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Redescription of *Tasmanodesmus hardyi* Chamberlin, 1920 (Diplopoda: Polydesmida: Dalodesmidae)

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ABSTRACT

Tasmanodesmus hardyi Chamberlin, 1920 is redescribed from abundant, recently collected material. Although endemic to Tasmania, *T. hardyi* is common in eucalypt forest in central and eastern areas from sea level to at least 1120 m.

R. V. Chamberlin (1920) erected *Lissodesmus* and *Tasmanodesmus* for two new Tasmanian Polydesmida collected by G. H. Hardy. The holotypes were deposited in the Museum of Comparative Zoology (Cambridge, Massachusetts, USA) and the published descriptions were clear, if brief, but Chamberlin did not illustrate the genitalia of his new millipedes. As a result, the type species *L. modestus* Chamberlin, 1920 and *T. hardyi* Chamberlin, 1920 were unfamiliar to later workers. Verhoeff (1932) went so far as to dismiss Chamberlin's 1920 monograph on myriapods of the Australian Region as unscientific, simply because it lacked illustrations:

'Die folgende Tabellen [for Australia, Tasmania and New Zealand] enthält nicht alle *Diplopoden*, welche aus diesen Gebieten beschrieben worden sind, aber eine beträchtliche Reihe von Arten ist so mangelhaft bekannt, dass ihre Aufzählung hier ganz zwecklos wäre. Besonders muss eine Arbeit von R. V. Chamberlin, "*The Myriopoda of the Australian Region*" (*Bulletin Museum Comp. Zoology at Haward [sic] College 1920, vol. 64, Nr. 1*) genannt werden, welche zahlreiche *Nova* enthält. Da für dieselben auch nicht eine einzige Abbildung beigebracht worden ist, obwohl jeder Myriapoden-Forscher wissen muss, dass das ganz unstatthaft ist, kann diese Arbeit weder berücksichtigt werden noch überhaupt als wissenschaftlich gelten. Für geographische Forschung hat eine solche Publikation gar keinen Wert.' (Verhoeff, 1932, p. 1981)

'The following table [for Australia, Tasmania and New Zealand] does not contain all diplopods which have been described from these regions; a considerable number of species is so poorly known that their enumeration here would be completely without purpose. In particular a work by R. V. Chamberlin must be cited, "*The Myriopoda of the Australian Region*" (*Bulletin Museum Comp. Zoology at Haward [sic] College 1920, vol. 64, Nr. 1*), which contains numerous new taxa. Since not even a single illustration has been supplied for these, although every myriapod researcher must know that this is wholly inadmissible, this work can neither be taken into consideration nor indeed be regarded as scientific. For geographical research such a publication has no value at all.' [Translation by present author.]

Later, Attems (1940) listed *Lissodesmus* and *Tasmanodesmus* among the 'uncertain genera' ('unsichere Gattungen') of Polydesmida which could not be assigned to a family. In his reclassification of the Diplopoda, Hoffman (1980) placed *Lissodesmus* in Dalodesmidae Cook, 1896 but inexplicably omitted *Tasmanodesmus*.

Lissodesmus was rescued from obscurity by Jeekel (1984), who redescribed *L. modestus* from specimens he had collected during a visit to Tasmania. In this paper I redescribe *T. hardyi* and support the informal indication of Jeekel (1984, p. 89) that *Tasmanodesmus* should be placed in Dalodesmidae.

Peter Johns (*in litt.*) has suggested that *Tasmanodesmus* is a junior synonym of the New Zealand genus *Pseudoprionopeltis* Carl, 1902. Acting on this suggestion, Eberhard *et al.* (1991, p. 71) used the name '*Pseudoprionopeltis hardyi*' in a non-taxonomic publication for specimens of *T. hardyi* collected in Tasmanian caves. Jeekel (1983), furthermore, noted a close relationship between *Pseudoprionopeltis* and his own *Gephyrodesmus*, erected for *G. cineraceus* Jeekel, 1983 from Victoria, and there are certainly similarities in overall form and gonopod details among the three dalodesmid genera. However, until the range of variation in *Pseudoprionopeltis* is better known, I am reluctant to synonymise either *Tasmanodesmus* or *Gephyrodesmus* with the New Zealand genus, in which there are said to be many undescribed species (Johns, 1979, p. 50).

So far as I know, the name *Tasmanodesmus* has appeared in only one non-taxonomic publication, namely *Insect Pests and Their Control* (Evans, 1943) by J. W. Evans, then Chief Biologist with the Tasmanian Department of Agriculture. On p. 3 of that work, a line drawing of what appears to be a species of *Tasmaniosoma* is labeled '*Tasmanodesmus* sp.'. On p. 83 'the Flat Brown Millipede (*Tasmanodesmus* sp.)' is said to be a native millipede commonly occurring in Tasmanian gardens. I have never seen *T. hardyi* in a garden, although *Tasmaniosoma armatum* Verhoeff, 1936, another dalodesmid, is sometimes found in part-native gardens in Hobart, the capital city of Tasmania. It is unclear how Evans came to confuse *Tasmanodesmus* with *Tasmaniosoma*. He may have had advice on millipede names from V. V. Hickman, a zoologist at the University of Tasmania, who in 1935 had collected *T. hardyi* at the Cascades on Mt Wellington near Hobart (see Material Examined, below) and the as-yet-unnamed *T. armatum* in the Queen's Domain, Hobart (unregistered specimen in Queen Victoria Museum collection).

Specimens collected by the present author were killed and preserved in 75-80% ethanol. Preliminary drawings were made using a camera lucida or an eyepiece graticule. Gonopods were cleared in 60% lactic acid; other body parts were temporarily mounted in glycerine jelly. Unless otherwise indicated, 'male' and 'female' in the main text refer to stadium VIII adults. Abbreviation in main text: MCZ = Museum of Comparative Zoology, Cambridge, Massachusetts, USA.

Order POLYDESMIDA Leach, 1815

Suborder DALODESMIDEA Hoffman, 1980

Family Dalodesmidae Cook, 1896

Genus *Tasmanodesmus* Chamberlin, 1920

Tasmanodesmus Chamberlin, 1920: 133. Attems, 1940: 491. Jeekel, 1971: 355. Jeekel, 1983: 146. Jeekel, 1984: 85, 86, 89. Jeekel, 1985: 52.

TYPE SPECIES: *Tasmanodesmus hardyi* Chamberlin, 1920, by original designation.

DIAGNOSIS: Dalodesmids *ca.* 20 mm long as adults, with head + 20 segments, prominent paranota, and numerous sphaerotrichomes on legs of males. Gonopod telopodite divided at about half its length into a solenomerite and two other processes; solenomerite the longest process, its tip directed anteriorly. Older juveniles and adults of both sexes readily distinguished from co-occurring dalodesmids in *Dasystigma* Mesibov, 2003 and *Lissodesmus* Chamberlin, 1920 by the size of the isolated seta near the posterior corner of each paranotum: seta long and conspicuous in *Dasystigma* and *Lissodesmus*, short and inconspicuous in *Tasmanodesmus*.

DISTRIBUTION: Central and eastern Tasmania.

SPECIES: One known.

Tasmanodesmus hardyi Chamberlin, 1920

Figs. 1-8; map Fig. 9

Tasmanodesmus hardyi Chamberlin, 1920: 134. Attems, 1940: 491. Jeekel, 1984: 85.

TYPE SPECIMENS: Male holotype, 'Tasmania', G. H. Hardy, MCZ 4643. No paratypes designated.

OTHER MATERIAL EXAMINED: 111 males, 124 females and 90 juveniles from Tasmania. See Appendix for details.

DESCRIPTION: Male *ca.* 20 mm long, *ca.* 2.0 mm in maximum vertical diameter, *ca.* 3.0 mm in maximum width (i.e., of paranota; see Remarks). In alcohol, well-coloured specimens a fairly uniform light purplish-brown dorsally and laterally,

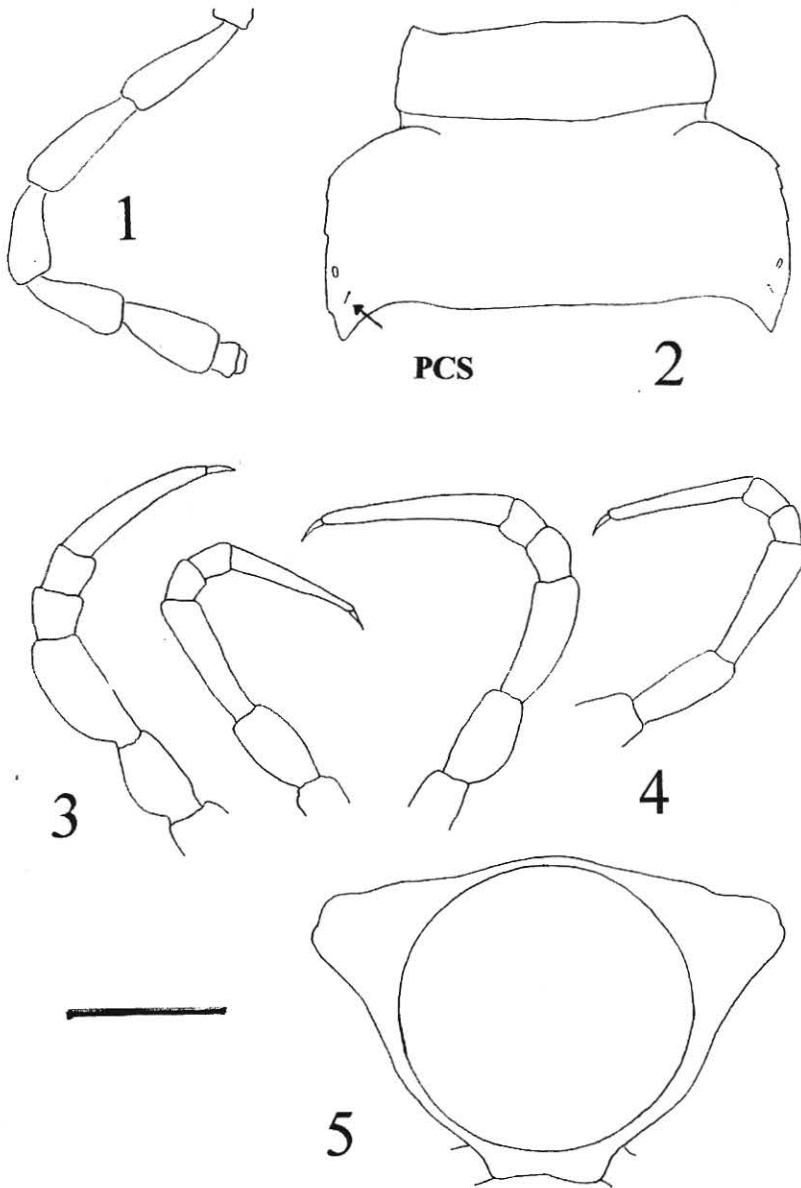


Fig 1. *Tasmanodesmus hardyi*. antenna, male. Fig. 2, somite 12 of male, dorsal view; arrow shows position of posterior corner seta (PCS). Fig. 3, posterior legs on somites 7 of male (left) and somite 6 of female (right). Fig. 4, posterior legs on somite 12 of male (left) and female (right). Fig. 5, somite 12 of male, posterior view. Scale bar for all drawings = 1.0 mm; setation not shown apart from PCS in 3. Male from Stella Glen (41°39'04"S, 146°42'51"E; QVM 23:14032), female from Elmers Creek (41°38'41"S, 146°43'04"E; QVM 23:13970); the two localities are about 800 m apart.

fading to pale white ventrally; pre-anal ring and valves well-coloured, head somewhat paler than collum and tergites; legs pale white.

Head more or less flat in dorsal view, slightly convex in lateral view; clypeus slightly impressed above labrum; clypeus and frons moderately setose, vertex almost bare; vertigial sulcus faint, extending forward to an imaginary line joining the dorsal margins of the antennal sockets. Antennae long, slender (Fig. 1); antennomeres 2 and 3 the longest, about equal in length; antennomere 6 the widest, about as long as 4 and 5. Antennal sockets slightly impressed below antennal bases; bases separated by about 2.5 times a base diameter.

Collum wider than head, anterior margin straight, posterior margin slightly emarginate in center, corners rounded. Collum lightly setose with a few marginal setae.

Somite surfaces smooth; waist pronounced and suture clearly visible (fig. 2); the three transverse rows of sparse, small setae noted on the metatergite by Chamberlin (1920, p. 133) very inconspicuous; limb a comb of fine, straight projections.

Paranotum inflated (Fig. 2); the anterior margin almost a straight diagonal meeting the lateral margin at an obtuse angle; lateral margin parallel to the long axis of the body in dorsal view, rising posteriorly in lateral view; the posterior corner projecting backwards as a broad tooth on somite 4 and more posterior somites, but with little increase posteriorly in the 'sharpness' or prominence of the tooth. Lateral margin inconspicuously notched, a very small seta at each notch in some specimens. Concave portion of posterior margin finely crenulate. A short, prominent seta (posterior corner seta, PCS) arising dorsally near the base of the tooth formed by the posterior corner of the paranotum, and roughly one-tenth the anterior-posterior length of the latter. Width of somite 3 paranotum about equal that of collum; paranotal widths increasing only slightly to somite 17, diminishing strongly in 18 and 19.

Sternites a little wider than long, lightly setose; transverse furrow pronounced, longitudinal furrow inconspicuous.

Pore formula 5, 7, 9, 10, 12, 13 and 15-19; pores small, opening dorsally on paranotum (Fig. 5) close to the lateral margin, two-thirds to three-quarters of the distance from anterior to posterior paranotal margins.

Legs (Figs. 3, 4) somewhat incrassate anteriorly; tarsus long and slender, up to 1.5 times the length of the next largest podomere, the femur. Numerous sphaerotrichomes on ventral surface of postfemur, tibia and tarsus of most legs; first sphaerotrichomes on leg 2, last on last leg (leg 31); shaft of each sphaerotrichome gently tapered. Dense, short setae forming a 'brush' ventrally on more basal podomeres; tips of 'brush' setae forked (Mesibov, 2004, fig. 1H). Genital opening on leg 2 coxa only slightly raised above coxal surface. Paired coxae of legs 3, 4 and 5 close together on sternite; legpair 6 a little separated at bases, legpair 7 well-separated; sparse clumps of long setae on somite 6 sternite between leg bases.

Spiracles small; the anterior spiracle just anterior to the anterior leg base, the posterior spiracle about midway between leg bases.

Epiproct blunt, extending well beyond paraprocts; hypoproct paraboloid in outline.

Gonopod aperture ovoid, a little longer than wide, a little less than one-third the width of the somite 7 prozonite, lateral margin slightly raised posteriorly. Gonopod coxae entirely contained within aperture, more or less cylindrical, tapering slightly distally, lightly joined mesally, with moderately dense, long setae on anterior and posterobasal surfaces. Cannula prominent (Fig. 6). Telopodite (Figs. 6, 7, 8) slender,

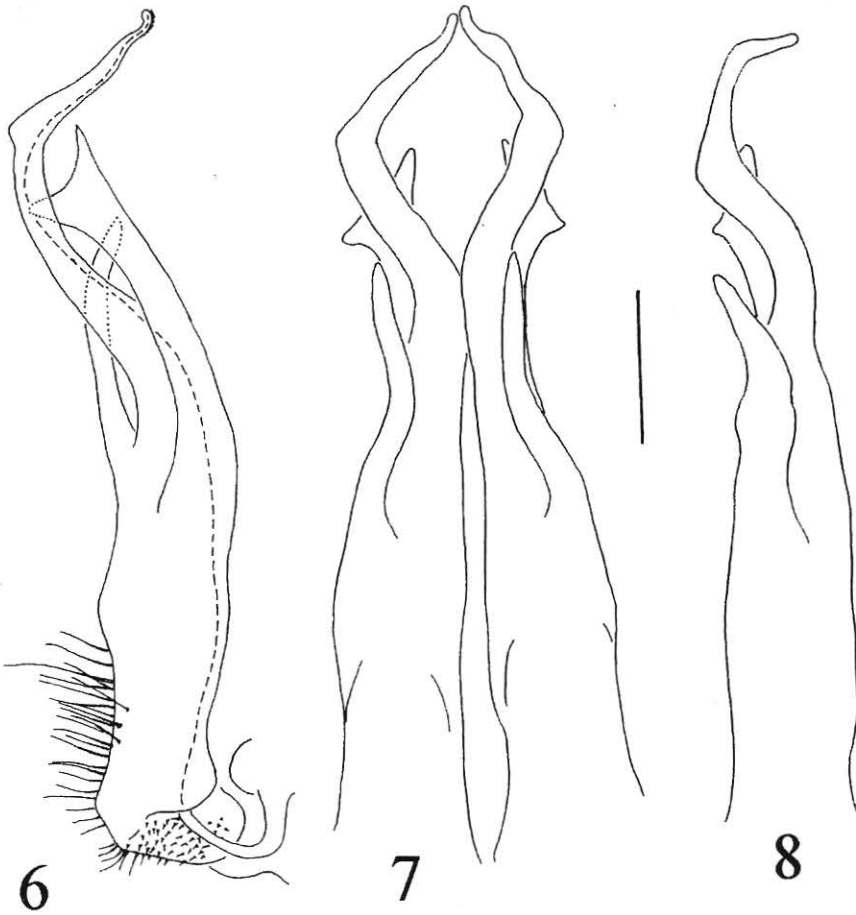


Fig. 6. *Tasmanodesmus hardyi*. Mesal view of right gonopod telopodite of male from Stella Glen (41°39'04"S, 146°42'51"E; QVM 23:14032). Dashed line marks course of prostatic groove. Fig. 7. Telopodites of both gonopods in situ, posterior view, male from Stella Glen (41°39'04"S, 146°42'51"E; QVM 23:14032). Fig. 8. Telopodite of right gonopod of male from Buffalo Brook (41°44'27"S, 147°35'12"E; QVM 23:22105) (right). Scale bar = 0.25 mm; setation not shown.

more or less straight, when retracted reaching leg 5 coxa; with dense, very short setae at base and moderately dense long setae on posterolateral surface to about one-quarter the length of the telopodite. At about one-third its length, telopodite divided into two large, closely appressed processes, the more lateral process dividing again at about half the telopodite length. The central process thus formed, the solenomerite, at its origin nearly half the basal width of the telopodite, tapering and curving first posteriorly, then posterolaterally, then turning anterodistally at a posterior thickening of the process, tapering more strongly beyond this point and terminating in a blunt tip turned distad and roughened on its anterior surface; prostatic groove following the anterior surface of the solenomerite. The more basal, anteromesal process gently curving posteriorly and very slightly laterally, flattening mesolaterally and forking near its tip to end in two blunt teeth, the more distal reaching to the level of the solenomerite thickening; the curvatures of the solenomerite and anteromesal process are such that they cross at about two-thirds the length of the telopodite. The more distal, posterolateral process typically narrow, rodlike, curving slightly posteromesally, then anterolaterally, tapering strongly near the tip, terminating at about half the length of the solenomerite just lateral to the anteromesal process (see Remarks).

Female closely resembling male but slightly larger, legs smaller and not incrassate (Figs. 3, 4, right), sphaerotrichomes lacking. Prefemur of legpair 2 with a short, rounded, posterior projection at the basal end. Epigynum in posterior view with posterior margin raised in center as a triangle with a rounded apex; cyphopods not examined.

Stadium V, VI and VII juveniles resembling miniature adults in overall appearance, without the more prominent lateral paranotal notches and transverse metatergal setae often seen in other Tasmanian dalodesmids.

DISTRIBUTION AND HABITAT: In dry and wet eucalypt forest and subalpine eucalypt woodland over ca. 30 000 km² in central and eastern Tasmania, from near sea level to at least 1120 m (Fig. 9). *T. hardyi* has not yet been collected in the far south of the main island or west of the Emu River valley in the northwest. It is absent from most of the northeast and is one of the millipede species with a sharp range boundary near Weavers Creek, ca. 20 km east of Launceston (Mesibov, 1997). The western boundary of the *T. hardyi* range corresponds to the major biogeographical divide known as Tyler's Line (Mesibov, 1994).

T. hardyi does not appear to be an active burrower and is generally found in leaf, bark and woody litter with a loose structure, i.e. with numerous cavities. It is only rarely found in *Nothofagus* rainforest within its range.

T. hardyi often seems to be less abundant at millipede-rich sites than co-occurring dalodesmids of similar size, such as species in the genera *Dasy stigma*, *Gasterogramma* Jeekel, 1982 and *Lissodesmus*. This subjective view is in agreement with the available results from methodical hand sampling of wet forest (searching small, equal-area plots for the same time on each plot). At three sites near Tarraleah in central Tasmania, the tallies of *Dasy stigma*, *Gasterogramma*, *Lissodesmus* and

T. hardyi specimens were 27, 85, 83 and 16, respectively (Mesibov *et al.*, 1995, p. 434). In a comparison of litter invertebrates in native forest and plantations in northwest Tasmania (Bonham *et al.*, 2002), the five native forest sites which yielded six specimens of *T. hardyi* also yielded 27 specimens of *Gasterogramma* and 11 of *Lissodesmus* (tallies by the author from the study published as Bonham *et al.*, 2002).

Occasionally *T. hardyi* is found in caves (Eberhard *et al.*, 1991, p. 71, as '*Pseudoprionopeltis hardyi*'), but all cave specimens seen to date are still pigmented and the species appears to be only an accidental cave inhabitant.

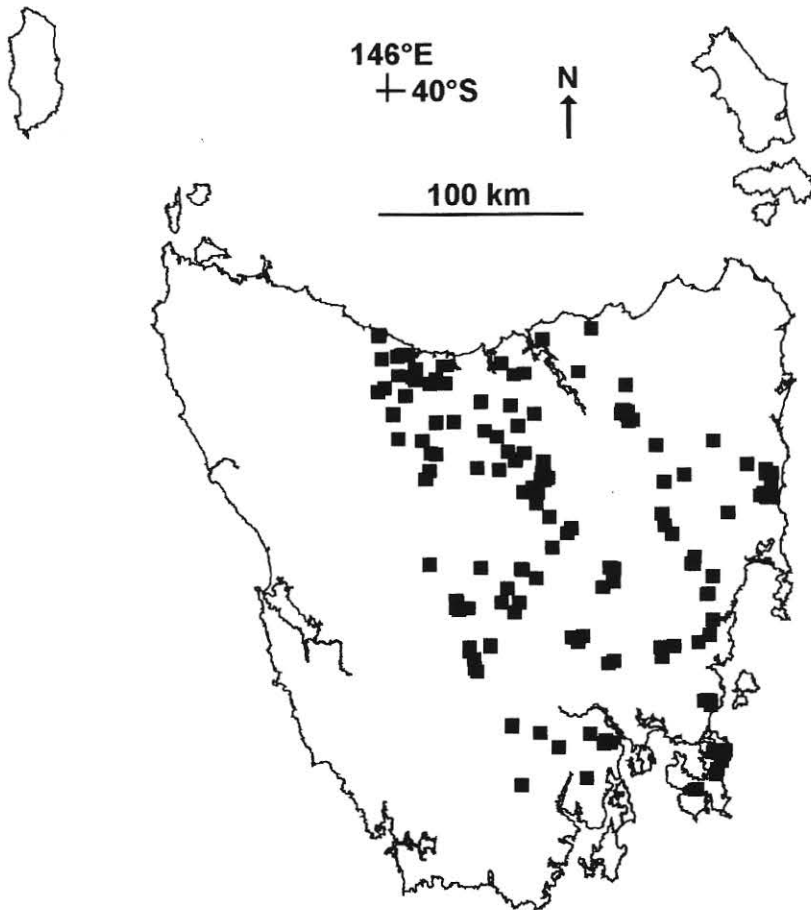


Fig. 9. *Tasmanodesmus hardyi*. Map of localities known to 29 November 2003.

REMARKS: I borrowed the holotype in early 1999 and re-examined it during a visit to the MCZ late in 2000. According to a label in the specimen vial, the holotype had dried out by 1957 and was 'reconstituted' in that year by addition of fresh

alcohol. The type is in pieces but is otherwise in reasonably good condition, and the gonopods are still attached to somite 7. As noted elsewhere (Mesibov, 2002, p. 535), it is likely that G.H. Hardy collected the type specimen between 1913 and early 1915. The type locality within Tasmania is unknown.

There is a substantial range of adult size in *T. hardyi* (male mid-body width *ca.* 2.25-3.5 mm), but little variation in colour or body proportions. On the gonopod telopodite, the solenomerite and anteromesal process vary little in the specimens so far examined, while the posterolateral process (PLP) varies considerably. Across the species range, the most typical form of the PLP is the one described above, with the PLP terminating just basal to the level of the more basal tooth of the anteromesal process (AMP), and just lateral to the latter (Fig. 7). Males at four scattered localities have been found in which the tip of the PLP lies just mesal to the AMP, i.e. between the latter and the solenomerite, and at another four scattered localities males have been found in which the gonopods are not mirror-symmetric: the PLP tip is lateral to the AMP in the right gonopod, and mesal in the left gonopod. At a number of scattered localities, mainly in the southern half of the range, the PLP is considerably shorter than shown in Fig. 7, while in a male from Pelverata Falls (QVM 23:25585) in southeast Tasmania the PLP is entirely absent. The most geographically coherent PLP variant is the form shown in Fig. 8, where the PLP is an anteroposteriorly flattened, blade-like structure. Males with this variant are found at the northern end of the Eastern Tiers, from the eastern coast west to Campbell Town and south to Tooms Lake. A blade-like variant with less curvature than shown in Fig. 8 has been found at Yarrington Tier (QVM 23:40474).

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APPENDIX

List of material examined (excluding type). In the list below, males are coded 'M' and females 'F', and stadia are given in Arabic numerals after the letter. Thus '2M6' means 'two stadium VI males'. Locality information is given as a locality name, a UTM grid reference (Australian Map Grid 1966, Grid Zone Designation 55G) when known and a latitude/longitude calculated from the UTM coordinates. Grid references in plain face type are +/- 100 m or better, and in italics generally +/- 500 m or better. All collections are by the author unless otherwise noted. Abbreviations: NRCP = National Rainforest Conservation Program survey, 1989-90; QVM = Queen Victoria Museum and Art Gallery, Launceston, Tasmania, Australia; TM = Tasmanian Museum and Art Gallery, Hobart, Tasmania, Australia.

3F8, Cascades, Hobart, *EN230500 (42°54'07"S, 147°16'54"E)*, 27.viii.1935, V. V. Hickman, QVM 23:6814; 2M8, same details, QVM 23:6841; 6F8, Tarraleah, *DP530160 (42°18'24"S, 146°25'47"E)*, v.1952, V. V. Hickman, QVM 23:6805; 3M8, same details, QVM 23:6830; 1M8, same details but 26.xii.1952 to 2.i.1953, QVM 23:16208; 1F8, 1F7, same details, QVM 23:6809; 1M8, Tarraleah, same details, QVM 23:6836; 1M8, Cashions Creek Cave, *DN575851 (42°35'06"S, 146°28'55"E)*, 17.iii.1968, Dr & Mrs A. Goede, TM J1229; 1M8, 1F8, same details but 8.xi.1970, A. Goede, TM J1230; 1M8, 3F8, same details but 25.ix.1971, A. Goede *et al.*, TM J1231; 1M8, 2F8, Eaglehawk Neck, *EN750370 (43°00'56"S, 147°55'13"E)*, 12.viii.1972, Dr & Mrs A. Goede, TM J1232; 1M8, West of Triabunna, 15.viii.1972, P. M. Johns & J. L. Hickman, TM J1233; 1M8, Cashions Creek Cave, *DN575851 (42°35'06"S, 146°28'55"E)*, 16.viii.1974, A. Goede, TM J1225; 1M8,

same details but 27.xii.1974, TM J1226; 1M8, Beginners Luck Cave, *DN563867* (42°34'14"S, 146°28'03"E), 3.v.1975, A. Goede, TM J1227; 2M8, The Quoin, *EN220890* (42°33'03"S, 147°16'04"E), 18.v.1975, P. Murray, TM J1228; 1F8, Maggs Mountain, *DP342842* (41°41'28"S, 146°12'33"E), 30.iii.1977, R. H. Green, QVM 23:25161, registered lot now missing; 1M8, Griffiths Road, Koonya State Forest, *EN650270* (43°06'24"S, 147°47'55"E), 14.xi.1977, J. L. Hickman, QVM 23:6829; 2F7, same details but 19.xi.1977, QVM 23:8410; 3F8, Tarraleah, *DP530160* (42°18'24"S, 146°25'47"E), v.1978, V. V. Hickman, QVM 23:6801; 1M8, same details, QVM 23:6826; 1F8, Maggs Mountain, *DP322802* (41°43'37"S, 146°11'05"E), 880m, 10.x.1983, R. H. Green, QVM 23:8412, pitfall; 1F8, Liffey Falls, *DP805735* (41°47'23"S, 146°45'55"E), 7.v.1984, S. Fearn, QVM 23:6785; 1M8, 1F8, 1F6, Cashions Creek Cave, *DN575851* (42°35'06"S, 146°28'55"E), 28.v.1985, S. Eberhard, QVM 23:12159, field no. JF6-1; 1M8, 1M6, Cheri's Cave, *DN560910* (42°31'55"S, 146°27'51"E), 2.iii.1986, S. Eberhard, QVM 23:12104, field no. JF-x2-1; 1M8, Thompsons Marshes, *FP016828* (41°41'59"S, 148°13'15"E), 490m, 9.vi.1988, QVM 23:6823; 1F5, Lookout Hill, *FP012771* (41°45'04"S, 148°13'01"E), 430m, 17.vi.1988, QVM 23:6813; 1F8, Denison Marshes, *FP004719* (41°47'53"S, 148°12'30"E), 360m, 18.vi.1988, QVM 23:6811; 1F8, Mt Allen, *FP021713* (41°48'12"S, 148°13'44"E), 390m, 18.vi.1988, QVM 23:6810; 1M7, Sandspit River, *EN685707* (42°42'46"S, 147°50'11"E), 260m, 26.vi.1988, QVM 23:6803; 1M8, Denison Marshes, *FP004715* (41°48'06"S, 148°12'30"E), 360m, 27.vi.1988, QVM 23:6815; 2M8, Tinmine Creek, *EP987827* (41°42'04"S, 148°11'10"E), 500m, 30.vi.1988, QVM 23:6817; 1F8, Apsley River, *EP957721* (41°47'49"S, 148°09'06"E), 290m, 6.vii.1988, QVM 23:6812; 1M8, same details, QVM 23:6834; 1F8, Mt Mismanagement, *EP633384* (42°06'13"S, 147°45'56"E), 590m, 10.vii.1988, QVM 23:6807; 1M7, Dogwood Hill, *EP987849* (41°40'53"S, 148°11'09"E), 570m, 26.vii.1988, QVM 23:6806; 1F8, 1F6, 1F5, Denison Marshes, *EP992710* (41°48'23"S, 148°11'39"E), 350m, 29.vii.1988, QVM 23:6787; 2M8, same details, QVM 23:6835; 1F8, Denison Marshes, *EP987715* (41°48'07"S, 148°11'17"E), 450m, 30.vii.1988, QVM 23:6799; 1M8, same details, QVM 23:6843; 1F8, south of Organ Hill, *EP975732* (41°47'12"S, 148°10'24"E), 420m, 31.vii.1988, QVM 23:6804; 1F8, Pirates Road, *EN742346* (43°02'15"S, 147°54'39"E), 400m, 26.iii.1989, J. Diggie, QVM 23:6794, NRCP collection; 2F8, Old Womans Head, *EP190268* (42°12'38"S, 147°13'48"E), 760m, 13.v.1989, QVM 23:6797; 2F8, Flash Charlies Creek, *EP035561* (41°56'48"S, 147°02'32"E), 600m, 10.x.1989, QVM 23:6793; 2F8, Mitchelmores Creek, *EP727106* (42°21'11"S, 147°52'57"E), 120m, 16.iv.1991, QVM 23:6783; 1M8, same details, QVM 23:6819; 1M7, 2F8, 2F7, Ravens Hill, *EP709034* (42°25'05"S, 147°51'42"E), 330m, 19.iv.1991, QVM 23:6808; 1F8, 2F6, Baldy Creek, *EN656997* (42°27'07"S, 147°47'51"E), 530m, 23.iv.1991, QVM 23:6790; 3M8, same details, QVM 23:6828; 1M8, Meander Dam site, Meander River, *DP684844* (41°41'29"S, 146°37'12"E), 2.vi.1991, R. Mesibov & D. L. Goldsworthy, QVM 23:6861; 1F8, Sandspit River, *EN700712* (42°42'30"S, 147°51'17"E), 230m, 31.vii.1991, QVM 23:6802; 1M8, same details, QVM 23:6845; 1F8, Myrtle Park, *EQ304264* (41°18'47"S, 147°21'47"E), 29.viii.1991, T. Timothy, QVM 23:7564; 1F8, Kelcey Tier, *DQ429364* (41°13'17"S, 146°19'07"E), 170m, 1.ix.1991, QVM 23:6795; 3M8, same details, QVM 23:6837; 1F8, Kenzies Hill, *DQ462082* (41°28'33"S, 146°21'20"E), 260m, 18.xii.1991, R. Mesibov & T. Scarborough, QVM 23:6782; 1F8, Laurel Creek, *DQ090230* (41°20'21"S, 145°54'44"E), 440m, 12.ii.1992, QVM 23:6789; 1M8, same details, QVM 23:6850; 2F7, Library Creek, *DQ236417* (41°10'20"S, 146°05'21"E), 50m, 12.ii.1992, QVM 23:6784;

1M7, 2F8, Nietta Creek, DQ227213 (41°21'21"S, 146°04'33"E), 500m, 13.ii.1992, QVM 23:6786; 4M8, same details, QVM 23:6848, 2 dissected; 1F8, Lower Wilmot, DQ345268 (41°18'26"S, 146°13'03"E), 300m, 13.ii.1992, QVM 23:6798; 1M7, 1F8, 5F7, Branchs Creek, DQ695375 (41°12'47"S, 146°38'10"E), 30m, 18.ii.1992, QVM 23:6796; 1F7, Saxons Creek, DQ755318 (41°15'52"S, 146°42'27"E), 140m, 18.ii.1992, QVM 23:6792; 1F7, Pipers Brook, EQ136546 (41°03'34"S, 147°09'42"E), 40m, 20.ii.1992, QVM 23:6791; 1M7, 2F7, Black Sugarloaf Creek, DQ855122(41°26'29"S, 146°49'35"E), 170m, 21.ii.1992, QVM 23:6774; 1M8, Nile River, EP449969(41°34'41"S, 147°32'18"E), 640m, 23.ii.1992, QVM 23:6858; 1F7, Native Hop Hill, DP727935 (41°36'34"S, 146°40'20"E), 330m, 5.iii.1992, QVM 23:6768; 1M8, Old Womans Head, EP190267 (42°12'41"S, 147°13'48"E), 760m, 13.iii.1992, QVM 23:6859; 1F8, 1F7, Vicarys Creek, EP245360 (42°07'39"S, 147°17'47"E), 440m, 13.iii.1992, QVM 23:6775; 2M8, same details, QVM 23:6852; 3F7, Brumbys Creek, DP924807 (41°43'31"S, 146°54'31"E), 250m, 18.iii.1992, QVM 23:6773; 1M8, same details, QVM 23:6856; 1F8, Den Hill, EN067998 (42°27'14"S, 147°04'53"E), 580m, 19.iii.1992, QVM 23:6781; 1M8, same details, QVM 23:6842; 1F8, Collins Cap, EN128544 (42°51'45"S, 147°09'24"E), 580m, 19.iii.1992, QVM 23:6780; 1F8, Ibbottvale Creek, EP039021 (42°25'59"S, 147°02'50"E), 580m, 19.iii.1992, QVM 23:6778; 1M8, same details, QVM 23:6831; 1M8, Browns Creek, EN736463 (42°55'56"S, 147°54'07"E), 190m, 20.iii.1992, QVM 23:6854; 2F8, Bellettes Creek, EN751450 (42°56'37"S, 147°55'13"E), 130m, 20.iii.1992, QVM 23:6788; 1M7, 1M6, 2F7, 1F6, Pinnacles Creek, EP528531 (41°58'19"S, 147°38'14"E), 520m, 22.iii.1992, QVM 23:6767; 1M8, same details, QVM 23:6816; 1M8, Parramores Creek, EP635419 (42°04'20"S, 147°46'03"E), 600m, 22.iii.1992, QVM 23:6846; 1F8, Tarralcah, DP472166 (42°18'03"S, 146°21'33"E), 720m, 17.iv.1992, QVM 23:8401; 1M8, same details but DP472167 (42°17'59"S, 146°21'33"E), 720m, 18.iv.1992, QVM 23:8396; 1F8, same details, QVM 23:8407; 1M8, Tarraleah, DP471194 (42°16'32"S, 146°21'30"E), 750m, 2.v.1992, QVM 23:8399; 1F8, same details, QVM 23:8408; 1M8, same details but DP471195 (42°16'29"S, 146°21'30"E), 750m, QVM 23:8397; 1F8, same details, QVM 23:8405; 1F8, Tarraleah, DP472200 (42°16'12"S, 146°21'35"E), 790m, 3.v.1992, QVM 23:8406; 1M8, same details but DP474194 (42°16'32"S, 146°21'43"E), 730m, QVM 23:8395; 1F8, Tarraleah, DP472200 (42°16'12"S, 146°21'35"E), 790m, 4.v.1992, QVM 23:8409; 1F8, Tarraleah, DP473197 (42°16'22"S, 146°21'39"E), 760m, 6.v.1992, QVM 23:8403; 1M8, Tarraleah, DP476195 (42°16'29"S, 146°21'52"E), 720m, 8.v.1992, QVM 23:8398; 1F8, 1F7, same details, QVM 23:8404; 1F8, Tarraleah, DP475197 (42°16'22"S, 146°21'48"E), 750m, 9.v.1992, QVM 23:8402; 1M8, Tom Legges Tier, EP728322 (42°09'31"S, 147°52'52"E), 660m, x.1992, R.J. Taylor, QVM 23:8400; 1F8, Lake Mackenzie Road, DP373924 (41°37'03"S, 146°14'50"E), 700m, 5.x.1992, R. D'Orazio & M. Cooper, QVM 23:22110; 1F7, Bullock Holes Creek, DP895832 (41°42'09"S, 146°52'25"E), 280m, 4.i.1993, QVM 23:16244; 1F8, 2F7, Fingal Tier, EP895874 (41°39'35"S, 148°04'29"E), 840m, 12.i.1993, QVM 23:8411; 1M7, east of Cowpaddock Creek, DP931613 (41°54'00"S, 146°55'00"E), 1000m, 26.i.1993, A. M. M. Richardson, QVM 23:11806; 1M8, Five Mile Marsh, DP725260 (42°13'03"S, 146°40'00"E), 830m, 27.i.1993, A. M. M. Richardson, QVM 23:11807; 2F7, Wellard Rivulet, EN730456 (42°56'18"S, 147°53'40"E), 140m, 24.ii.1993, QVM 23:16210; 1M8, Bellettes Creek, EN751451 (42°56'34"S, 147°55'13"E), 120m, 24.ii.1993, QVM 23:16209; 1F6, same details, QVM 23:16211; 3F8, Western Creek, DP578854 (41°40'54"S, 146°29'34"E), 880m, 8.viii.1993, QVM 23:16212; 1M6, Wolfs Craig Creek, EP493572 (41°56'07"S, 147°35'40"E), 350m, 3.x.1993, QVM 23:12526;

1F8, West Swan River, EP802638 (41°52'24"S, 147°57'59"E), 480m, 3.x.1993, QVM 23:12527; 1M8, same details, QVM 23:12710; 1M8, Plenty River, DN885549 (42°51'29"S, 146°51'33"E), 470m, 11.x.1993, R. D'Orazio & D. Soccol, QVM 23:40447; 1M8, Buffalo Brook, EP488788 (41°44'27"S, 147°35'12"E), 360m, 19.x.1993, R. D'Orazio & T. Kingston, QVM 23:22105, dissected; 1M6, Fern Glade Reserve, DQ097516 (41°04'54"S, 145°55'29"E), 10-20m, 30.x.1993, QVM 23:16213; 1M7, 2F8, 1F7, Emu River, DQ096509 (41°05'16"S, 145°55'25"E), 20m, 17.xi.1993, QVM 23:16251; 1M8, Winter Brook, DQ166120 (41°26'20"S, 146°00'06"E), 600m, 2.xii.1993, L. Robertson, QVM 23:15470, pitfall; 1M8, Blackwood Creek, DP903817 (41°42'58"S, 146°53'00"E), 390m, 9.xii.1993, QVM 23:16480; 2F8, same details but DP905795 (41°44'09"S, 146°53'08"E), 330m, QVM 23:16252; 1M8, same details, QVM 23:16481; 1M7, 1M6, 1F7, same details but DP908811 (41°43'18"S, 146°53'21"E), 380m, QVM 23:16253; 1M6, Whitmore Creek, DP900887 (41°39'11"S, 146°52'47"E), 260m, 14.xii.1993, QVM 23:16254; 1F8, Westons Rivulet, DP847759 (41°46'06"S, 146°48'57"E), 1120m, 2.i.1994, QVM 23:16214; 2M7, Cathcart Bluff, DP873733 (41°47'30"S, 146°50'49"E), 1090m, 2.i.1994, QVM 23:16215; 1M8, Winter Brook, DQ164122 (41°26'14"S, 145°59'57"E), 600m, 14.i.1994, L. Robertson, QVM 23:15473, pitfall; 1F8, same details, QVM 23:15474, pitfall; 1F8, Brumbys Creek, DP888799 (41°43'56"S, 146°51'55"E), 550m, 17.i.1994, R. Mesibov & Z. Korsos, QVM 23:13590, registered lot now missing; 1M7, Palooa Dam, DQ375292 (41°17'09"S, 146°15'13"E), 160m, 4.ii.1994, R. Mesibov, L. Hill & P. Stys, QVM 23:13968; 1M8, Don River, DQ420274 (41°18'09"S, 146°18'25"E), 210m, 4.ii.1994, R. Mesibov, L. Hill & P. Stys, QVM 23:14031; 2F8, Serpentine Dam, DP592363 (42°07'27"S, 146°30'23"E), 640m, 15.ii.1994, G. Woods, QVM 23:22111; 1F8, Mossy Marsh Creek, DP487155 (42°18'39"S, 146°22'39"E), 630m, 18.ii.1994, QVM 23:13969; 2M8, Stella Glen, DP762889 (41°39'04"S, 146°42'51"E), 600m, 4.iii.1994, QVM 23:14032, dissected; 2F8, 'Elmers Creek, DP765896 (41°38'41"S, 146°43'04"E), 500m, 4.iii.1994, QVM 23:13970, dissected; 1M8, Library Creek, DQ236417 (41°10'20"S, 146°05'21"E), 50m, 30.v.1994, QVM 23:15472; 1F7, same details, QVM 23:15476; 1F8, Bradys Creek, DQ739165 (41°24'08"S, 146°41'15"E), 320m, 22.vi.1994, S. Leighton, QVM 23:40448; 1M8, Picton Valley, DN794290 (43°05'28"S, 146°44'48"E), 100m, 15.vii.1994, K. Michaels, QVM 23:22106, pitfall PC3; 1M8, same details but pitfall PC5, QVM 23:22107; 1F8, Weavers Creek, EQ307122 (41°26'27"S, 147°22'02"E), 680m, 19.vii.1994, QVM 23:15477; 1M8, Don River, DQ408362 (41°13'23"S, 146°17'37"E), 90m, 25.vii.1994, QVM 23:15469; 1F8, 1F6, same details, QVM 23:15475; 1M8, Weavers Creek, EQ338094 (41°27'58"S, 147°24'17"E), 600m, 30.vii.1994, R. Mesibov & T. Moule, QVM 23:15471; 1F7, Weavers Creek, EQ316087 (41°28'21"S, 147°22'42"E), 480m, 31.vii.1994, R. Mesibov & T. Moule, QVM 23:15478; 1F8, Nunamara, EQ286142 (41°25'23"S, 147°20'32"E), 610m, 4.viii.1994, R. Mesibov & D. Soccol, QVM 23:17756; 1M8, Mt Walter, EN717687 (42°43'50"S, 147°52'33"E), 350m, ix.1994, G. Blake & K. Michaels, QVM 23:22108; 1M8, Picton Valley, DN794290 (43°05'28"S, 146°44'48"E), 100m, i.ix.1994, K. Michaels, QVM 23:22109, pitfall PC5; 1F8, Jacob Hill, EN714709 (42°42'39"S, 147°52'18"E), 350m, xi.1994, G. Blake & K. Michaels, QVM 23:40812; 1F6, Razorback Road, EP729991 (41°33'22"S, 147°52'27"E), 590m, 25.xii.1994, R. Mesibov & T. Moule, QVM 23:17841; 1M8, Pump House Point, Lake St Clair, DP342381 (42°06'22"S, 146°12'14"E), 740m, 27.xii.1994, T. Kingston, QVM 23:25584, pitfall 47; 2M7, Mt Dismal, EQ072330 (41°15'15"S, 147°05'09"E), 320m, 20.i.1995, QVM 23:17842; 1F8, St Patricks River, EQ279121 (41°26'31"S, 147°20'02"E), 430m, 25.i.1995,

QVM 23:17843; 1M7, Organ Pipes, Mt Wellington, EN198497 (42°54'17"S, 147°14'33"E), 780m, 21.ii.1995, QVM 23:22112; 1F7, Weavers Creek, EQ308116 (41°26'47"S, 147°22'07"E), 640m, 22.iii.1995, QVM 23:22113; 1F7, same details but EQ306123 (41°26'24"S, 147°21'58"E), 710m, QVM 23:22114; 1F8, Mt Roland, DQ375080 (41°28'37"S, 146°15'05"E), 650m, 4.vi.1995, QVM 23:22115; 1F8, Weavers Creek, EQ312132 (41°25'55"S, 147°22'24"E), 580m, 23.viii.1995, QVM 23:22116; 1M7, 1F7, Weaning Paddock Creek, DP191999 (41°32'53"S, 146°01'47"E), 760m, 28.i.1996, R. Mesibov & T. Moule, QVM 23:22262; 1F8, Mt Gnomon, DQ189411 (41°10'38"S, 146°01'59"E), 340m, 14.ii.1996, QVM 23:21841; 1M8, Mt George, DQ899493 (41°06'26"S, 146°52'46"E), 90m, 2.iii.1996, R. Mesibov & T. Moule, QVM 23:40449; 1F8, Englishmans Gully, EP480629 (41°53'03"S, 147°34'42"E), 370m, 9.iii.1996, QVM 23:40450; 2M8, same details, QVM 23:40451; 2M8, Moaners Tier, EP705234 (42°14'17"S, 147°51'16"E), 680m, 18.vi.1996, K. Michaels, QVM 23:41868, pitfall, site 'brookerana 3'; 1F8, Eureka Pot cave, Gunns Plains, DQ192313 (41°15'56"S, 146°02'07"E), 21.vi.1996, S. Blanden, QVM 23:41674; 1M7, Weavers Creek, EQ300134 (41°25'48"S, 147°21'32"E), 700m, 7.ix.1996, QVM 23:40452; 2M8, East Gawler River, DQ262305 (41°16'24"S, 146°07'07"E), 250m, 24.x.1996, QVM 23:40453; 1M6, 2F8, 1F6, Gawler River, DQ276343 (41°14'21"S, 146°08'09"E), 130m, 24.x.1996, QVM 23:40454; 1M8, same details, QVM 23:40455; 2M7, Waddamana, DP792358 (42°07'46"S, 146°44'54"E), 22-25.xi.1996, C. Brockmann, QVM 23:40456; 1M7, 1F8, Beefeater Hill, DQ673009 (41°32'33"S, 146°36'28"E), 290m, 2.xii.1996, R. Mesibov & C. Brockmann, QVM 23:40457; 1M7, Waddamana, DP797355 (42°07'55"S, 146°45'15"E), 650m, 24.xii.1996, C. Brockmann, QVM 23:40458, to DP805356, 830m; 1F7, Dee Lagoon, DP696190 (42°16'49"S, 146°37'52"E), 710m, 25.xii.1996, R. Mesibov, C. Brockmann & T. Moule, QVM 23:40459; 2F7, Central Castra, DQ273288 (41°17'19"S, 146°07'54"E), 270m, 2.i.1997, R. Mesibov & R. van Riet, QVM 23:40460; 1F8, Library Creek, DQ238417 (41°10'20"S, 146°05'29"E), 20m, 4.i.1997, R. Mesibov & C. Brockmann, QVM 23:40461; 1F6, Poatina Intake Road, Great Lake, DP866683 (41°50'12"S, 146°50'18"E), 1080m, 9.ii.1997, QVM 23:40462; 1M7, Holwell Gorge, DQ808323 (41°15'37"S, 146°46'14"E), 150m, 8.iii.1997, QVM 23:40463; 1M8, Myrtle Gully, EN206513 (42°53'25"S, 147°15'08"E), 580m, 13.iii.1997, C. Brockmann, QVM 23:40464; 3F8, Bellettes Creek, EN752452 (42°56'31"S, 147°55'18"E), 60m, 6.vii.1997, K. Bonham, A. Walsh & A. Bolger, QVM 23:40465; 1M8, McGuinness Creek, EN787463 (42°55'54"S, 147°57'52"E), 100m, 6.vii.1997, K. Bonham, A. Walsh & A. Bolger, QVM 23:40466; 2F8, Long Hill, DQ596183 (41°23'08"S, 146°31'00"E), 280m, 19.ix.1997, QVM 23:40467; 1F8, north of Porters Bridge, DQ777065 (41°29'33"S, 146°43'58"E), 250m, 5.xi.1997, QVM 23:40468; 1F8, Long Hill, DQ594178 (41°23'24"S, 146°30'51"E), 270m, 7.xi.1997, QVM 23:40469; 1F8, Pig Creek, DQ611039 (41°30'55"S, 146°32'01"E), 220m, 7.xi.1997, QVM 23:40470, fragments; 1F8, Cluan Tiers, P808930 (41°36'51"S, 146°46'10"E), 450m, 9.xi.1997, R. Mesibov & T. Moule, QVM 23:40471; 1M6, Dee Lagoon, DP695189 (42°16'52"S, 146°37'48"E), 730m, 28.xii.1997, K. Bonham & R. Crookshanks, QVM 23:40472; 1M7, Victoria Valley Falls, DP761141 (42°19'29"S, 146°42'35"E), 480m, 28.xii.1997, K. Bonham & R. Crookshanks, QVM 23:40473; 1M8, Yarlinton Tier, EN244903 (42°32'20"S, 147°17'49"E), 650m, 22.ii.1998, K. Bonham & R. Crookshanks, QVM 23:40474; 1M8, Little Den Creek, EP093027 (42°25'40"S, 147°06'46"E), 440m, 22.ii.1998, K. Bonham & R. Crookshanks, QVM 23:40475; 1F7, Mt Hobbs, EN480924 (42°31'08"S, 147°35'03"E), 600m, 5.vi.1998, K. Bonham & R. Crookshanks, QVM

23:40476; 1F8, Tin Pot Creek, EN538978 (42°28'12"S, 147°39'16"E), 320m, 5.vi.1998, K. Bonham & R. Crookshanks, QVM 23:40477; 3F8, Regents Plain, EP016533 (41°58'19"S, 147°01'09"E), 680m, 12.ix.1998, K. Bonham & R. Crookshanks, QVM 23:40478; 2F8, Tunbridge Tier, EP224364 (42°07'26"S, 147°16'15"E), 760m, 12.ix.1998, K. Bonham & R. Crookshanks, QVM 23:40479; 1M8, Blackman River, EP242294 (42°11'13"S, 147°17'35"E), 640m, 12.ix.1998, K. Bonham & R. Crookshanks, QVM 23:40480; 3M8, Castle Cary Rivulet, EP584823 (41°42'31"S, 147°42'07"E), 450m, 30.xii.1998, R. Mesibov & K. Bonham, QVM 23:40710; 1F8, Yangena Hill, DP943463 (42°02'06"S, 146°55'52"E), 1070m, 14.iii.1999, R. Mesibov & T. Moule, QVM 23:40743; 1F8, Whisky Creek, DQ217420 (41°10'09"S, 146°03'59"E), 70m, 28.iv.1999, K. Bonham, QVM 23:41869, site 3b; 1M8, Gawler River, DQ276343 (41°14'21"S, 146°08'09"E), 160m, 29.iv.1999, K. Bonham, QVM 23:41870, site 7b; 1M6, same details but DQ277347 (41°14'08"S, 146°08'14"E), 150m, QVM 23:41871, site 6b; 1F8, Keddies Creek, DQ208417 (41°10'19"S, 146°03'20"E), 70m, 28.v.1999, K. Bonham, QVM 23:41872, site 38a; 1M8, Macgregor Peak, EN769413 (42°58'36"S, 147°56'35"E), 550m, 9.x.1999, K. Bonham, D. Hird & A. Thompson, QVM 23:41089; 2M8, Florentine River, DN537967 (42°28'49"S, 146°26'12"E), 500m, vi.2000, O. Seeman, QVM 23:24803, pitfall, location is centre of coupe TI03C; 1F8, Coles Creek, DN539948 (42°29'51"S, 146°26'20"E), 400m, vi.2000, O. Seeman, QVM 23:24804, pitfall, location is centre of coupe TI03H; 3M8, Gulf Creek, DN641974 (42°28'29"S, 146°33'47"E), 420m, vi.2000, O. Seeman, QVM 23:24805, pitfall, location is centre of coupe RP012A; 1M8, same details but DN641982 (42°28'03"S, 146°33'47"E), 400m, QVM 23:24806, pitfall, location is centre of coupe RP012F; 1M8, Diamond Tier, DP866312 (42°10'15"S, 146°50'15"E), 800m, 16.vii.2000, R. Mesibov & T. Moule, QVM 23:41873; 1F8, IF7, Fingal Tier, EP895875 (41°39'32"S, 148°04'29"E), 840m, 6.i.2001, R. Mesibov & T. Moule, QVM 23:25671, in absolute ethanol; 4F8, Anglers Creek, EP699233 (42°14'21"S, 147°50'49"E), 580m, 11.i.2001, QVM 23:25672, in absolute ethanol; 1M7, Native Tier, DP782191 (42°16'47"S, 146°44'08"E), 620m, 26.i.2001, QVM 23:41864; 1F8, Little Quoin, EN245905 (42°32'14"S, 147°17'54"E), 650m, 4.ii.2001, R. Mesibov & K. Bonham, QVM 23:25673, in absolute ethanol; 2M8, Loyetea Peak, DQ124251 (41°19'14"S, 145°57'11"E), 650m, 22.vii.2001, R. Mesibov & T. Moule, QVM 23:41874; 1M8, Mersey River, DP348928 (41°36'49"S, 146°13'02"E), 390m, 22.ix.2001, R. Mesibov & R. van Riet, QVM 23:41922; 1F8, Emu Plains, DP306990 (41°33'27"S, 146°10'03"E), 740m, 14.x.2001, QVM 23:24807; 1F7, Woodsdale, EN472973 (42°28'30"S, 147°34'27"E), 370m, 3.xi.2001, R. Mesibov & T. Moule, QVM 23:24808; 1F8, near 'Christmas Tree', Styx Valley, DN746581 (42°49'44"S, 146°41'21"E), 440m, 9.xii.2001, K. Bonham, QVM 23:24809; 1M8, near 'Chapel Tree', Styx Valley, DN747585 (42°49'31"S, 146°41'25"E), 420m, 9.xii.2001, K. Bonham, QVM 23:24810; 1M6, IF6, Blue Tier Creek, EP620386 (42°06'07"S, 147°44'59"E), 580m, 23.iii.2002, R. Mesibov & T. Moule, QVM 23:25013; 1M8, Mt Clark, EN638267 (43°06'34"S, 147°47'02"E), 250m, 4.v.2002, K. Bonham, QVM 23:25014; 1M8, Blythe River, DQ110399 (41°11'14"S, 145°56'19"E), 70m, 15.vi.2002, QVM 23:25015; 1M8, Pelverata Falls, EN112325 (43°03'35"S, 147°08'15"E), 6.iv.2003, K. Bonham, QVM 23:25585; 1F8, Judds Creek, DN976476 (42°55'24"S, 146°58'15"E), 390m, 29.xi.2003, R. Mesibov & K. Bonham, QVM 23:25586.