterally narrow, so the whole effect is one of apparent streamlining. In addition, the peraeopods are extremely short when compared to those of other landhoppers, giving the amphipod a very distinctive facies. Otherwise, the extremely hard exoskeleton, the very deep posterior lobe of peraeopod 5 coxa, the broader hand of male gnathopod 2, and the apically more spinose telson serve to differentiate *O. quasimodo* from *O. neambulans*. Males with large second gnathopods are much more common in this species than in *O. neambulans*. Fully grown males of *O. quasimodo* are smaller than fully-grown females.

Several specimens resembling *O. quasimodo*, but including larger adults with a less hunched body shape, were collected near Strathgordon (AM P37496). While these amphipods possessed the distinctive peraeopod 5 coxa of *O. quasimodo*, females had oostegites present on gnathopod 2. It is likely that these specimens belong to a third species of *Orchestiella*, closely allied to *O. quasimodo*.

Like *O. neambulans*, *O. quasimodo* appears to be most abundant in teatree woodland and swamps. These amphipods appear to favour hopping, using the strong pleosome as a means of locomotion; the very short legs are apparently not as well adapted for walking as the long slender legs of many other leaf-litter species.

The very hard body cuticle of this small species is a unique feature amongst the Tasmanian amphipods. It is tempting to liken this feature to the thickening of the exoskeleton found in Oniscoidea, which allows much greater water retention. *Orchestiella quasimodo*, however, inhabits forests with an average annual rainfall of at least 1800 mm, which falls throughout the year. Unless this species has undergone a major change of habitat, it is unlikely that the tendency to desiccate has been sufficiently strong to cause this radical adaptation. It is more probable that a hard exoskeleton and a well developed jumping ability together help avoid predation to a significant extent.

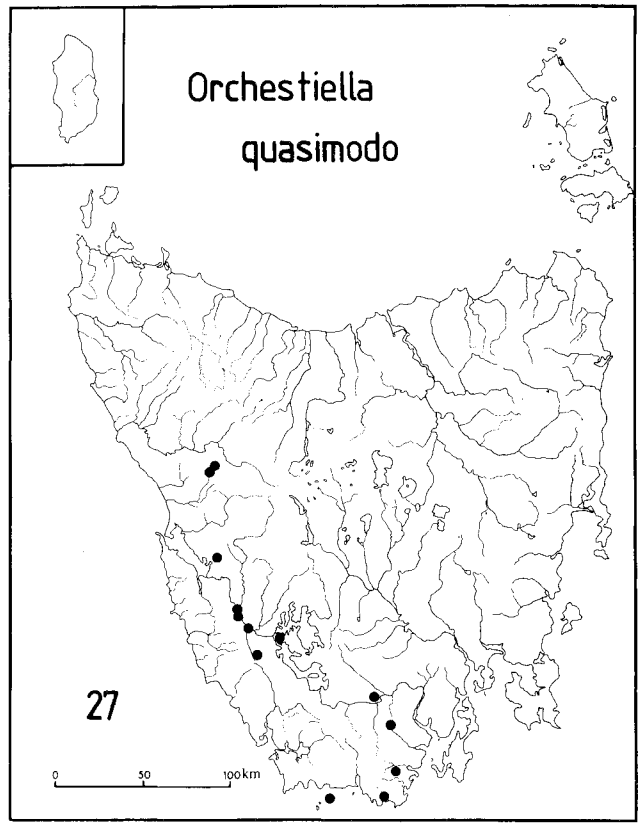

Fig. 64. Distribution of *Orchestiella quasimodo*. Total number of records is shown at lower left.

Distribution. (Fig. 64) A somewhat similar, but more southerly distribution than that of *O. neambulans* is displayed by this species, which also shows an affinity for teatree swamp. *Orchestiella quasimodo* rarely occurs very near the sea; the only known island occurrence is on De Witt Island, the largest of the Maatsuyker Group, where specimens were collected well inland in wet sclerophyll forest. Distributions of the two *Orchestiella* species overlap between the Tyndall Range and the Olga River valley (Figs 58 and 64).

Tasmanorchestia n. gen.

Diagnosis. Sexually dimorphic landhoppers. Antenna 1 almost as long as peduncle of antenna 2. Upper and lower lips, maxillae 1 and 2 narrow. Maxilliped, palp segments lobate with spinose inner margins, segment 4 partly masked by lateral lobe of segment 3. Gnathopod 1 subchelate in both sexes, gnathopod 2 strongly subchelate in ♂ with long curved dactyl; mitten-shaped in ♀, with segment 6 narrow, anterior margin naked to hinge of dactyl. Peraeopods 3–7 cuspidactylate. Peraeopod 7 the longest, dactyls of peraeopods 6 and 7 long and slender with long terminal spines. Anterior and posterior gills larger than others, sac-like. Oostegites broad, bearing long simple distal setae. Pleopods reduced or vestigial. Uropods similar in both sexes, uropod 2, peduncle lacking marginal spines.

Type species. *Tasmanorchestia annulata* n. sp.

Etymology. The name alludes to the distribution of this species, restricted to Tasmania and its offshore islands. Gender, feminine.

Remarks. The characters distinguishing this monotypic genus from *Agilestia* Friend are the sharp distal lobe and lack of anterior marginal spine-groups on segment 6 of ♀ gnathopod 2, the partially masked fourth segment of the maxilliped palp, the ventrally unmodified peraeonite 1, the reduced or vestigial pleopods, and the non sexually dimorphic uropods 1 and 2.

Tasmanorchestia differs from *Orchestiella* in the possession of reduced or vestigial pleopods, an elongate sixth segment of ♀ gnathopod 2, the very oblique palm of ♂ gnathopod 2, exceeded by the long dactyl, non sexually dimorphic first and second uropods, the hand of ♂ gnathopod 1 not strongly lobate behind, and the more slender maxilliped palp and semi-masked fourth segment.

Tasmanorchestia annulata n. sp.

Figs 65–69

Type material. HOLOTYPE ♀, AM P37368; ALLOTYPE ♂, AM P37369; western Tasmania, beside Strahan-Zeehan Rd, 4 km north of Henty River bridge, in *Pittosporum bicolor* litter, map ref. 7913-592483, 29 Oct 1977. 2 PARATYPES ♂, ♀, AM P37370; 2 PARATYPES ♂, ♀, BMNH; 1 PARATYPE ♂, NMNS; western Tasmania, 2.2 km south of 4-mile peg on Savage River pipeline road, map ref. 7915-523123, coll. A.M.M. Richardson *et al.*, 11 May 1975.

Other material examined. Tasmania: 401 further specimens in 30 collections listed in Friend (1980).

Diagnosis. Body with dark and light lateral stripes. Antenna 2 as long as head and first 3 peraeon segments. Pleopods 1 and 2 biramous, peduncles with laterodistal plumose setae, inner rami much shorter than outer. Pleopod 3 reduced to a minute stump with 1 single distal segment. Telson with 2 spines on each side of apex.

Description. Female: 7.9 mm long, ovigerous, 2 eggs. Body brown in life with light and dark transverse stripes. Head capsule longer than deep, eye almost round, large, width over ⅔ head length. Antenna 1 long, reaching almost to the distal end of the peduncle of antenna 2, flagellum 6-segmented [3–8], shorter than peduncle. Antenna 2 relatively short, exceeding the length of the head and first 3 body segments together, segment 5 of peduncle long, longer than segments 2–4 together; flagellum 13-segmented [5–15], most segments long, with 4 groups of long bristles; last segment short with long terminal setae.

Upper lip deep, strongly pilose apically. Lower lip narrow, lateral lobes small, pilose on outer margins, inner shoulders stiffly pilose, sides of central trough lightly pilose on distal part only. Left mandible, incisor 5-cuspate, lacinia mobilis 4-dentate, molar strong, 20-striate. Right mandible, incisor 5-toothed, lacinia mobilis 3-dentate. Maxilla 1, inner plate slender, inner terminal seta longer than outer; outer plate narrow, 2-segmented palp at broadest point, terminal spines slender, dentition formula 2-2-2-4-5-4-4-4-6.

Maxilla 2, plates slender, inner rather shorter than outer, terminal spines long, slender, distally curved, plumose seta at inner end of distal margin large, inner margin distally finely pilose. Outer plate as broad as inner, apical spines long and slender, outer margin distally bare, proximally pilose.

Maxilliped inner plate broadening distally to truncate apex which bears 3 short rounded spine-teeth, concealed among 6 apical plumose setae; lateral surface with a group of 6 plumose setae, inner margin of medial side with 5 plumose setae. Outer plate long, slender, apically rounded with 3 plumose setae set into the outer distal margin; submarginal spine-row double, strong, spines blunt. Palp fairly broad, spines on lateral face and inner margin small; segments 2 and 3 with lateral lobes, each set with a group of small spines; lobe of segment 3 half masking the rounded segment 4, which bears 4 small apical spines.

Gnathopod 1, coxa broad, distally rounded, spinose; inner shelf weak, spinose. Segment 2 linear, both margins weakly spined. Segment 4 with a barely perceptible posterior lobe. Segment 5 long, well

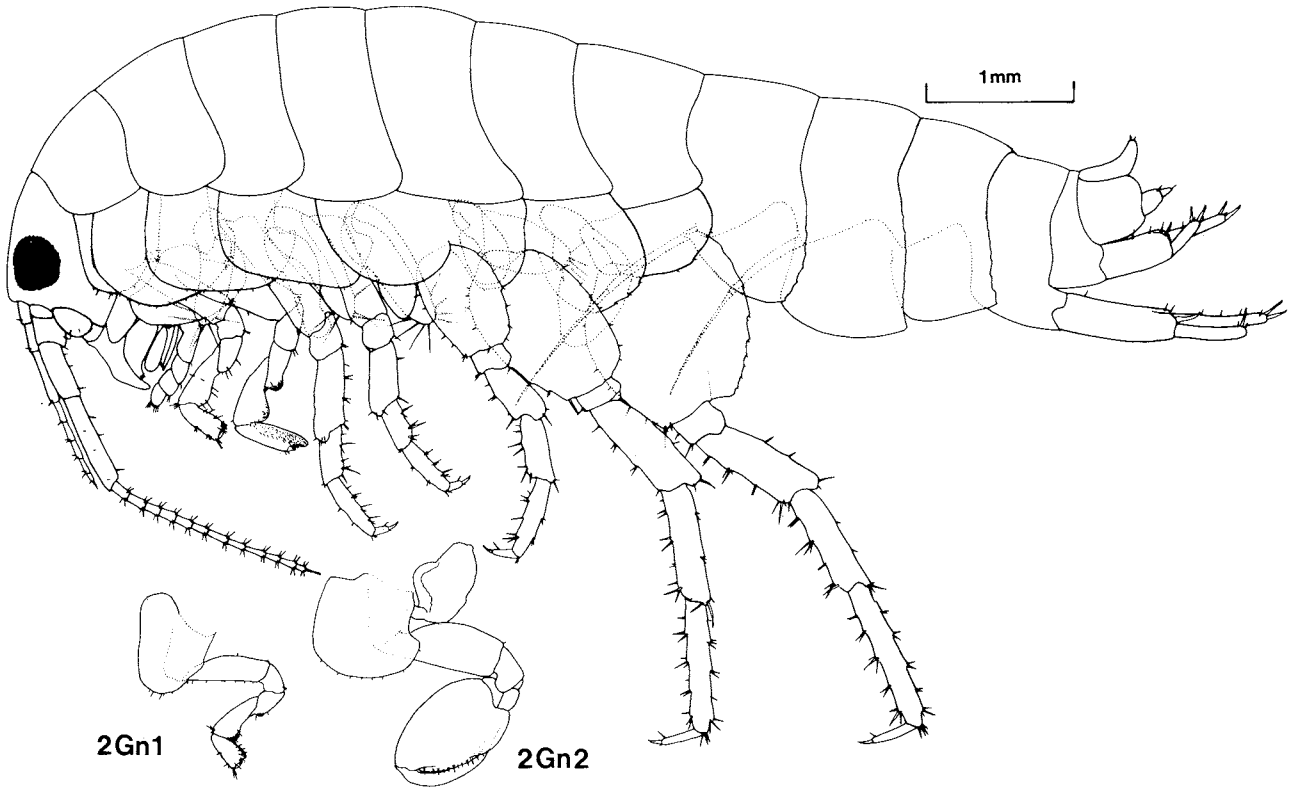

Fig. 65. *Tasmanorchestia annulata* n. gen., n. sp., holotype, female, 7.9 mm; 2, allotype, male 5.6 mm; near Henty River, western Tasmania.

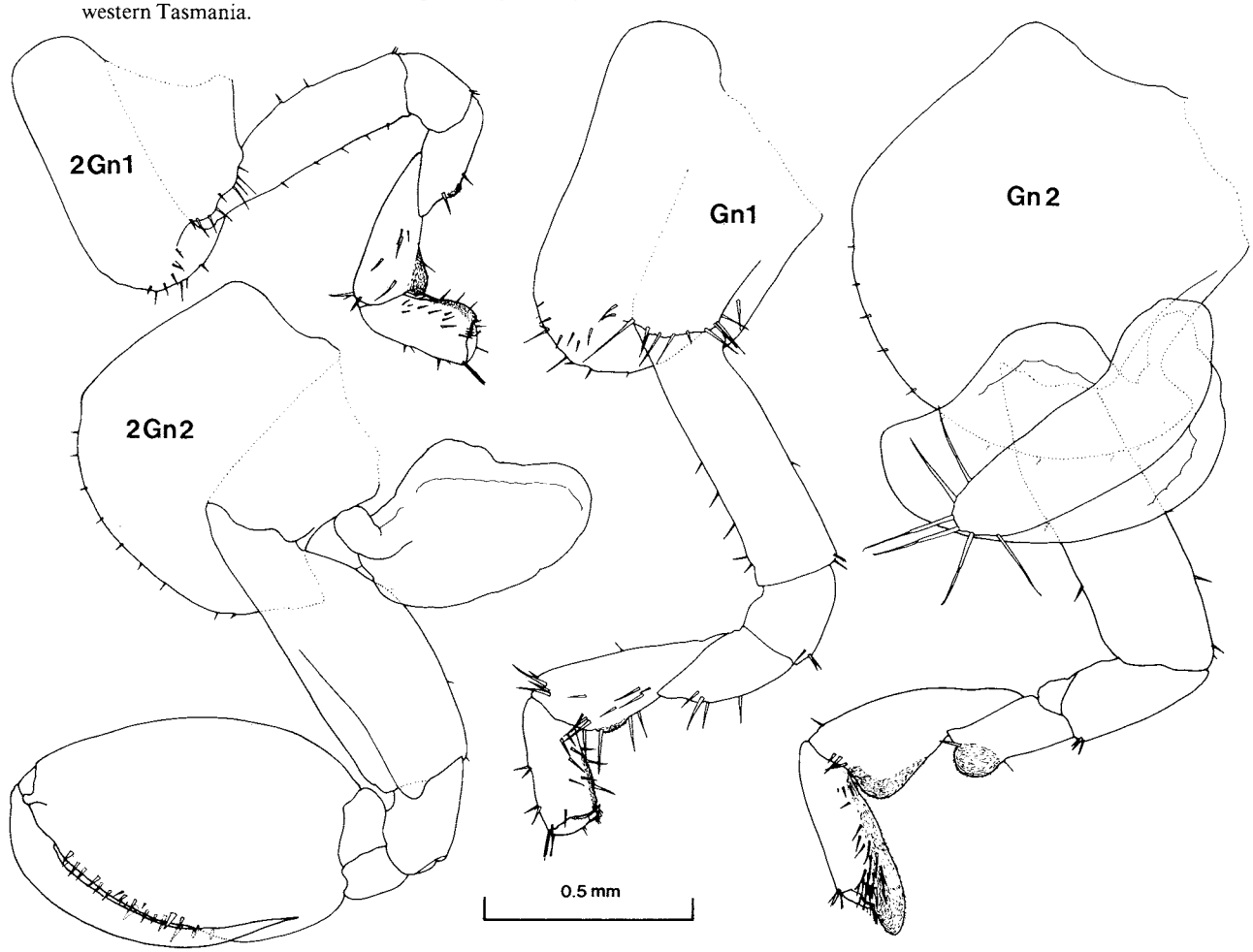

Fig. 66. *Tasmanorchestia annulata* n. gen., n. sp., holotype, female, 7.9 mm; 2, allotype, male, 5.6 mm; near Henty River, western Tasmania.

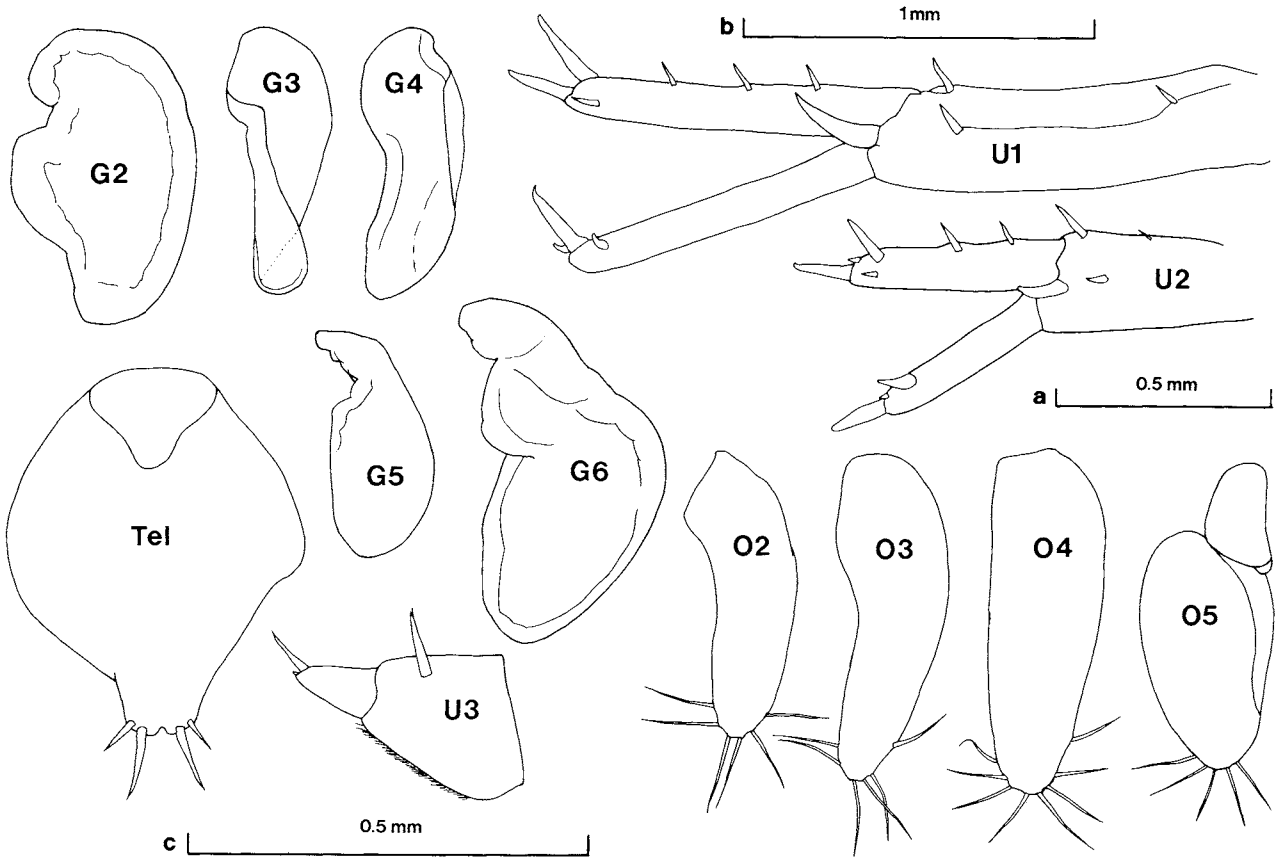

Fig. 67. *Tasmanorchestia annulata* n. gen., n. sp., holotype, female, 7.9 mm, near Henty River, western Tasmania. Scale a: U1&2; scale b: G2-6, O2-5; scale c: Tel, U3.

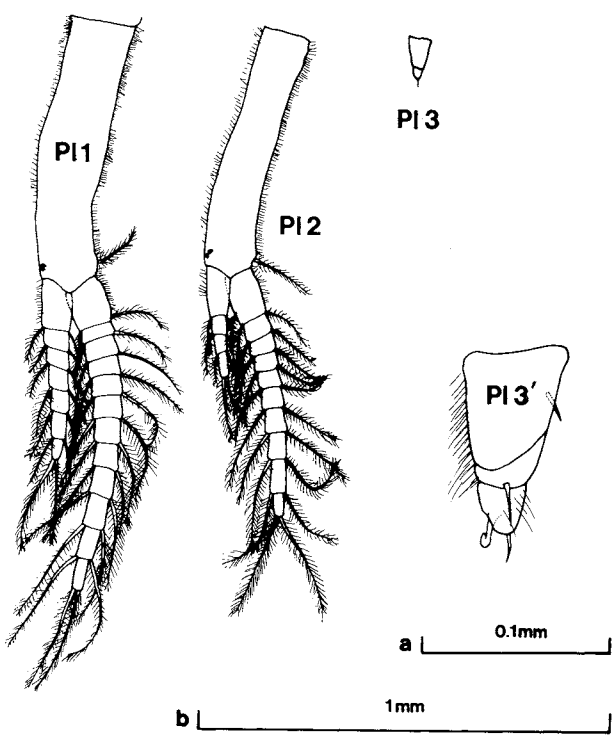

Fig. 68. *Tasmanorchestia annulata* n. gen., n. sp., holotype, female, 7.9 mm, near Henty River, western Tasmania. Scale a: P1 3'; scale b: p1 1-3.

spined behind, posterior tumid lobe very weak. Segment 6 much shorter than 5, almost linear, with small spines on medial surface, anterior margin with 2 small spine-groups; palm transverse, covered with minute serrations, just exceeded by strong dactyl.

Gnathopod 2, coxa broad, lower margin smoothly rounded, spinulose, posterior process prominent, almost a right angle. Gill simple, kidney-shaped, broader and slightly longer than gills of peraeopods 3 and 4, oostegite curved anteriorly, shorter than segment 2, apically rounded with 6 slender setae. Segment 2 almost linear, fairly broad, weakly spinose. Segment 4 with a sharply rounded posterodistal tumescence, margins weakly spined. Segment 5 deep, very poorly spinose, posterior tumid lobe well developed. Segment 6 as long as 5, slender, medial spines forming dense distal group near oblique dactyl; distal lobe long, apically pointed; anterior margin with spines only at hinge of dactyl.

Peraeopod 3, coxa broader than deep, lower margin almost straight, spinulose; posterior process prominent, subacute. Gill simple, sac-like, shorter than segment 2; oostegite similar to but slightly longer than that of gnathopod 2, with 6 slender apical setae. Segment 2 broadening slightly distally, margins almost bare. Dactyl quite short, terminal spine curved.

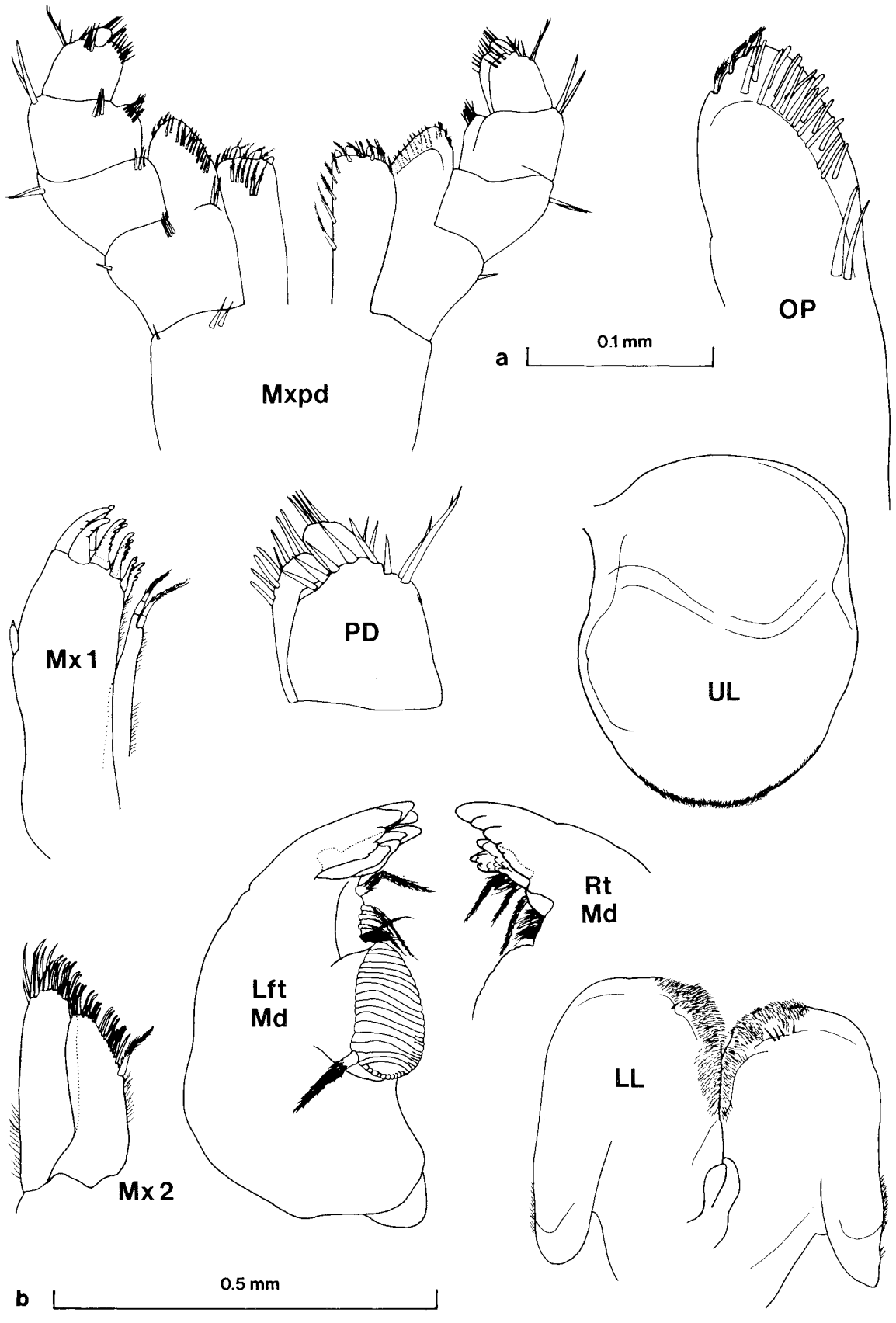

Fig. 69. *Tasmanorchestia annulata* n. gen., n. sp., holotype, female, 7.9 mm, near Henty River, western Tasmania. Scale a: OP, PD; scale b: Mxpd, Mx1&2, UL, LL, Lft Md, Rt Md.

Peraeopod 4, coxa shallow, much broader than deep; lower margin slightly convex, spinulose. Gill as in peraeopod 3, oostegite broader and longer, with 8 setae near apex. Segments 2 and 4 shorter than in peraeopod 3, limb otherwise similar.

Peraeopod 5, anterior coxal lobe very shallow, front and lower margins smoothly rounded, naked; posterior lobe longer, weakly spinulose, convex behind. Gill sac-like, smaller than in previous 2 legs, oostegite shorter and broader, with 2 lobes, apically with 4 slender setae. Segment 2 oblong, hind margin weakly serrulate and spinose. Dactyl slender, terminal spine curved.

Peraeopod 6, anterior coxal lobe very shallow, posterior lobe deep, expanded posterodistally, hind margin serrate. Gill largest, sac-like, twisted near base. Segment 2 ovate, margins spinose, hind margin serrulate. Segment 3 very short, segments 4–6 slender, normally spinose. Dactyl long, slender, terminal spine curved.

Peraeopod 7 longest, coxa fairly shallow, spinulose below. Segment 2 longer than broad, indented above to hinge, expanded in front, serrulate behind. Segments 4–6 slender, dactyl long, slender, terminal spine curved.

Epimeral plate 1 deep, lower margin oblique, rounded, hind margin convex, serrulate, hind corner sharply obtuse. Plate 2 broadening distally, lower margin smoothly rounded, posterodistal corner slightly produced behind, hind margin slightly sinuous, serrulate. Plate 3 smaller, subsquare, hind margin almost straight, serrulate, hind corner minutely produced.

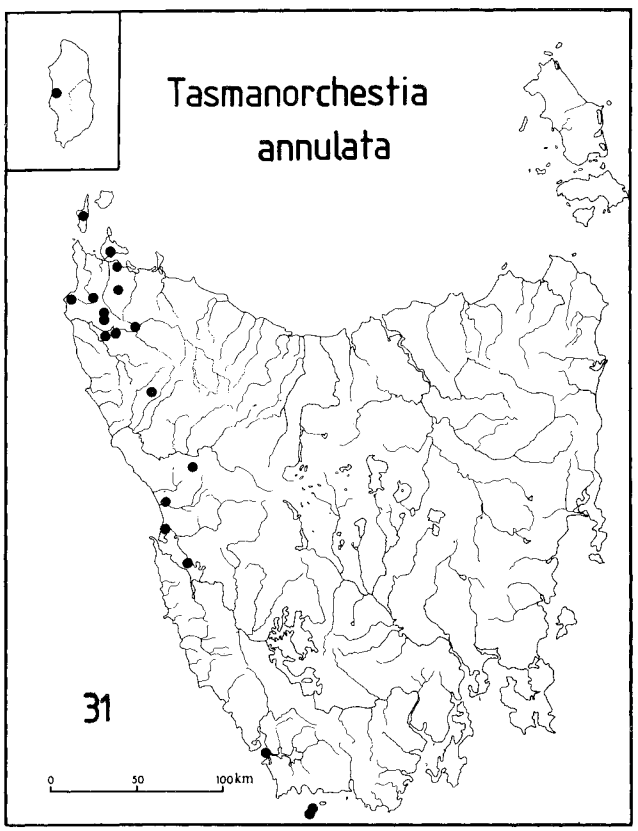

Fig. 70. Distribution of *Tasmanorchestia annulata*. Total number of records is shown at lower left.

Pleopods 1 and 2, biramous, inner ramus shorter than outer. Peduncular margins clothed with minute hairs except near 2 coupling spines, 1 plumose seta distally placed on outer margin of each. Rami generally with 2 long plumose setae on each segment, pleopod 1 with 7 inner and 12 outer ramal segments, second with 4 inner and 10 outer ramal segments. Pleopod 3, a tiny stump, with ramal vestige with 1 terminal spine and 1 hook-shaped subapical spine. Peduncle pilose on inner side, with 1 distal spine and 1 spine near the outer margin.

Uropod 1, peduncle slender, with 1 inner and 2 outer marginal spines, distolateral spine short, strong and curved. Rami slender, subequal, margins of outer ramus naked, those of inner ramus with 3 evenly spaced spines. Uropod 2 ramus slender, with 1 inner and 2 outer marginal spines, rami subequal, outer with naked margins, inner with 2 marginal spines. Uropod 3, peduncle narrowing strongly, lower margin distally straight, pilose, 1 strong peduncular spine; ramus fairly short, slender, with 1 long and 1 very short apical spine.

Telson fairly narrow, apex produced, minutely cleft, with 1 long and 1 short slender apical spine on each side.

Male: length 5.6 mm. Antenna 1, flagellum 4-segmented [3–6]. Antenna 2, flagellum 11-segmented [5–11].

Gnathopod 1, as in female, but hind margin convex, posterior lobes of segments 4 and 5 more pronounced, so that segment 5 is deep. Segment 6 broadening distally due to posterior tumescence, which also causes palm to exceed dactyl.

Gnathopod 2, coxa broad, shallow; posterior process large, acute. Gill sac-like, basally twisted. Segment 2 powerful, hind margin strongly convex, lightly spinulose. Segment 6 large, subovate, palm strongly oblique, convex, lined with small stout spines. Dactyl closely fitting palm, curved, very long, just shorter than segment 6, produced into long tapering point.

Remarks. These fairly large landhoppers display alternately light and dark banding across the dorsum when alive, which persists for some time after preservation. Females are significantly larger than males when full grown.

Etymology. The name refers to the striped colouration of the species.

Distribution. (Fig. 70) This western species exhibits a distribution complementary to that of the *Orchestiella* species. It is generally found in more coastal situations, except in the far north-west, where it tends to inhabit rainforest and teatree swamps as well. This last vegetation type represents a large proportion of the wooded areas in that part of

Tasmania and on the nearby islands. The centre of distribution of *T. annulata* appears to be in the north-west and the Hunter Group, with coastal extensions southward. It is not found in Victoria; King Island records constitute its northernmost known occurrence.

Doubtful species

Talitrus assimilis Haswell, 1880

As outlined earlier, W.A. Haswell described this species in 1880 on the basis of material from Tasmania. He provided a figure of the last four segments of the second gnathopod (no sex given). The short diagnosis was as follows:

"Distinguished from *T. sylvaticus,* which it otherwise closely resembles, by the form of the posterior gnathopoda–the meros having a truncate process below, the carpus having its lower border convex, and the propodos having a longitudinal, hairy ridge."

Later, Haswell (1885) synonymised this species (referring to it as '*Talitrus affinis')* with *T. sylvaticus* Haswell, 1879. The present study has shown that *T. sylvaticus* does not occur in Tasmania, so Haswell was apparently studying one of the fifteen species treated here. His original material was deposited in the Australian Museum, but is not among present-day holdings.

Haswell's description does not provide any useful distinguishing features. The shape of the 'truncate process' of segment 5, gnathopod 2 shown in his diagram is not found in any known species, and is most probably an artifact. All Tasmanian landhoppers possess a rounded tumescence in this postion, which often collapses during the mounting process. The 'hairy ridge' on segment 6 is also found in all species.

The locality of Haswell's species is given merely as 'Tasmania'. The material is most likely to have been collected near the capital, Hobart, or possibly Launceston, the second largest settlement. In that case, the only species likely to have occurred in the collection would be *Mysticotalitrus tasmaniae, M. cryptus* and *Keratroides vulgaris.*

If the shape and proportions of the segments of gnathopod 2 in Haswell's drawing are compared with these three species, however (Table 3), no clear candidate for *T. assimilis* emerges. The posterior margin of segment 5 most resembles that of *M. cryptus;* however the large posterior tumescence of segment 4 is more similar to those of *M. tasmaniae* and *K. vulgaris.* Ratios of lengths and widths of segments shown in Table 3 are similarly unenlightening.

A sample in the British Museum (Natural History) from Stebbing's collection is labelled "*Talitrus affinis* WAH". It appears that Stebbing received this material from Haswell. However, it contains four specimens of a species belonging to the marine talitroid genus *Hyale.*

As no identity for *Talitrus assimilis* can be clearly established, this name is regarded as doubtful and should be suppressed due to non-usage.

Table 3. Ratios of gnathopod 2 segment lengths in *Talitrus assimilis* Haswell (from Haswell, 1880, pl. 1) and in males and females of three known Tasmanian species (± S.D.; n = 6 in each column except the first).

	T. assimilis	*M. tasmaniae*		*M. cryptus*		*K. vulgaris*	
Segment 6 length: width	4.2	3.17 ±0.19	3.77 ±0.34	3.35 ±0.47	3.81 ±0.23	3.88 ±0.36	3.82 ±0.29
Segment 6 length: length of segments 4 & 5	0.86	0.82 ±0.03	0.81 ±0.09	0.86 ±0.03	0.87 ±0.04	0.85 ±0.03	0.85 ±0.02

ZOOGEOGRAPHY

The aim of this section is to attempt to explain present day distributions of Tasmanian landhopper species in terms of past and present environments in south-eastern Australia.

Tasmanian environments today

Physical Description. Tasmania is an island about 67 000 km² in area which lies between latitude 40°30′S and 44°S and longitude 144°30′E and 148°30′E. There are many offshore islands, some of which are relatively large; these are shown in Figure 71, with a number of other localities mentioned in the text. Tasmania is separated from south-eastern Australia by Bass Strait, a shallow marine transgression over 240 km wide and up to 85 m deep. A chain of island groups occurs on the eastern side of Bass Strait, including the Furneaux, Kent and Hogan Groups, with several small islands near Wilsons Promontory, Victoria. On the western side, there a few very small islands; King Island is situated about halfway between Cape Grim (north-west Tasmania) and Cape Otway (Victoria). The Hunter Group is much closer to Tasmania and constitutes the only other significant land on the western side of Bass Strait. The Maatsuyker Group comprises several small islands off the south coast, while Bruny, Maria and Schouten are larger islands off the east coast, separated by shallow water from mainland Tasmania.

The main island, especially the western half, is mountainous, the highest peak reaching 1617 m. The Central Plateau (over 1000 m) and the mountains of the north-east are separated by the relatively low-lying Midlands graben, while the coastal plains are generally narrow, except in the north and north-east.

Geologically complex, the island may be broadly divided into the 'fault structure province' of the centre, east and south-east, and the 'fold structure province' of the west and north-east (Davies, 1965).

The fault structure province is made up of mostly Permian and Triassic sediments with massive dolerite instrusions. These layers are roughly horizontal, but the formation of grabens in the central north and south east has caused strong drainage patterns to emerge. The fold structure province is made up of the pre-Carboniferous basement rocks which have undergone folding and some intrusion by granite. The folding in the west runs roughly north and south, forming a number of low ranges with interposed depositional plains.

Climate. The climate of Tasmania is temperate maritime (Bureau of Meteorology, 1979). Temperatures are influenced by topography, but January mean maximums vary between 18° and 23° and July mean minimums between -1° and 5°. Daily temperature ranges average between 8° and 12°, depending on locality. As the island lies in the path of the 'Roaring Forties' (a westerly air stream), rainfall is year round, with a winter peak. The elevated nature of western Tasmania causes a strong west to east decrease in precipitation. Average annual rainfall varies between 550 mm and 3600 mm; the distribution of this is shown in Figure 72.

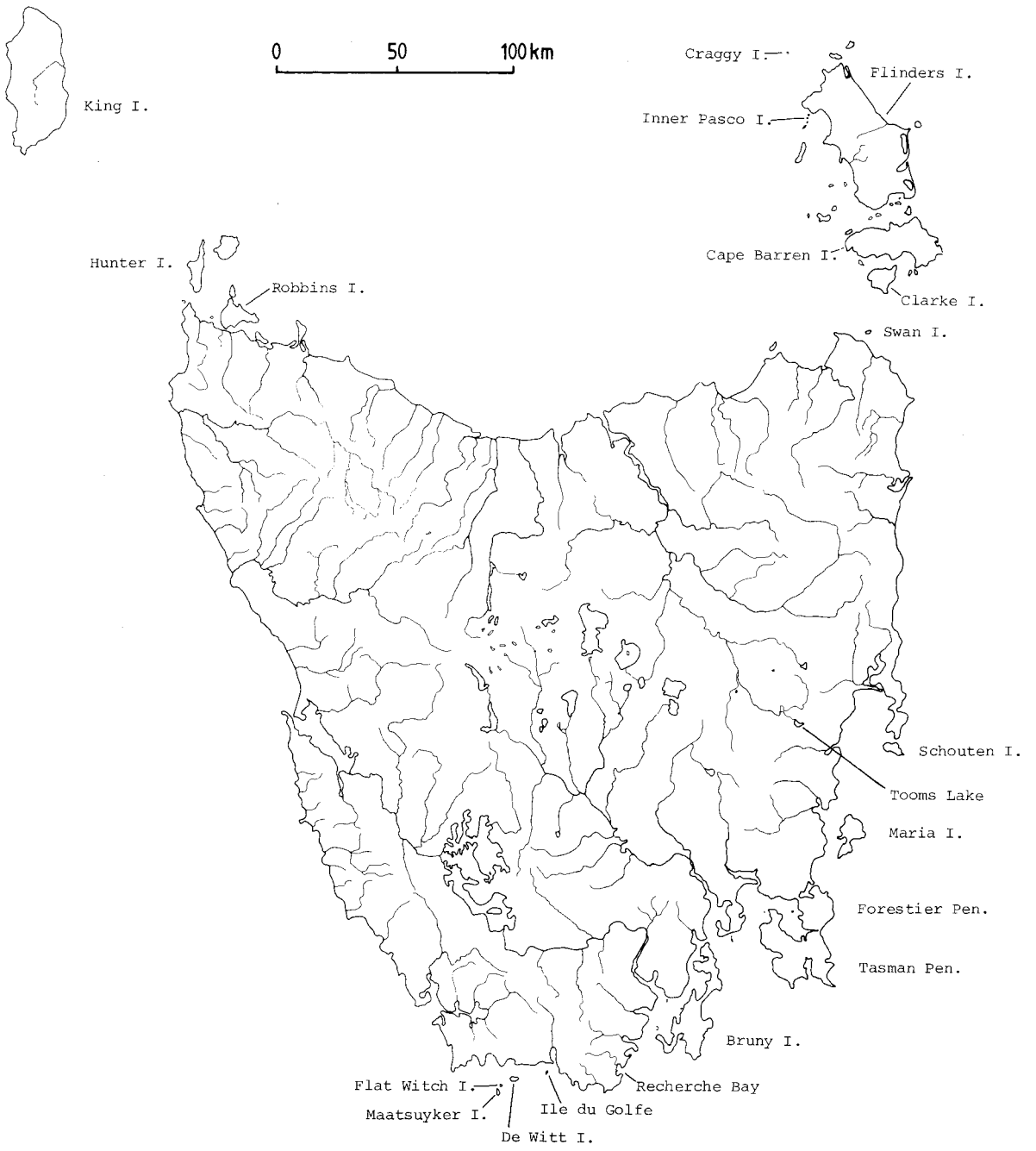

Fig. 71. Location of some Tasmanian geographical features mentioned in text.

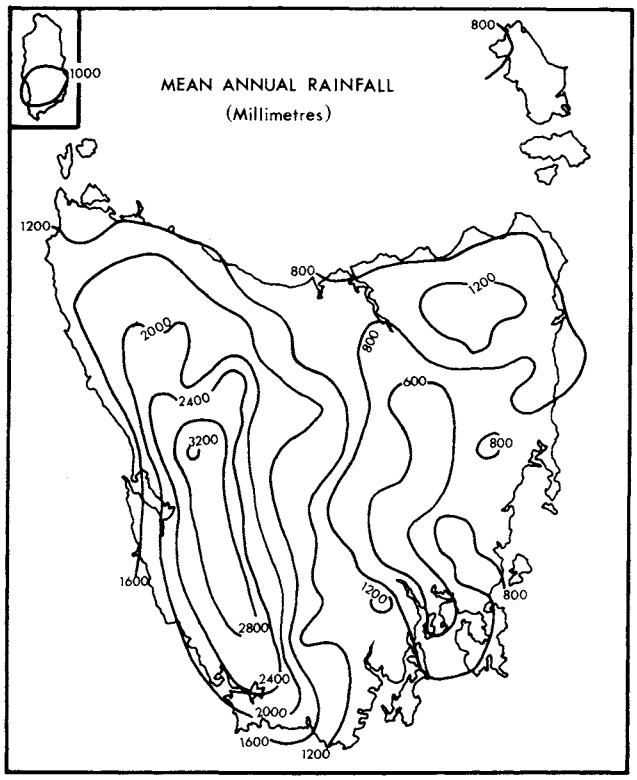

Fig. 72. Rainfall map of Tasmania (from Bureau of Meteorology, 1979).

Vegetation and terrestrial amphipod habitats. Jackson (1965) has distinguished five broad vegetational types in Tasmania; rainforest, sclerophyll forest, moorland, sedgeland and coastal heath. The first two of these appear to support most of the landhopper populations in Tasmania, while the other three seem to be marginal habitats. Figure 73 shows the distribution of rainforest, sclerophyll forest, and the three non-forest types, grouped together.

Rainforest occurs mainly in the western, high rainfall area with an outlier in north eastern Tasmania. This forest type is a mosaic of different communities, intergrading according to the conditions prevailing at each site.

According to Jackson (1965, 1968), much of the area climatically suited to rainforest carries other communities because of mineral and fire frequency status. An extreme case is the occurrence of Button-grass (*Gymnoschoenus sphaerocephalus)* sedgeland (which occupies most western areas in the non-forest category, Figure 73), where poor soils and frequent burning prevent forest development. Another important fire-mediated subclimax is *Leptospermum* scrub and woodland, which is usually poorly drained, and provides habitats to which the two *Orchestiella* species seem adapted. At low fire frequencies, but low mineral status, *Nothofagus* climax rainforest gives way to Horizontal (*Anodopetalum biglandulosum),* which forms a tangled mass of interwoven stems at understorey level. Progressively better soils support Celery-top Pine *(Phyllocladus asplenifolium)* and then Sassafras *(Atherosperma moschatum)* dominants, before the climax Myrtle *(Nothofagus cunninghamii)* rainforest, which occurs on good soils. These last three forest sub-types have almost closed canopies and litter layers with a mat of rootlets above the mineral soil; the litter/soil interface, an important microhabitat for many amphipod species, is not well developed. In wet areas with good soils and intermediate fire frequency, eucalypts occur above rainforest subdominants. This mixed forest provides a heterogeneous litter which is well colonized by land-hoppers. All forest types mentioned above are grouped as rainforest in Figure 73.

The other major forest type in Tasmania is sclerophyll forest, which occurs mainly in the east. It is dominated by eucalypt trees and the structure is closed with a thick understorey in wet situations, tending to be more open with the understorey sparse or absent as conditions become drier. This forest type provides suitable habitat for amphipods, except where low rainfall and open structure allow desiccating conditions to prevail in summer. Even in these dry sclerophyll areas, gullies tend to support thicker vegetation, higher humidity and amphipod populations.

Previous environments in Tasmania

Cretaceous. During the Cretaceous period, the Australian continent (including Tasmania) was still part of the Gondwana landmass. Tasmania was at a much higher latitude than its present position (Crook & Belbin, 1978). Global climatic patterns differed greatly from those experienced today, however; Cretaceous laterite and bauxite found in northern Tasmania give evidence of a hot, humid climate (Banks, 1973). The Gondwana supercontinent supported mixed forests of austral gymnosperms and evergreen angiosperms (Raven & Axelrod, 1972) and it seems that suitable habitats for landhoppers were widespread.

Tertiary. During the Tertiary period, a long-term climatic change occurred in Australia, from widespread warm, tropical conditions to cooler climates with aridity developing in the centre of the continent. Forests suitable as landhopper habitat probably occurred across the continent at the beginning of this period, but gradually contracted southwards until they reached the present-day distribution in the south-west, the south-east, and in Tasmania (Dorman, 1966; Raven & Axelrod, 1972; Hos, 1975; Beard, 1977; Kemp, 1978, 1981). The disjunct nature of these southern forests, therefore, is probably a fairly recent phenomenon.

The depression between mainland Australia and Tasmania which, when flooded, formed Bass Strait, originated during the separation of Australia and

Antarctica at the beginning of the Tertiary (Griffiths, 1971). This area was flooded between the late Oligocene and the end of the Miocene, and again from the Pliocene until the Pleistocene.

Pleistocene. During the Pleistocene period, climates were at times more severe than those of the late Tertiary. Five glacial phases apparently occurred in other parts of the world during this period (Ericson & Wollin, 1968) and sea-level changes associated with these probably exposed the Bassian Plain several times during the epoch. Most available climatic information covers the late Pleistocene-Holocene, an interval particularly relevant to the present discussion.

There is some evidence for glaciations older than the last one, found in northern Tasmania; this

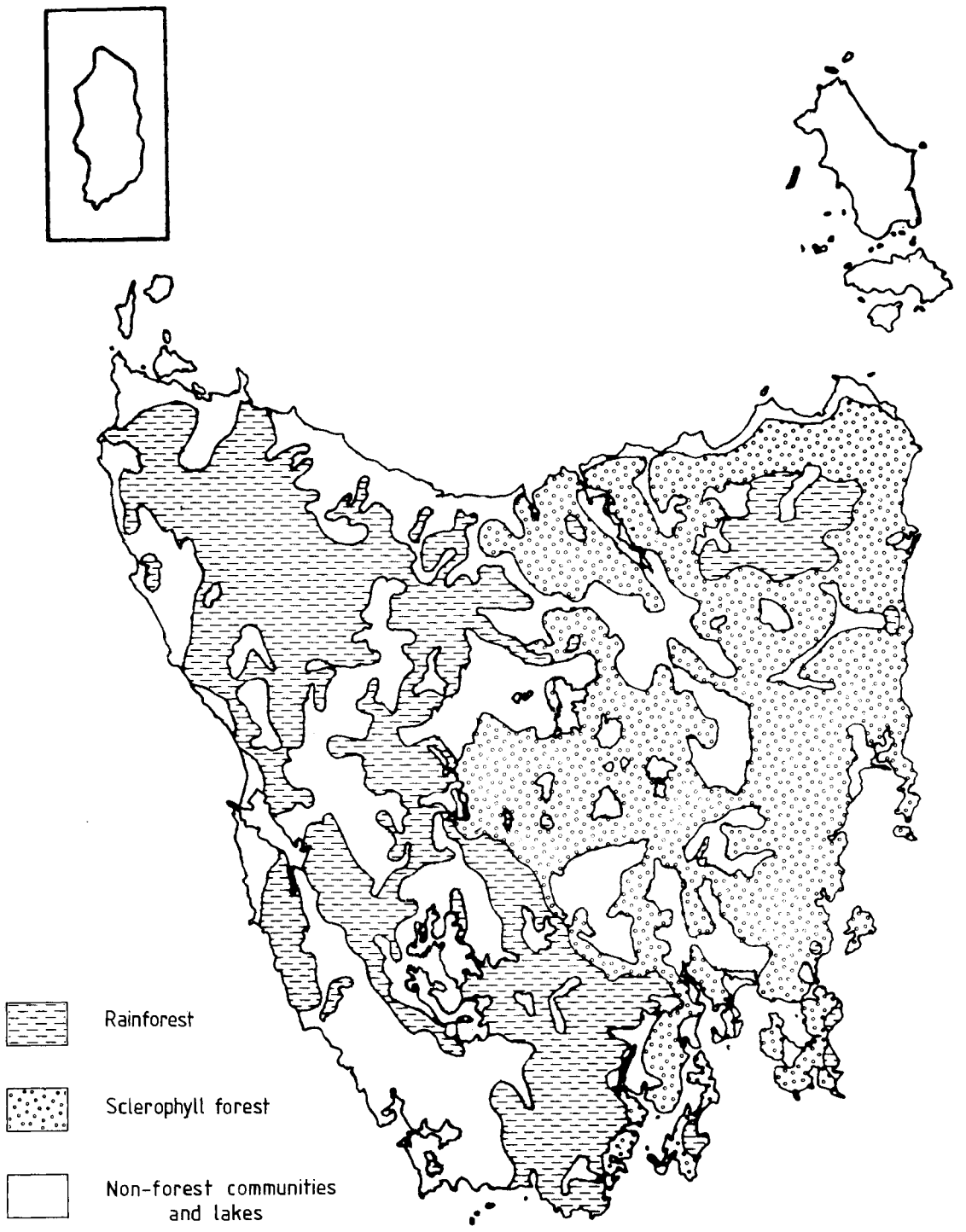

Fig. 73. Distribution of forest types in Tasmania (after Jackson, 1965: adapted from Thomas, 1978).

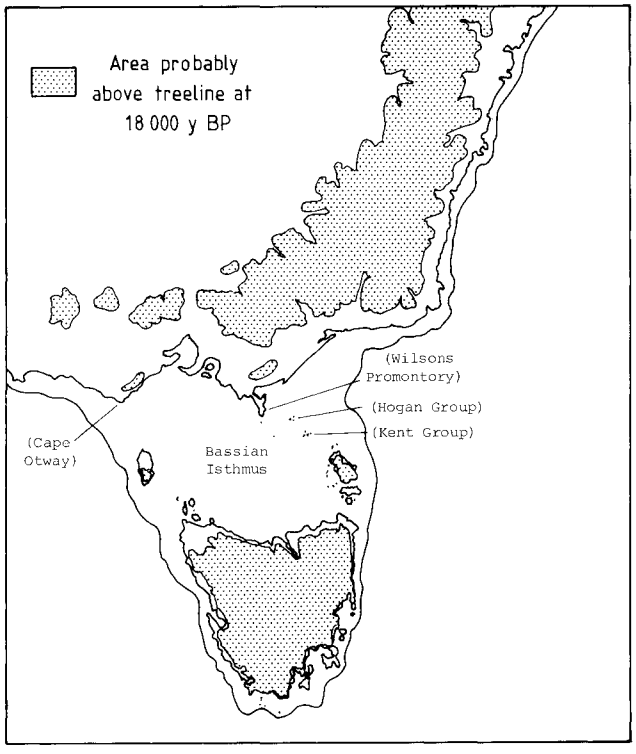

Fig. 74. Reconstruction of south-east Australian environments at about 18 000 y BP, showing areas of glacial-periglacial and alpine-subalpine influence (above treeline). Supposed coastline corresponds to -150 m contour of present day. Present coastline superimposed for reference, modern place-names bracketed. Adapted from Rawlinson (1975).

consists of an unconsolidated till probably older than 120 000 y BP, and an even earlier tillite. Cool, dry conditions prevailed in southern Australia before 40 000 y BP; over the next 10 000 y, precipitation effectiveness increased (Bowler *et al.*, 1976). This was possibly due to a drop in temperatures at the beginning of the most recent cold phase. Between 30 000 and 25 000 y BP, glaciers were active in Tasmania, and periglacial activity occurred at low altitudes. During the next 10 000 y, the lowest temperatures on the Australian mainland were experienced (Bowler *et al.*, 1976), and the sea-levels dropped over 130 m as water was locked up in ice, reaching their minimum at 20 000–18 000 y BP (Milliman & Emery, 1968; Gill, 1971). During this time, the greatest aridity on the Australian mainland occurred (Bowler *et al.*, 1976).

Pollen studies in Tasmania give some indication of the local vegetation during the last glaciation. Between 28 000 and 14 700 years ago, the area north of Tasmania, exposed by low sea-levels, supported open shrubland and later, grassland, becoming more open, with abundant composites. Eucalypts were present in the area, but sparse. This cold steppe formation probably extended from the Adelaide region in South Australia down to and across the Bassian Plain which was subject to colder, drier and possibly windier conditions than occur today (Hope, 1978). At the closing stages of glaciation, Tasmania probably also bore sparse grasslands in lowland situations. Climates there too were cold and dry, and a west-east precipitation gradient existed, causing 'glacial-arid' conditions in eastern Tasmania (Macphail, 1975, 1979). Any forests which existed probably consisted mainly of eucalypts and *Acacia*, and occurred on the continental shelf. Rainforest species survived as minor constituents of scrub in western Tasmania, on lowlands or occupying wet gullies. The climatic timberline was near present-day sea-level in the west and at about 400 m in the east.

Using rates of sea-level change from several sources and depths from navigational charts, Rawlinson (1974) determined postglacial isolation dates of various land masses in south-east Australia (Table 4). Bass Strait was last dry from 22 500 until 12 750 y BP. Figure 74 shows the coastline of south-east Australia at 18 000 y BP, assuming that the sea was 150 m below its present level. The outline and extent of glacial-periglacial and alpine-subalpine zones are from Rawlinson (1975). These zones correspond approximately to the area which was above the timberline in Tasmania before 11 500 y BP, according to Macphail (1979).

The reforestation of Tasmania during the period of postglacial rising temperatures has been intensively studied by Macphail (1975, 1976, 1979; Macphail & Peterson, 1975; Macphail & Jackson, 1978). Temperatures rose rapidly from before 11 500 until 9500 y BP; precipitation levels increased and deglaciation of highland areas occurred during this period. Grasslands and heathlands were replaced by forest, although this process was retarded in the east by low rainfall. Subsequent climatic changes have been slight, althouth temperature and effective precipitation increased somewhat to a climatic optimum occurring between 8000 and 5000 y BP.

Nothofagus forest was most widespread at about 7800 y BP. Closed forests developed first, but at 4600 y BP, more open forests prevailed. Sclerophyllous taxa (eucalypts) became more widespread, and the

Table 4. Approximate severance dates for land links near Tasmania during most recent major rise of sea-level. Information from Rawlinson (1974) and navigational charts.

Land Link	Depth of channel (m)	Date (y B.P.)
Craggy I. — Flinders I.	44	11 000
Clarke I. — Swan I.	31	9500
Swan I. — Tasmania	8	6250
Hogan Group — Wilsons Promontory	60	12 750
Hogan Group — Kent Group	60	12 750
Kent Group — Flinders I.	53	12 000
Robbins I. — Tasmania	2	5000
Hunter I. — Tasmania	10	7000
King I. — Tasmania	50	11 750
King I. — Cape Otway	80	14 750
Bruny I. — Tasmania	9	6750
Maria I. — Tasmania	7	6250
Schouten I. — Tasmania	18	7750

effect of fire (largely due to man) caused rainforests to become more restricted, and *Gymnoschoenus* sedgelands to spread in the west.

Since 8000 y BP, Hunter Island, off north-west Tasmania, has carried coastal shrubland like that now found there (Hope, 1978).

It is clear that during the last glaciation in Tasmania, and probably in mainland Australia, landhopper habitats were severely restricted. Forest cover was apparently very limited, in great contrast to conditions which had prevailed for most of the Cenozoic, and to those found today. Even when Bass Strait was not a marine barrier, it appears that vegetation types there were not those which might be expected to support amphipod populations. The overall dryness which limited the extent of forest would not have encouraged the movement and spread of this fauna.

Zoogeography of Tasmanian landhoppers

Endemism of the Tasmanian fauna. The landhopper fauna of the main island of Tasmania comprises fifteen species, of which only one *(Arcitalitrus bassianus)* is found on the mainland of Australia. If species occurring on the Tasmanian mainland but not on the Australian mainland (even if they exist on islands in Bass Strait) are designated endemics, then the endemism of Tasmanian land amphipods, at the species level, is 93%.

The explanation of this very high rate of endemism is evident from the discussion of previous environments; despite recent land connection, the Bass Strait area has for a long time been a barrier to the north-south movement of forest dwelling landhoppers. During the last period of connection, this barrier was climatic, due to the aridity of the Bassian Isthmus, inhibiting exchange of desiccation-prone organisms. Friend (1980) compared rates of endemism among Tasmanian representatives of a number of faunal groups. He found that there was a strong correspondence between endemism and lack of vagility. Groups of poor vagility which possess means to withstand dry periods (e.g. land planarians, molluscs) display lower endemism than the Tasmanian landhoppers and other obligate soil and litter dwellers.

The endemism displayed by Tasmanian faunal groups is to some degree ecological, that is, due to the different requirements of the species and the different conditions prevailing on either side of Bass Strait. Tasmania is generally cooler and wetter than Victoria; sedgeland and alpine herbfield are either absent or at least floristically different in the mainland State. However, most Tasmanian forest habitat types are represented in Victoria, the wetter ones being found on southern mountains such as the Otway Range. Amongst forest-dwelling animals then, the relatively low endemism displayed by the more vagile groups (Friend, 1980) indicates that for the less vagile groups, ecological differences probably make only a small contribution to endemism. It is reasonable to assume that establishment might have occurred to a similar degree amongst the less vagile groups had Bass Strait not been such an effective barrier.

At the generic level, the endemism of Tasmanian landhoppers is much lower. Only three *(Mysticotalitrus, Orchestiella* and *Tasmanorchestia)* of the seven genera found in Tasmania do not also occur on mainland Australia. Islands isolated from Tasmania since the late Pleistocene support populations of landhoppers indistinguishable from their conspecifics on the main island. These observations indicate that extensive interchange of animals between Tasmania and mainland Australia last occurred much earlier than the most recent period of land connection.

Biogeographic provinces and patterns of species distributions. The distributions of landhopper species in Tasmania and some of its offshore islands are shown in maps in the 'Systematics' section and summarised in Table 5. The table shows the occurrence of each species in the biogeographic provinces delimited by Neboiss (1977). The boundaries of these provinces, which were determined on the basis of geology, landforms, rainfall and vegetation, are shown in Figure 75.

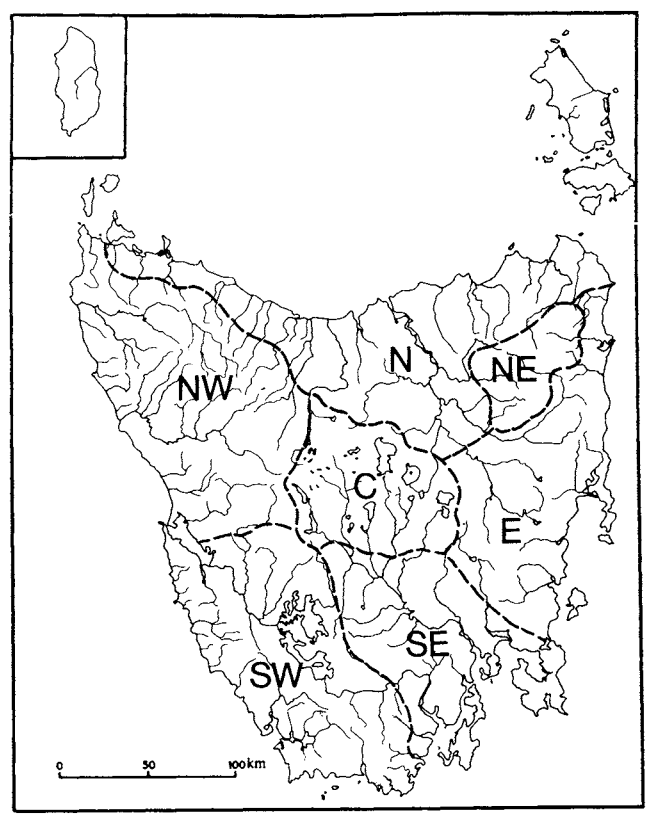

Fig. 75. Biogeographic provinces of Tasmania, after Neboiss (1977). N: Northern province; NE: North-eastern province; E: Eastern province; C: Central province; NW: North-western province; SW: South-western province; SE: South-eastern province.

Table 5. Distribution of Tasmanian landhoppers in biogeographic provinces of Neboiss (1977) and on offshore islands. X indicates species present; 0 indicates presence only at edge of province.

Province:	*Protaustrotroides victoriae*	*Austrotroides longicornis*	*Austrotroides leptomerus*	*Austrotroides maritimus*	*Neorchestia plicibrancha*	*Mysticotalitrus tasmaniae*	*Mysticotalitrus cryptus*	*Arcitalitrus bassianus*	*Keratroides albidus*	*Keratroides vulgaris*	*Keratroides pyrensis*	*Keratroides rex*	*Keratroides angulosus*	*Orchestiella neambulans*	*Orchestiella quasimodo*	*Tasmanorchestia annulata*
NW				0	X			X	X	X		X	X	X	X	X
SW		X	X	X	X	X	X		X	X		X	X	X	X	X
SE		X	X	X	0	X	X			X						
C						X				X						
E						X	X			X			X			
NE										X	X		X			
N									X	X	X	X	X			0
North-west islands:																
King I.	X							X				X				X
Hunter I.								X				X				X
Robbins I.								X		X		X				X
South-west islands:																
Breaksea I.				X								X				X
Southern islands:																
De Witt I.			X	X	X		X		X	X		X	X		X	
Flat Witch I.				X								X				X
Maatsuyker I.				X	X		X		X			X	X			X
Ile du Golfe				X						X						
Eastern islands:																
Bruny I.					X	X				X						
Maria I.						X				X						
Schouten I.						X				X						

The most significant of these boundaries with respect to landhopper distribution is the eastern limit of the North-western and South-western provinces. A number of species extend to, but not east of this line, which is near the eastern limit of extensive rainforests in the south, and the western edge of the Central Plateau (Central province) to the north. The Central Plateau provides only poor habitat for terrestrial amphipods. Within the western provinces the highest numbers of species exist, and there are local areas of very high species richness on the south coast, in the Macquarie Harbour-Franklin River area, and in the far north-west. These concentrations of species may indicate the locations of landhopper refugia during the arid period of the late Pleistocene. All three species with disjunct distributions, *Keratroides angulosus, Austrotroides longicornis* and *A. maritimus,* are found on the south coast. This area, therefore, appears to have been particularly important for landhoppers at that time, probably due to the rainfall derived from exposure to southerly winds. Further collecting between Low Rocky Point and New River Lagoon may significantly increase the size of this supposed refugium.

The land amphipods of Tasmania show a range of distribution patterns, but they may be broadly classified into three groups, the western forest group, the eastern forest group and coastal group.

a) The western forest group: *Orchestiella neambulans, O. quasimodo, Neorchestia plicibrancha, Austrotroides longicornis, A. leptomerus, Keratroides albidus.* This group includes species which are restricted to the western half of the island (the North-western and South-western provinces), and are almost exclusively found in forest habitats. As shown in Figure 72, this area experiences the highest rainfall in Tasmania, while the most important forest communities are rainforest and wet sclerophyll forest. The species comprising this group, which clearly have failed to colonize the drier eastern side of the island, generally display a high degree of plesiomorphy. This gives rise to the suggestion that the development of apomorphic characters in landhoppers occurs in parallel with the development of eurytopicity.

None of the landhopper species of this group are found in the North-eastern province, a substantial high-rainfall area in north-east Tasmania around the Ben Lomond massif and the mountains to the north. Precipitation in this region is not as high as in some parts of the west, but it is high enough to allow the development of climax *Nothofagus* rainforest. The absence of the western amphipod group implies that this tract of rainforest has always been disjunct from those of western Tasmania. In fact, Macphail's findings (1975, 1979) suggest that the occurrence of rainforest here is of postglacial origin. The glaciation of the area in the Late Wisconsin was very limited (Derbyshire, 1972) despite its altitude (up to 1573 m). This was apparently due to low precipitation levels prevailing in eastern Tasmania during the last glaciation. It is probable, therefore, that the western forest group survived this glacial period in lowland forest remnants in the west and has not colonized the eastern rainforest since then.

b) The eastern forest group: *Mysticotalitrus tasmaniae, M. cryptus, Keratroides vulgaris, K. pyrensis, K. angulosus.* While these species occur in forests in the drier eastern side of Tasmania, all but *K. pyrensis* are also found in the west. On the other hand, each of these species shows a different distribution pattern, and these will be discussed individually, below.

c) The coastal group: *Tasmanorchestia annulata, Austrotroides maritimus, Keratroides rex, Arcitalitrus bassianus.* These species are restricted to coastal situations to various degrees. *Austrotroides maritimus* and *K. rex* occur only within a few metres of the shore. One might speculate that these species are restricted to this habitat by a poorer ability to retain ions than is possessed by the forest species, as suggested by MacIntyre (1954) in his comparison of the sandhopper *Talorchestia quoyana* (Milne Edwards) with the more eurytopic *T. telluris* (Spence Bate).

Tasmanorchestia annulata is found further inland than *A. maritimus* and *K. rex,* but is also found with them near the coast, and the three species together form the landhopper fauna typical of small western and southern islands around Tasmania. *Tasmanorchestia annulata* is a common forest species only in the far north-west, where the species of the western forest group are poorly represented or absent. In the south, this species may therefore be restricted by competition to the coastal areas.

On the islands of the Hunter Group, off north-west Tasmania, and on King Island, *Arcitalitrus bassianus* replaces *Austrotroides maritimus;* the typical north-west island fauna thus comprises *K. rex, T. annulata* and *A. bassianus.*

Distribution of genera. While the ecological groupings above are a useful way to describe modern distributions, the history of the terrestrial amphipod fauna may be better elucidated by comparing the distributions of related species. This is done within generic units.

The endemic genera *Orchestiella* and *Tasmanorchestia* are found only in Tasmania, although relationships with *Agilestia,* the other Australian cuspidactylate genus from Victoria and Queensland, may yet be established. The component species of these genera are all found in western Tasmania, with *T. annulata* occurring on southern, western and north-western offshore islands and King Island. The northern range extension is apparently only recent, as there is little morphological divergence between specimens from isolated populations.

Mysticotalitrus is also endemic to the Tasmanian region, with the distribution of both species centred

in the south-east of the Tasmanian mainland. Both occur on islands off the east coast, but the range of *M. cryptus* includes De Witt and Maatsuyker Islands and extends further into the west than that of *M. tasmaniae*. It is likely that both species were restricted to southern relict forest areas during the height of the recent glacial-arid period, extending northward during deglaciation to colonise the east coast islands before they were isolated. On the other hand, morphological differences between populations of *M. tasmaniae* north and south of the Derwent River point to a possible disjunction at some time, and gene flow within that species may still be restricted.

Both species of *Mysticotalitrus* are able to live in much drier situations than those usually found in the western half of the island. Unlike *Keratroides vulgaris,* however, these species are not strongly represented in the wetter areas.

Mysticotalitrus may be related to the *Talitriator eastwoodae* Methuen complex of South Africa (E.L. Bousfield, pers. comm.). If this is so, and the modern distributions are due to continental drift, an origin of the group before the end of the Cretaceous (McKenna, 1973) is implied.

Neorchestia. Another two species of *Neorchestia* occur in the south-western wet sclerophyll forests of Western Australia (unpublished data). This disjunct distribution is presumably the result of a former wide occurrence of this genus. Southern Australia has experienced long periods of mesic climate since the early Cretaceous, and Tasmania has been linked to the mainland during some of this time. On the basis of the present-day distribution of the mallee eucalypts *Eucalyptus diversifolia* and *E. incrassata,* Parsons (1969) has argued that Late Pleistocene low sea-levels led to wooded coastal areas south of the Nullarbor Plain, which could have provided migratory routes for forest taxa. However, the morphological divergence between the species of *Neorchestia,* as well as that between the species of *Austrotroides* from the two areas (see below), is consistent with the most recent continuous distribution of these genera across southern Australia much earlier than the late Pleistocene. In addition, evidence produced by Hope (1978) suggests the existence of an extensive grassy plain between Adelaide and north-west Tasmania at that time. It is likely, therefore, that any forest development on the southern coastal plains was an open, dry sclerophyll forest, mallee or savannah woodland formation typical of low precipitation levels (Macphail & Jackson, 1978). This would provide no suitable habitat for the fauna of mesic forests, especially amphipods.

Austrotroides. The Tasmanian species of *Austrotroides* show sometimes disjunct distributions confined to the south of the island. While generally restricted to wet forests, *A. longicornis* and *A. leptomerus* are often found in drier microhabitats than sympatric species, while *A. maritimus* is strongly confined (on the Tasmanian mainland) to backshore habitats. These disjunct distributions (Figs 4, 13) provide evidence of restriction of previously wider distributions. This can be understood in terms of the late Pleistocene contraction of forest habitats; it is possible also that the two forest species have not since returned to their former ranges because of competition with more apomorphic forms like *Keratroides vulgaris* (see below).

The existence in Western Australia and South Australia of further *Austrotroides* species (Friend, 1982) implies that ancestors of these species inhabited the extensive southern forests of the Cretaceous and Tertiary periods at some time. The Tasmanian and mainland Australian groups can be distinguished from each other today, so it appears that the groups were derived from different, though related, progenitors. The distinctness of the Western Australian and South Australian forms from each other also casts doubt on the availability of a late Pleistocene migration route south of the Nullarbor Plain, at least for amphipods.

Both groups of *Austrotroides* display a number of apomorphic features, such as the large anseriform posterior gills and reduced pleopods. It is thus most likely that the progenitors of these groups, and their common ancestor, also possessed these features, which are evidence of substantial adaptation to the terrestrial environment. Two of the present-day mainland Australian species (*A. pectinalis* and *A. crenatus)* are found in drier habitats than most land amphipods. It is interesting to consider, therefore, whether the ancestral *Austrotroides* occurred in dry or wet habitats. Two possibilities are as follows:

1) The predecessor of *Austrotroides* was adapted to dry forests, but the Tasmanian colonist moved into moister southern forests and radiated into those habitats. In support of this alternative are the extreme morphological adaptations to life on land, which might have developed more quickly in a dry habitat. Modern Tasmanian species appear to inhabit dry microhabitats within the wet forest ecosystem.

2) The ancestor of *Austrotroides* was adapted to wet forests. Tasmanian species arose, and persist within this habitat (except *A. maritimus,* which lives in wet coastal habitats). The Australian species also appeared in wet forests but with the development of aridity during the Tertiary (Beard, 1977) were pushed to south-coastal ranges and trapped in habitats which became progressively drier.

The second alternative appears more reasonable, because Tertiary climates in southern Australia were generally mesic.

The relationship between the amphipod faunas of Tasmania and Western Australia is by no means unique. Spencer (1896), in delimiting Australian faunal provinces, united Tasmania and south-west Western Australia with parts of Victoria and coastal New South Wales in the Bassian province because of faunal similarities. He separated this from the arid Eyrean and tropical-subtropical Torresian provinces.

Arcitalitrus. This is a morphologically apomorphic genus, possibly in a phase of expansion. *Arcitalitrus sylvaticus* is an opportunistic species which is common in gardens of Melbourne and Sydney, although being replaced to some extent in Sydney by the introduced *Talitroides topitotum* (Burt) and *T. alluaudi* (Chevreux). Centres of distribution of this genus appear to be near the New South Wales/Victoria border, where five species are found, and the New South Wales/Queensland border, where there are four species, the only species common to the two areas being *A. sylvaticus* (unpublished data). *Arcitalitrus bassianus* is a predominantly Victorian species occurring in a wide range of habitats from wet to dry sclerophyll forest in Victoria, surviving in fairly open situations in coastal heath, as well as teatree woodland, in the Hunter Group.

It is most likely that this species moved into Tasmania during the last glaciation, and that this invasion occurred along the western side of the Bassian isthmus, isolating populations, which persist on those islands today. This side of the isthmus apparently bore more shrubs and patches of woodland than other exposed land in Bass Strait (Hope, 1978) because of higher rainfall from the westerlies.

While *A. bassianus* has survived well on the islands, it appears to be ecologically restricted to the far north-west of the Tasmanian mainland, possibly through interaction with other landhopper species. The distribution of the bullfrog *Limnodynastes peroni,* which resembles that of *A. bassianus,* may be limited by competition with other species of frog (Littlejohn & Martin, 1974).

Keratroides. Species of this genus show a variety of distribution patterns which seem to bear little relationship to each other. However, if they are examined closely, several interesting facts emerge.

The genus *Keratroides* comprises three subgroups: *Keratroides albidus,* the most morphologically specialised species, the *vulgaris*-group and the *kershawi*-group. Both the *vulgaris*-group and *kershawi*-group are found in Victoria, in Tasmania and on some eastern Bass Strait islands.

Although *Keratroides albidus* is the species most specialised for a particular microhabitat, it is the only species of the genus with biramous setose pleopods, a plesiomorphic feature. It shows a western forest distribution and does not occur off the Tasmanian mainland. These observations suggest that the ancestor of *K. albidus* was an early offshoot from the *Keratroides* line which became established in Tasmania before the other extant species of the genus arose. A Tasmanian origin for the group is therefore postulated, followed by a northward spread of the genus as far as Victoria.

The *vulgaris*-group is represented by an undescribed species from East Gippsland, Victoria, and by three species in Tasmania, but reaches its greatest diversity in the Furneaux Group, where six species have been found.

The *kershawi*-group includes the most apomorphic species of the genus, and consists of at least five species. One of these occurs on the Tasmanian mainland, two on the eastern Bass Strait islands, and two or more in Victoria.

While distributions appear to have been modified by events in the last 30 000 years (see below), *Keratroides* seems to have been established in both Tasmania and Victoria before their latest land connection.

Bass Strait island faunas. The landhopper fauna of the western Bass Strait islands (Hunter Group and King Islands) shares species with Tasmania and Victoria, differing completely from the fauna of the eastern islands in the Strait, which is highly endemic. This situation is unusual among animal groups, in which distinct faunal elements have tended to arise on King Island, apparently due to long-term isolation. For instance, an endemic emu, *Dromaius minor,* occurred there in the early days of white settlement (Green & McGarvie, 1971); Hynes & Hynes (1980) decided that King Island representatives of the stonefly *Reikoperla tribloba* deserved subspecific recognition. An explanation of the rather different situation found amongst the landhoppers of Bass Strait follows.

The western isthmus. The four terrestrial amphipod species occurring on King Island are all found in either Victoria or Tasmania, suggesting that their occurrence on King Island results from the existence of continuous populations during a recent period of dry land connection, probably in the last glaciation. The two predominantly Victorian species found there, *Arcitalitrus bassianus* and *Protaustrotroides victoriae,* both occur in fairly dry habitats in Victoria, as well as in dry sclerophyll forest. The two Tasmanian species, *Tasmanorchestia annulata* and *Keratroides rex,* both belong to the coastal group and were in fact found in situations near the west coast of King Island. The dry climate and shrubland-grassland vegetation of the isthmus during the period of connection have already been described, and consequently it is not surprising that the Tasmanian forest amphipods are not represented today on King or Hunter Islands.

The eastern isthmus. At the most recent time of lowest sea-level, a low ridge ran in a north-westerly direction between Tasmania and Victoria on the eastern side of the Bassian Isthmus. Raised above the general level of this ridge were a number of granite knolls, which today are islands, such as Curtis and Rodondo, and the Kent and Hogan Groups. The most striking features would have been the peaks still exposed on Flinders and Cape Barren Islands.

There are very little data indicating the nature of environments on this side of the Bassian Isthmus during this period of exposure. Macphail (1975) postulated a strong west-east decrease of

precipitation for Tasmania at that time, but due to the low relief of the western margin (Jennings, 1959), this rain-shadow effect on the moisture-bearing westerlies would have been much weaker across the isthmus. The eastern granite hills may have caused some local orogenic rain allowing the development of wooded pockets, but these were surrounded on all sides by extensive *Poa* grasslands which apparently covered much of the isthmus (Hope, 1978).

The landhoppers so far found on the eastern Bass Strait islands (from the Kent Group to Swan Island) belong to eight species, all of which are in the genus *Keratroides,* and all of which, with the possible exception of one species, are endemic to that island chain. The occurrence of several of these species on a number of different islands suggests that there was movement between those areas of the isthmus and that species have not arisen since isolation. During the final stages of deglaciation (11 500–9500 y BP), rainfall increased markedly (Macphail, 1975) probably causing an increase in woody vegetation near these eastern hills. A range expansion by amphipods might then be expected on parts of the isthmus still exposed. By this time, however, most of the island groups were already isolated (Table 4) so the distribution of species on the islands was apparently due to previous movement across grassland habitats.

There is no trace of any of these species on King Island or the Hunter Group, so they appear to have been absent from this side of the isthmus.

Two alternative hypotheses are advanced in explanation:

a) The eastern group reached the western margin but could not compete with those species on that side, where rainfall was high enough to support both groups.

b) The eastern group was limited to areas on the eastern side and did not cross the central plain. The grassland(?) of the central Bassian Plain may have been a less suitable amphipod habitat than that between the eastern granite outcrops.

Both explanations are plausible on the basis of the data available. A discussion of possible competition which has some bearing on this matter follows.

Range expansion by *Keratroides vulgaris*. The distribution of *K. vulgaris* (Figure 41) stands out amongst that of other Tasmanian species because of its almost ubiquitous presence on the main island. At the same time it is noteworthy that while occupying Schouten, Maria and Bruny Islands in the east, *K. vulgaris* is present on only a few of the islands off other coasts, and then only those closest to the mainland (Ile du Golfe, De Witt and Robbins Islands). It is tempting to suggest that this distribution is due to a range expansion by this species near the time when the sea was approaching its present level, and only the closer islands were still connected to mainland Tasmania.

By inspection of Table 4, it is possible to postulate a time for this expansion and a direction from which it came. For instance, *K. vulgaris* reached Schouten Island, but apparently not Hunter Island, although Schouten was cut off first. This species does not occur on Swan Island either, although that link to Tasmania was severed at about the same time as that to Maria Island. If extinctions of *K. vulgaris* on offshore islands have not created a false impression, then this distribution corresponds to an expansion of the range of the species during the postglacial increase in rainfall in the midlands and southern Tasmania between 11 500 and 6000 y BP as climates approached the 'optimum' mentioned earlier. This expansion appears to have originated in the east. Unfortunately there are no published soundings for waters inshore of or between the islands of the Maatsuyker Group, so it is impossible to test this hypothesis with respect to the presence of *K. vulgaris* on only De Witt Island and Ile du Golfe. Other data, however, contribute interesting extensions to this discussion.

The absence of all (or all but one) of the eight eastern Bass Strait island species from the Tasmanian mainland is intriguing, especially as one of these species is found on Swan Island, 3 km off the north-east coast. It is reasonable to expect that this species once occurred in what is now north-east Tasmania, leading to the suspicion that its absence now is connected with the presence of *K. vulgaris* in that area. All species of *Keratroides* coexisting with *K. vulgaris* occupy microhabitats which are distinctly different from the forest litter microhabitat of this widespread species. *Keratroides albidus* burrows deep in the soil of rainforests, *K. angulosus* inhabits lower levels in the soil/litter profile than *K. vulgaris,* and *K. rex* is found exclusively in backshore habitats, except on islands from which *K. vulgaris* is absent, where it occurs further inland. *Keratroides pyrensis* occurs in streamside litter in north-eastern Tasmania. This evidence suggests that other *Keratroides* species cannot coexist in the litter with *K. vulgaris,* and that this may account for the absence of eastern Bass Strait *Keratroides* species, some of which appear to be litter dwellers, from the mainland of Tasmania.

None of the island *Keratroides* species have been found in Victoria. A similar hypothesis may be advanced to explain this distribution, candidates for the displacing species being *Arcitalitrus sylvaticus* and *Keratroides kershawi.*

If this suggestion is correct, then the eastern Bass Strait island species seem to have been well adapted to dry conditions by the end of the Late Wisconsin glaciation. They were apparently unable to compete with some species adapted to more mesic conditions, only persisting today in places protected by water barriers from invasion by the latter group.

Conclusions

The zoogeographic evidence presented above points to a number of conclusions about the Tasmanian landhoppers.

1) Species show a high tendency to be endemic or restricted in distribution. Despite a recent land connection, and the opportunity for dispersal through rafting, only one species is shared between the Tasmanian and Victorian land masses. Islands much closer offshore (in eastern Bass Strait) possess species not found on the Tasmanian mainland and lack mainland species. It appears then, that rafting and subsequent establishment of landhoppers are not important processes in their zoogeography.

2) At the generic level, present-day distributions (particularly *Neorchestia* and *Austrotroides)* imply that that identifiable ancestors of at least part of today's fauna existed in the early Tertiary.

3) Within the Tasmanian fauna at least, the development of apomorphy and the development of eurytopicity (particularly with respect to an ability to live in less humid habitats) have occurred in parallel. Thus genera possessing the most apomorphic features (*Keratroides, Mysticotalitrus)* occur in the drier eastern half of the island, whereas the more plesiomorphic genera (*Orchestiella, Tasmanorchestia, Neorchestia, Austrotroides)* occur in the wetter western areas. An apparent exception, *Austrotroides maritimus*, is restricted in the east to humid backshore microhabitats.

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