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TWO NEW TERRESTRIAL SPECIES OF *TALITRUS* (AMPHIPODA: TALITRIDAE) FROM TASMANIA

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(with one table and five text figures)

ABSTRACT

FRIEND, J.A., 1979 (20 vii): Two new terrestrial species of *Talitrus* (Amphipoda: Talitridae) from Tasmania. *Pap. Proc. R. Soc. Tasm.*, 113: 85-98. ISSN 0080-4703. Department of Zoology, University of Tasmania, Hobart, Tasmania, Australia.

Two new species of terrestrial amphipod from the soil and litter of Tasmanian forests are described and figured. They are provisionally placed in the genus *Talitrus* Latreille (*sensu* Hurley 1955) and, with *T. kershawi* Sayce, in the subgenus *Keratroides* Hurley (1975), which is seen as a highly specialised group of land-hoppers.

INTRODUCTION

Terrestrial amphipods (family Talitridae) were first recorded from Tasmania by Haswell (1881), who described *Talitrus assimilis* from the island, pointing out slight differences which set it apart from *T. sylvaticus* Haswell. In 1885 he synonymised these two species (calling the former species *T. affinis* by mistake). Thomson (1892) described and figured some terrestrial amphipods from Mt. Wellington, near Hobart, assigning them to *T. sylvaticus*. Later Sayce (1909), in his redescription of *T. sylvaticus* from Victoria, mentioned that this species was "very common in Tasmania", but named no material. In 1925, Hunt included some drawings of an unnamed Tasmanian species in his paper on the genus *Talitrus*, but later Ruffo (1949) named this species *T. tasmaniae* Ruffo on the basis of two specimens lodged in an Italian museum, and identified a third specimen as *T. sylvaticus*. Hurley's paper on the genus *Talitrus* in New Zealand (1955) included some figures of Tasmanian material which he identified as *T. kershawi*.

Thus no major work has yet appeared on the taxonomy of Tasmanian terrestrial amphipods. Recent unpublished work has shown that the island has a relatively diverse terrestrial talitrid fauna, and descriptions of two species are presented here. Both are placed in the genus *Talitrus* Latreille, as redefined by Hurley (1955), for reasons discussed below.

TAXONOMY

Family TALITRIDAE Stebbing emend. Bulycheva 1957

Talitrus vulgaris n.sp.
(figs 1-3)

Talitrus sylvaticus Thomson Pap. Proc. R. Soc. Tasm. (1892) *(partim)* - *Talitrus sylvaticus* Ruffo Ann. Mus. civ. Stor. Nat. Genova 63, (1949) - *Talitrus kershawi* Hurley Pac. Sci. 9, (1955).

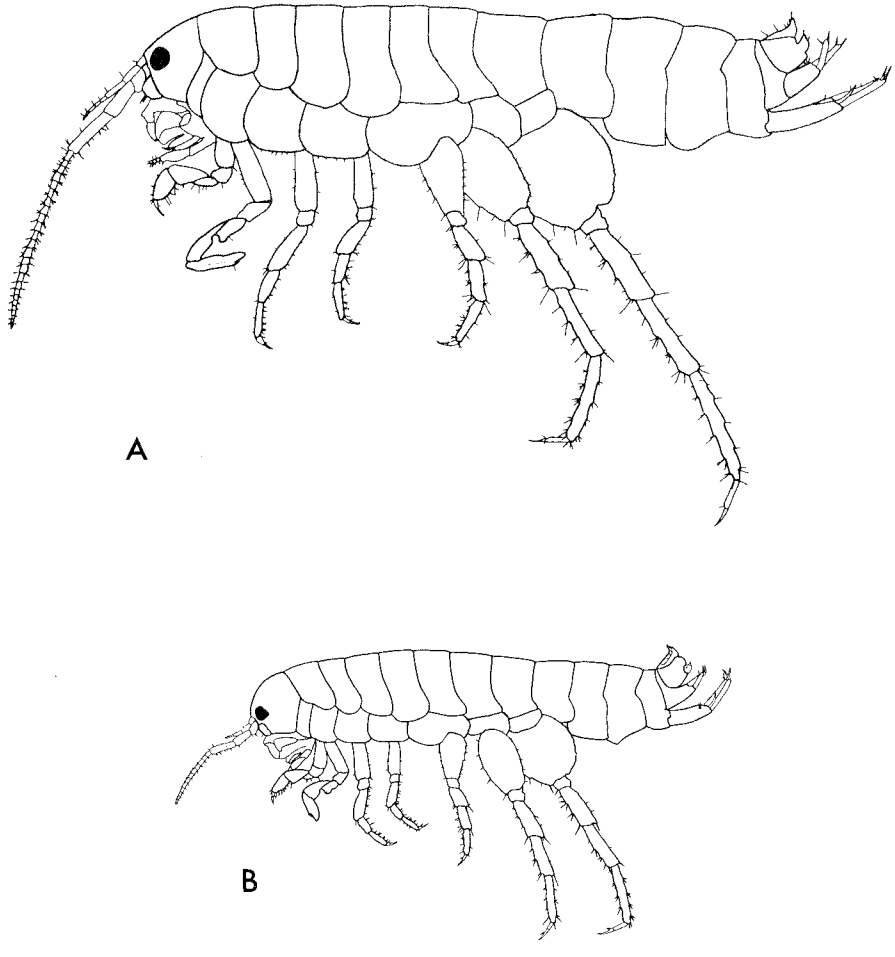

FIG. 1.- a. *Talitrus vulgaris* n.sp., holotype ♀, 11.5 mm; x 7.5. b. *Talitrus angulosus* n.sp., holotype ♀, 7.1 mm; x 7.5.

Description

Female

11.5 mm long; variation in other specimens shown in square brackets. Head as long as deep, dorsal surface gently curving. Eye round, about one third as wide as head is long. Antenna 1 short, almost reaching middle of distal peduncular segment of antenna 2. Flagellum of five segments [range 3-5], shorter than peduncle. Antenna 2, flagellum of 24 segments [range 8-28] each bearing four groups of three spines, except

the distal segment, which bears a group of six or more, and the proximal segment, single spines; peduncle shorter, distal segment as long as penultimate two combined. Upper lip shallow, broad, apically pilose. Lower lip broad, inner shoulders pilose, sides of central trough lightly pilose. Mandible, incisor 3-toothed, left lacinia bicuspate, large cusp with four teeth, molar process well developed. Maxilla 1, inner plate short, narrowing distally, inner margin setose, outer plate setulose proximally, palp situated distal of midpoint of outer margin, very small, 2-jointed. Maxilla 2, outer plate the longer, outer margin bearing five small teeth distally. Maxilliped, inner plate with setose spines distally, three terminal teeth, inner small, others larger; outer plate short, narrowing distally, apex truncate and bearing spine groups at the corners (two spines on outer, nine on inner corner). Palp slender, bearing a few long spines, fourth segment delimited proximally by a slight shoulder.

Gnathopod 1, coxal plate broad with obtusely rounded distal margin, supplied with small spines. Segment 2 broadening slightly distally, poorly spined. Segment 3 shorter than 4, which bears a shallow posterior lobe. Segments 5 and 6, short, equal in length, segment 5 expanded deeply into a scabrous posterior lobe. Segment 6 gently narrowing distally, with strongly spined posterior margin forming a simple hand with the strong dactyl. Gnathopod 2, coxal plate subsquare, gently rounded below, posterior process very small, obtusely rounded. Gill large, with anterior and wide posterior extensions. Oöstegite entirely absent. Segment 2 linear, several large anterior spines. Segment 4 subequal to segment 3, with large scabrous tumid posterior lobe. Segment 6 equal in length to segment 5, both with scabrous posterior surfaces. Dactyl strongly exceeded by sharp apical lobe.

Peraeopods long, slender, larger spines bifid, especially on distal segments. Peraeopods 3 and 4, coxal plate deep, subquadrate, posterior process small, sharply rounded. Gill small, wider posteriorly. Oöstegite narrow, linear, with six long apical setae. Peraeopod 5, anterior coxal lobe shallow, lower margin oblique, lightly spinulose. Posterior lobe smaller, shallow, sharply rounding to slightly excavate posterior margin. Gill small, convoluted, reduced oöstegite of gill-like texture, held laterally across ventral surface. Segment 2, proximally broad, narrowing distally, hind margin straight, spinulose. Dactyl slender, terminal spine curved. Peraeopod 6, posterior coxal lobe moderately deep, squarish distally, hind margin smoothly rounded, weakly serrate. Anterior coxal lobe rounded distally, front margin gently excavate. Gill long, sinuous, proximally convoluted, then flattened, narrowing distally. Segment 2 subovate, posterior margin spinulose, distal lobe very small. Segments 4-6 slender, spinose. Dactyl slender, terminal spine long. Peraeopod 7, coxal plate subrectangular, posterodistally rounded and minutely serrate, with proximal anterior process. Segment 2 subcircular, posterior margin weakly serrate, distal lobe shallow. Segments 4-6 slender and spinose, dactyl slender, terminal spine long.

Epimeral plate 1 shallow, distal margin very slightly oblique. Posterior margin gently convex, weakly serrate and spinulose. Epimeral plate 2 subsquare, lower margin very gently rounded. Anterior corner round, anterior margin bearing one small spine. Posterior margin gently sinuous, weakly serrate and spinulose. Epimeral plate 3 exceeding second plate, lower margin gently convex, oblique anterior corner smoothly rounded; posterior margin gently sinuous, weakly serrate and spinulose along its length, posterior corner sharp.

Pleopods vestigial; peduncle of first short and slender, outer margin gently concave, inner bearing two coupling spines; a single terminal one-segmented ramus [sometimes two rami]: pleopod 2 similar, but both peduncle and ramus shorter; pleopod 3 reduced to a minute stump, with [or without] a small spine. [First instar specimens; pleopods reduced; peduncle of first short, slender, outer margin gently concave, bearing two coupling spines and sometimes a short simple spine; two unequal one-segmented rami present, the outer the longer, each with two long (and sometimes a

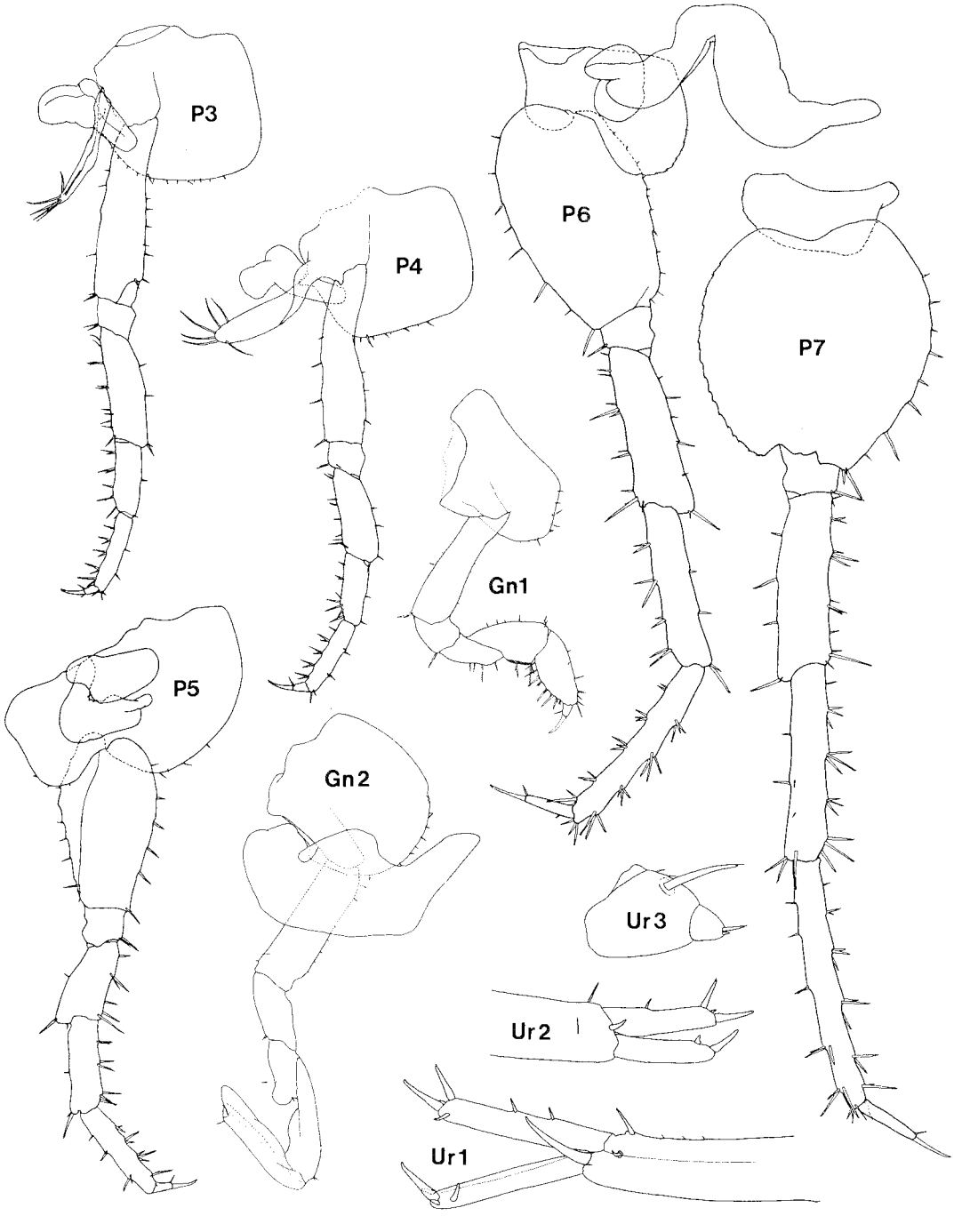

FIG. 2.- *Talitrus vulgaris* n.sp., holotype ♀, 11.5 mm. Gn 1 and 2, P 3-7-x20: Ur 1 and 2-x30: Ur 3-x60.

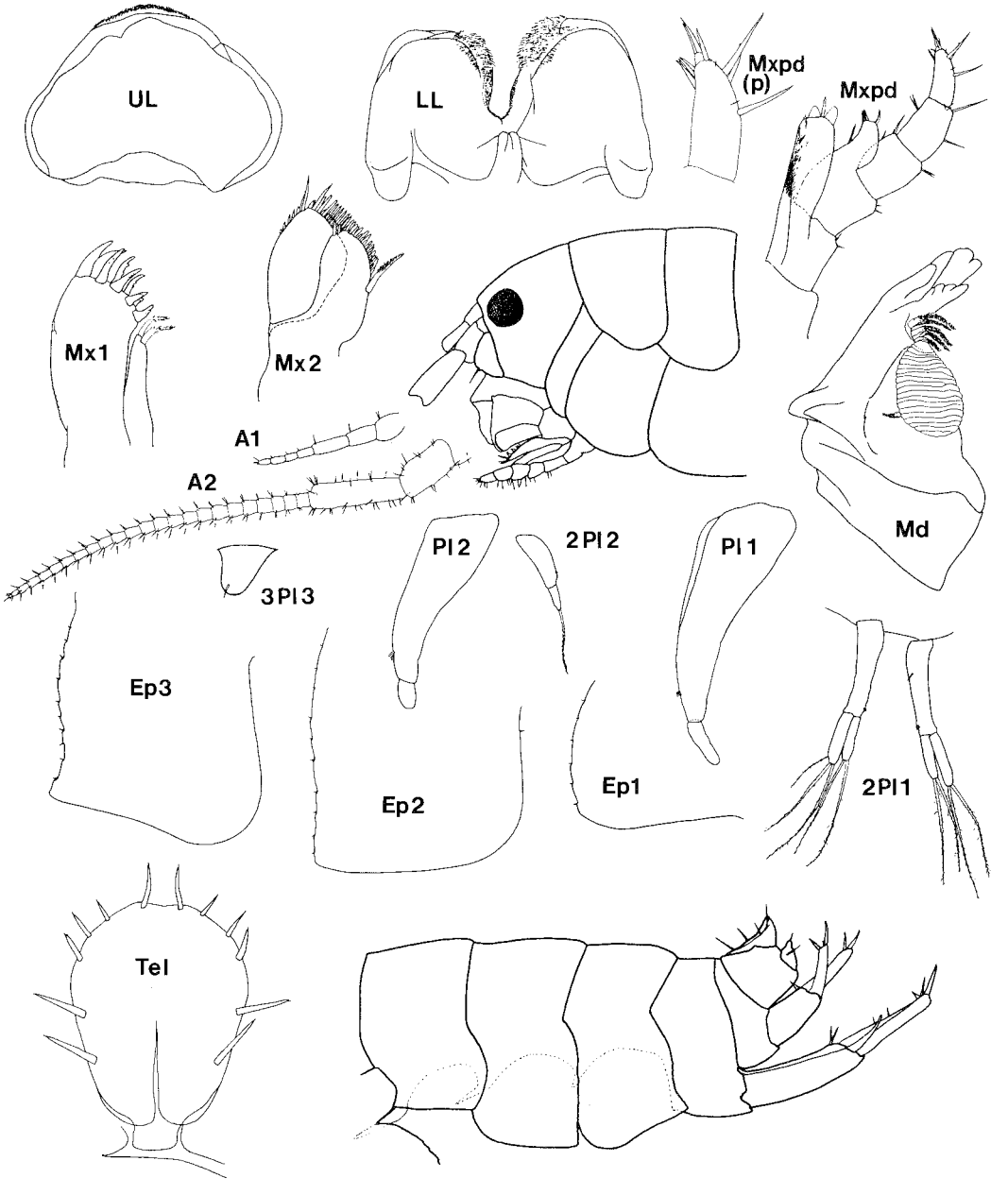

FIG. 3.- *Talitrus vulgaris* n.sp. holotype ♀, 11.5 mm; the prefix 2 applies to an instar 1 juvenile 4.0 mm, Tower Rd., Hobart; the prefix 3 applies to a male 10.4 mm, type locality: Mxpd(p): distal portion, right palp of maxilliped, dorsal view; Mx1, Mx2, Md all left side, dorsal aspect. Head, abdomen, A1 and A2-x15: UL, LL, Md, Mx1, Mx2-x50: Mxpd-x40: Mxpd(p)-x40: P11, P12-x75; P13-x100: Ep 1-3-x30: Te1-x50.

shorter third) plumose setae, with thicker proximal and thinner distal portions. Second pleopod like that of adult, or peduncle very short, outer margin slightly concave, bearing two coupling spines; a one-segmented ramus present, with one long apical plumose seta. Third pleopod a minute stump as in adult specimens.]

Uropod 1, peduncle long, slender, with two subterminal spines, interramal spine long, simple. Rami slender, shorter than peduncle, inner with two marginal spines, outer smooth. Uropod 2, peduncle as long as rami, with two spines near distal end; inner ramus with one marginal spine, outer ramus smooth. Uropod 3 very small, peduncle short, bearing one large lateral spine and several spinules, ramus small, conical with one small and one minute apical spine. Telson longer than wide, widening distally, apex rounded, slightly emarginate, one apical and five [up to five, usually four] marginal spines on each side.

Male

10.8 mm long. Like female, but bearing paired penes ventrally on segment 7 and lacking oöstegites.

Type material

Under leaf litter, *Atherosperma moschatum* stand, gully near Strickland Ave., foothills of Mt. Wellington, near Hobart. UGR 8312-213485 coll. JAF (J.A. Friend) 20/11/1977. Holotype ♀ 11.5 mm ovig. (three eggs), allotype ♂ 10.8 mm, paratypes 9 ♀♀ (1 ovig.) 11 ♂♂, five juveniles. Tasmanian Museum and Art Gallery nos. G1945-G1948. Under leaf litter, *Olearia argophylla* stand near Anglers Creek, off Tower Road, Tooms Lake area. UGR 8413-702229 coll. JAF 12/1/1976, one first instar juvenile. Tasmanian Museum and Art Gallery no. G1949.

Other material examined

Mt. Wellington, coll. E. D'Albertis and O. Beccari 12/2/1878, one specimen, Museo Civico di Storia Naturale, Genova. "Tasmania, old coll." 4 ♀♀ ovig. Australian Museum G5422. Lady Barron Falls, National Park, Tasmania, 19/1/1928, pres. G.P. Whitley, two specimens, South Australian Museum, TC902. Kingston, Tasmania, coll. C. Oke 14/5/1948, 2 ♂♂ 7 ♀♀ National Museum of Victoria.

Distribution

Recent collection has revealed that *T. vulgaris* n.sp. appears to be found in all parts of Tasmania, on Robbins, Schouten, Maria, Bruny and De Witt Islands, and on Ile de Golfe.

Remarks

The synonymies listed above were fairly easily proved. The types of *T. sylvaticus* and *T. kershawi* (registered in the Australian Museum, G5423, and the National Museum of Victoria, respectively) were examined for comparison. Thomson's figure 7 (1892) shows the distinctive sixth peraeopod gill of *T. vulgaris* n.sp. (which he refers to as "the branchiae of the fifth pair"), while his figure of the maxillipeds shows the outer plate with two distinct spine groups on the tips of the truncate apex, unlike the single spine group which is found apically on the sharply pointed outer plate of *T. sylvaticus*. Thomson apparently had more than one species present in his material; this is indicated by the other form of sixth peraeopod gill he describes, and the feathery pleopods figured, neither of which characterises *T. vulgaris* n.sp.

On examination, Ruffo's specimen proved to belong to *T. vulgaris* n.sp.: the distinctive third epimeral plate and fourth peraeopod gill, as well as the form of gnathopods, pleopods and telson, clearly indicated its identity. Hurley's figure

(1955) of the maxilliped of *"T. kershawi"* from Tasmania shows spination very similar to that shown here: in *T. kershawi* from Victoria, the maxilliped outer plate and palp, although similar in shape to those of *T. vulgaris* n.sp., are more spinous. Recent surveys have indicated that *T. kershawi* is absent from Tasmania.

Talitrus angulosus n.sp.
(figs 1, 4 and 5)

Description

Female

7.1 mm long. Head as long as deep, dorsal surface strongly rounded. Eye sub-circular, small, about a quarter as wide as head is long. Antenna 1 very short, reaching only to one third length of distal peduncular segment; flagellum of four segments [3-5] much shorter than peduncle. Antenna 2 short, flagellum of 13 [8-16] segments, all bearing four groups of three spines, except proximal three (groups of two) and distal segment (one group of six); peduncle just shorter, distal segment shorter than penultimate two combined. Upper lip shallow, broad, apically pilose. Lower lip broad, inner shoulders pilose, sides of central trough lightly pilose. Mandible, incisor 3-toothed, left lacinia bicuspate, large cusp 4-toothed, molar process broad, accompanying setose spine large. Maxilla 1, inner plate short, inner margin proximally setose, outer plate, palp relatively large, 2-jointed, near midpoint of outer margin. Maxilla 2, outer plate the longer. Maxilliped, inner plate with inner margin pilose medially, and three setose spines distally; three terminal teeth, inner very small, outer tall; outer plate narrowing distally, apex truncate bearing spine groups at the corners (two spines on outer, four on inner corner). Palp slender, bearing a few long spines, fourth segment delimited proximally by a slight shoulder.

Gnathopod 1, coxal plate broad, almost square distally. Segment 2 broadening distally, poorly spined. Segment 4 longer than 3, bearing a shallow posterior lobe. Segment 6 fairly strongly spined posteriorly, narrowing distally, forming a simple hand with the strong dactyl. Gnathopod 2, coxal plate subsquare, distal margin evenly rounded, lightly spined; posterior process small, bluntly pointed. Gill large, with anterior and wide posterior extensions. Oöstegite entirely absent. Segment 2 linear, lightly spined with two or three larger spines proximally. Segment 4 subequal to segment 3, with large scabrous posterior lobe. Segment 5 equal to segment 6, expanded deeply posterodistally into a scabrous lobe. Segment 6 posterior surface rounded, dactyl well exceeded by apical lobe.

Peraeopods of medium length and stoutness, with larger spines bifid, especially on distal segments. Peraeopods 3 and 4, coxal plate shallow, broad, posterior process prominent, blunt. Gill of medium size, broadening posteriorly. Oöstegite short, linear, five [5-7] apical setae. Peraeopod 5, anterior coxal lobe shallow, lower margin oblique, lightly spinulose, posterior lobe smaller, shallow, posterior margin smoothly rounded. Gill small, convoluted, reduced oöstegite of gill-like texture, held laterally across ventral surface. Segment 2 relatively thin, narrowing distally, posterior margin gently convex, spinulose. Dactyl slender. Peraeopod 6, posterior coxal lobe deep, smoothly rounded distally; anterior lobe not so deep, rounded distally. Gill long, sinuous, convoluted proximally, then flattened, narrowing distally, with medial distal incision. Segment 2 sub-ovate, posterior margin bearing a few spines, distal lobe lacking. Segments 4 to 6 moderately spinose. Dactyl slender, terminal spine long. Peraeopod 7, coxal plate subrectangular, smoothly rounded posterodistally, with proximal anterior process. Segment 2 not very broad, posterior margin weakly serrulate, distal lobe absent. Segments 4-6 moderately slender and spinose, dactyl long and slender.

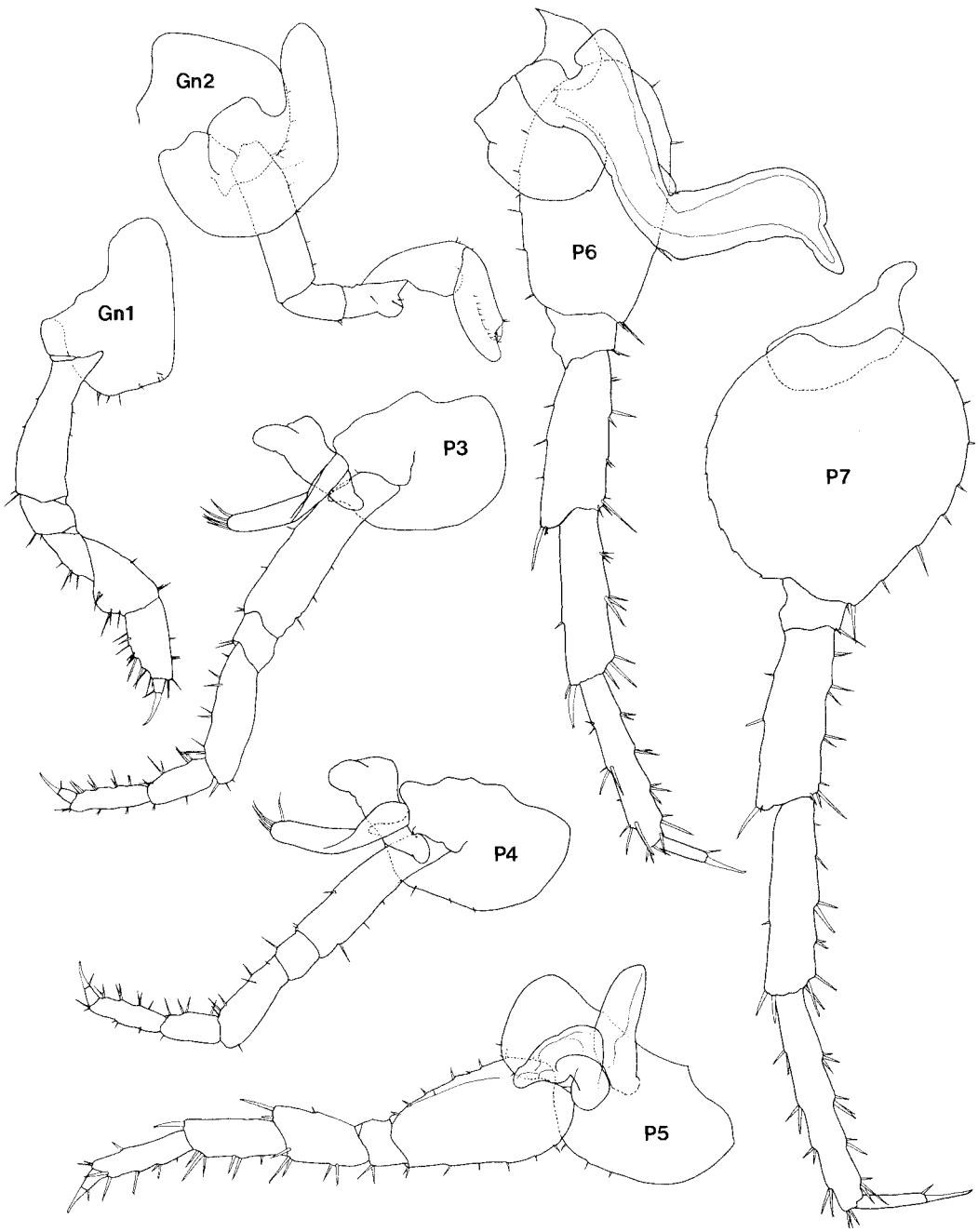

FIG. 4.- *Talitrus angulosus* n.sp., holotype ♀, 7.1 mm. All x 37.

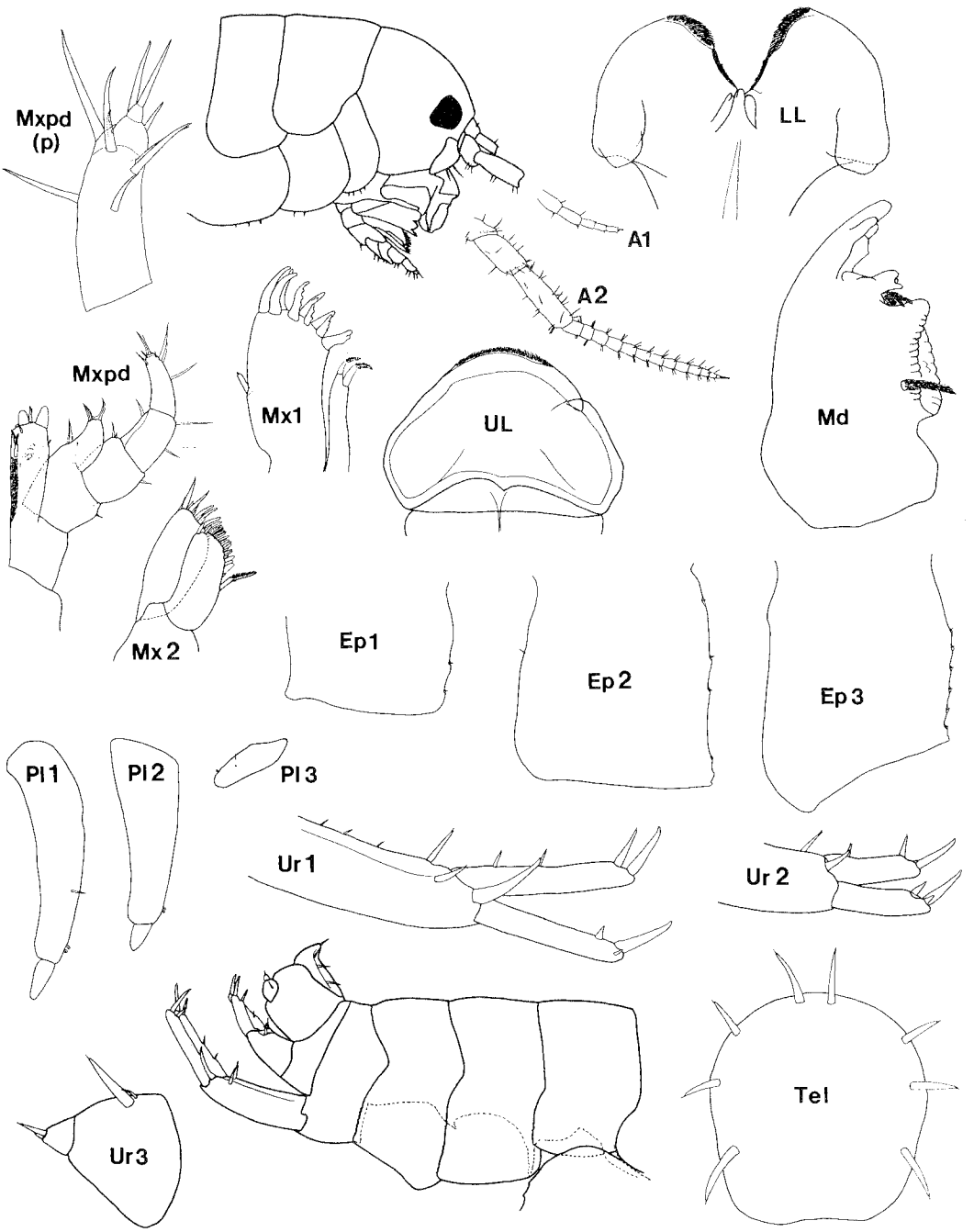

FIG. 5.- *Talitrus angulosus* n.sp., holotype ♀, 7.1 mm. Mxpd(p): distal portion, right palp of maxilliped, ventral view; Mx1, Mx2, Md all left side, dorsal aspect. Head, abdomen, A1, A2-x25: UL, LL, Md, Mx1, Mx2-x90: Mxpd-x75: Mxpd(p)-x225: P1 1-3-x125: Ep 1-3-x45; Ur1, Ur2-x50: Ur 3-x115; Te1-x95.

First epimeral plate shallow, subsquare, posterior margin gently convex, bearing few serrations and spinules. Epimeral plate 2 subsquare, anterior margin bearing one small spine, anterior corner rounded. Posterior margin very weakly serrate and spinulose, posterior corner sharp. Epimeral plate 3 deep, well exceeding second plate. Lower margin excavate, oblique, anterior corner sharply rounded distally. Posterior margin weakly serrate and spinulose distally, proximally smooth.

Pleopods vestigial; peduncle of first short and slender, bearing a spine on the distal half, outer margin concave, inner margin with coupling spines. Ramus a terminal segment. Pleopod 2 similar but smaller and without subterminal spine. Pleopod 3 reduced to a small stump, bearing one subterminal spine and one coupling spine. [First instar specimens, South Coast population: pleopod 1, peduncle short, concave outer margin, inner margin with two coupling spines. Two rami present, outer longer than inner, both bearing two long plumose setae, equal in length to peduncle plus respective ramus. Pleopod 2 similar to pleopod 1 but half as long, ramal setae shorter proportionally. Pleopod 3 as in adult.]

Uropod 1, peduncle slender, bearing two subterminal spines, interramal spine long, simple, rami slender, as long as peduncle, inner bearing two marginal spines, outer smooth. Uropod 2, peduncle as long as rami, with two distal spines, inner ramus with one marginal spine, outer ramus smooth. Uropod 3 very small, peduncle short, bearing one large and one very small lateral spine, ramus small, conical, with one small and one minute apical spine. Telson short, broad, apex broadly rounded, entire; one apical and three [up to four, usually three] marginal spines each side.

Male

6.3 mm long. Like female, but bearing paired penes ventrally on segment 7 and lacking oöstegites.

Type material

Under litter, *Olearia argophylla* stand near Anglers Creek, off Tower Road, Tooms Lake area. UGR 8413-702229 coll. JAF 12/1/1976. Holotype ♀ 7.1 mm (ovig.) allotype ♂ 6.3 mm paratypes 19 ♀♀ (2 ovig.) 5 ♂♂ six juveniles. Tasmanian Museum and Art Gallery nos. G1950-G1952.

Other material examined

Under *Anopterus glandulosus* litter beside South Coast Track, top of high bank above east end of Prion Beach, south coast of Tasmania. UGR 8210-682786 coll. JAF 29/12/1976, 75 specimens. In soil and litter under eucalypt, tea-tree and blackwood trees beside Emu River, Burnie, North-West Tasmania. UGR 8015-094521 coll. JAF 28/7/1975, 23 specimens.

Distribution

Found in two apparently separate areas of Tasmanian mainland: in the north from the west coast near Temma, north of the Central Plateau, to the east coast at Ansons Bay and in an eastern strip south to Orford; and near the south coast, between New River Lagoon and South East Cape.

DISCUSSION

The species described herein have been allocated to the genus *Talitrus*, which, following Hurley (1955), includes all non-sexually-dimorphic terrestrial talitroid amphipods described to date. I support the view of Bousfield (1956) and Bousfield and

Carlton (1967), that the supralittoral *Talitrus saltator* (Montagu) should be separated generically from the terrestrial species, and that this can be done on morphological, and not simply ecological, grounds. However, rather than setting up or resurrecting a genus at this stage to receive these species, I prefer simply to point out their affinities within the current grouping.

T. kershawi Sayce, which occurs in southern and eastern Victoria (Sandell, 1977) falls into a natural group with the two species described here, as they share the following distinctive combination of features:

Maxilliped	:	Outer plate arcuate with truncate apex bearing a spine group at each corner.
Gnathopod 1	:	Segment 5 short and deep. Segment 6 proximally expanded.
Gnathopod 2	:	Segment 2 anterior margin bearing several large spines. Oöstegite absent.
Peraeopod 5	:	Oöstegite does not hold eggs against ventral surface of amphipod.
Peraeopod 6	:	Gill long, distally tapering.
Epimeral plate 3	:	Concave distal margin.
Pleopods 1 and 2	:	Reduced, usually bearing one or two ramal vestiges.
Pleopod 3	:	Reduced to a vestigial stump.
Pleopods	:	First instar young tend to bear long plumose setae on some pleopods.

Hurley (1975) has initiated the subdivision of the entire genus *Talitrus* by proposing eight subgenera. One of these, *Keratroides*, a monotypic subgenus comprising *T. kershawi*, is defined by some of the above characters, and would include *T. angulosus* n.sp. and *T. vulgaris* n.sp., provided several modifications of Hurley's definition are made. *T. vulgaris* n.sp. has no coupling hook on pleopod 3, and up to 5, not three pairs of marginal spines on the telson. I also find the above description of the distal end of the maxilliped outer plate more accurate than "relatively sharply pointed".

The three species may be separated by use of the following key. Table 1 includes further features in which the species differ.

Key to *Keratroides* Group

1 Third epimeral plate, anterodistal corner rounded ..... *T. vulgaris* n.sp.
Third epimeral plate, anterodistal corner sharp 2

2(1) Second antenna longer than head and first five body segments, dorsal surface of head gently curving anteriorly, body pigmented ..... *T. kershawi* Sayce
Second antenna not longer than head and first three body segments, dorsal surface of head strongly rounded anteriorly, body lacking pigment ..... *T. angulosus* n.sp.

While *T. vulgaris* n.sp. is fairly easily separated from the other two species, *T. kershawi* and *T. angulosus* n.sp. are very close in form and spination of appendages such as the form of third epimeral plate, third pleopod and telson spination, which are generally regarded as significant characters. They differ in more superficial characters, like colour, body size and relative size of appendages. However, I am separating these species because the variation of the appendage ratios does not overlap (there are differences between the species type collections in all three statistically treated parameters, at the 0.1% level) and because the overall impressions of the two groups of animals caused by their superficial differences are so distinct. Their taxonomic closeness must indicate that *T. kershawi* and *T. angulosus* n.sp. are recently derived from a common ancestor. This, coupled with their

TABLE 1

Comparison of type material

	T. kershawi Sayce	*T. angulosus* n.sp.	*T. vulgaris* n.sp.
Number of specimens	32	30	24
Ratio of eye width to head length ± S.D.	0.36 ± 0.02	0.24 ± 0.02	0.29 ± 0.08
Length of antenna 2	= head + 5-7 body segs. (5.6 ± 1.2)	= head + 2-2½ body segs. (2.1 ± 0.3)	= head + 4-5½ body segs. (4.5 ± 0.7)
Ratio of length of Pr 5 (segs. 2-6) to body length ± S.D.	0.60 ± 0.06	0.50 ± 0.03	0.57 ± 0.54
Greatest body length (all material)	16 mm	10.5 mm	15.5 mm
Number of antenna 2 flagellum segments, instar 1 (not types)	11	8	8
Telson: marginal spines each side	3 (2-4)	4 (3-5)	3 (2-4)
Egg numbers	?	1-6	1-10
Pigmentation of body	normal,brown	lacking	normal, brown to black

distribution on either side of Bass Strait (and the presence on a number of Bass Strait islands of a form resembling them), would support the contention that this ancestor was distributed across the Bassian isthmus during the Late Pleistocene lowering of sea level.

Preliminary observations of *T. vulgaris* n.sp. and *T. angulosus* n.sp. in the field and in the laboratory indicate ecological differences where these species are sympatric (Friend and Richardson, in press). The morphological differences outlined here are consistent with field observations that *T. angulosus* n.sp. is found deeper in the soil during the day, and moves less freely on the surface at night, than *T. vulgaris* n.sp. Lack of surface pigmentation and eye reduction are features found in animals of the deeper soil layers (Kuhnelt, 1976, pp.249-250) while smaller overall size and relatively shorter appendages would appear to equip an animal better for pushing through soil spaces. A consequence of the smaller size of *T. angulosus* n.sp. is a smaller brood size which could reduce breeding potential. On the other hand, *T. angulosus* n.sp. young are released at a smaller size than those of *T. vulgaris* n.sp. despite the increased danger of desiccation, so it is highly probable that the more stable soil environment enhances survival of young in the soil-dwelling species. Observations made during recent collection of *T. kershawi* near Melbourne indicated that this species resembles *T. vulgaris* n.sp. rather than *T. angulosus* n.sp. in its choice of microhabitat.

Both of the new species were found to bear bifid spines on peraeopods 3 to 7, segments 4 to 6, on all uropods and on the telson. In *T. vulgaris* n.sp. they occurred also on segments 2 and 3 of peraeopods 3-7. These spines have been drawn in many descriptions of talitrid amphipods, mentioned in a few (e.g. Hurley 1957: "bifurcated spines" and "bifurcate-tipped spines") and have appeared in Dahl's scanning electron microscope study (1973) of probable chemosensory receptors in this amphipod group.

Bifid spines distinguishable at the light microscope level must correspond only to the type mentioned by Dahl in which the hair is significantly longer than its protecting spine-tip, rather than to all the spine-hair types he named. However, the occurrence of such spines is noted here, as their presence or absence in talitrid species may prove to be important in phylogeny, or in relation to the particular adaptations of those species.

The *Keratroides* group of land-hoppers displays a number of advanced morphological features. The distinctive third epimeral plates of *T. kershawi* and *T. angulosus* n.sp. are highly modified from the talitrid type, but the causes of this are unclear. Perhaps the most significant features are the greatly reduced pleopods and the enlarged gills on both gnathopod 2 and peraeopod 6. Marsupium young of *T. vulgaris* n.sp. and *T. kershawi* possess biramous first and usually second pleopods bearing two long plumose setae terminally on each ramus (see Fig. 3: 2 Pl. 1). These setae have disappeared by the time the young have increased their second antennal segment number: there are indications that they are lost even before the first moult. In *T. angulosus* n.sp. this phenomenon has been noticed in only a few individuals from the south coast population. No north-western marsupium young have been examined and in the considerable number of east coast marsupium young examined, none has been found with these pleopod rami. Most probably, this pleopod form acts to enhance aeration of the gills of the young in the confined marsupium.

Special marsupium formation also points to the advanced state of this group. The oöstegites usually found on gnathopods 2 are entirely absent, while those on peraeopods 5 lack terminal setae and are held close to the ventral surface, rather than folding out around the eggs in an ovigerous female. Thus only two pairs of oöstegites on peraeopods 3 and 4 hold the eggs in place in these three species, although the fifth peraeopod oöstegites probably prevent the eggs from slipping out posteriorly from the marsupium. In another, as yet undescribed, Tasmanian species I have found a sperm mass held in place on the ventral surface of a non-ovigerous female by a similar pair of oöstegites, so it is likely that this form of posterior oöstegites in the *Keratroides* group is associated with modifications to the fertilisation process.

ACKNOWLEDGEMENTS

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