

DESCRIPTION OF TWO NEW LARVAL SMARIDIDAE (ACARINA) FROM AUSTRALIA

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SOUTHCOTT, R. V. 1997. Description of two new larval Smarididae (Acarina) from Australia. *Records of the South Australian Museum* 30(1): 1–12.

Two new Australian larvae of Smarididae (Acarina) are described, *Smaris arenicola* sp. nov. and *Sphaerotarsus monticolus* sp. nov., both from South Australia, from soil and litter. Each is the second species known as larva in its genus; both earlier described species were also Australian. The term AME is introduced in the coding of the metric data of the larval dorsal scutum.

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The mite family Smarididae Vitzthum, 1929 is cosmopolitan, most members being known as adults. The adults (and deutonymphs) are small mites, of a generally flattened stature, living as predators in litter or under the bark of trees. These mites are mostly known from their adult instars. The larvae are probably all ectoparasitic on small arthropods, as is the case with most other members of the superfamily Erythraeoidea. Thus one Australian larva, *Smaris prominens* (Banks, 1916), has been found as an ectoparasite of small Psocoptera (Womersley & Southcott 1941). A taxonomic and historical review of the family was given by Southcott (1961a). Seven genera are known as larvae (Southcott 1995). Of these two are Australian, each with a single described species; that of *Smaris prominens* (Banks, 1916) (by Womersley & Southcott 1941), and of *Sphaerotarsus leptopilus* Womersley & Southcott, 1941 (by Southcott 1960). The present paper describes a further new species in each of these genera, both from South Australia, and known only as larvae.

MATERIALS AND METHODS

Specimens described in this paper were obtained by Berlese funnel extractions of samples of soil and litter in South Australia. They were collected as active larvae, and each was confined individually in a small tube and various small arthropods were introduced as potential hosts, in an effort to elucidate life histories.

The larvae were eventually mounted in Hoyer's medium after first being cleared in 50% lactic acid solution. Microscopy was done with the use of

Leitz Ortholux/Laborlux microscope equipped with phase contrast and polarizing facilities. Drawings were made with the use of a drawing apparatus.

Chaetotaxic and other nomenclature and coding are as in Southcott (1961b, c, 1963, 1992, 1995). The code AME is introduced as a measure of the anterior central emargination of the dorsal scutum. (In my previous papers I had misinterpreted the use of this term as ASBM, which was introduced by Fain & Elsen 1987). AME may be formally defined as the distance between the anterior end of the scutum, in the midline, to the central anterior point of the scutum; hence $AME = ASBa - ASBM$ (Fain & Elsen).

The terms protorostral, deutorostral and tritrostral will be used for the anterior setae of the gnathosoma, following Newell (1957).

All measurements are in micrometres (μm) unless otherwise stated.

All specimens will be deposited in the South Australian Museum (SAM).

SYSTEMATICS

Family SMARIDIDAE Vitzthum

Smarididae Vitzthum, 1929: 69, 70; Womersley & Southcott 1941: 61; Southcott 1946: 173; 1948: 252; 1960: 149; 1961a: 174; 1961b: 413; 1961c: 133; 1963: 159; 1995: 57; Shiba 1976: 189.

Erythraeidae Womersley, 1934: 218 (part).

Smarisidae Grandjean, 1947: 1.

For other synonymy see Southcott 1961b: 413–414.

Genus *Smaris* Latreille

Smaris Latreille, 1796: 180; Womersley & Southcott 1941: 63; Southcott 1946:175; 1948: 252; 1960: 155; 1961a: 176–177; 1961b: 438; 1961c: 133; 1963: 163; 1995: 63.

Sclerosmaris Grandjean, 1947: 3, 53.

For other synonymy see Southcott 1961b: 438–439.

KEY TO LARVAL *SMARIS*

- PDS 27–29 μm long. AL scutalae blunt-ended. Sternala I thickened, well setulose *S. prominens* (Banks, 1916)
- PDS 28–45 μm long. AL scutalae pointed. Sternala I narrow, lightly setulose *S. arenicola* sp. nov.

Smaris arenicola sp. nov.

(Figs 1A–D, 2A,B)

Material examined

Holotype. South Australia: Loveday, 7–8.ix.1985, R. V. Southcott, larva ACA2158 from soil and litter sample TX244, site Map: Department of Lands, South Australia, Barmera-Loveday, 2nd Edition 1:10,000 6929–26, MR 466055 (140°25'03"E, 34°17'25"S), extracted by Berlese funnel live 6.x.1985; to Hoyer's medium 28.i.1991. SAM.

Paratypes. Same data as holotype, 21 larvae from same site and sample, ACA2150, 2152–2156, 2159–2173, extracted live similarly 24.ix.1985–10.x.1985; Hoyer's medium. SAM.

Diagnosis of larva

Anterior scutalae pointed. GeIII 65–72 μm long. PDS 28–45 μm long.

Description of larva (from slide-mounted holotype, supplemented by paratypes)

Colour in life red. Idiosoma 245 long, 180 wide; total length of animal 330.

Dorsal scutum transverse, oval, with slight central anterior emargination, minutely porose. Scutalae slender, pigmented, AL pointed, PL blunt-ended, with adnate to slightly outstanding setules. AL scutalae placed anterolaterally on scutum; PL placed posterolaterally; all near edge of scutum. Anterior sensillary setae placed about midway between levels of AL and PL scutalae bases; sockets of posterior sensillary setae lightly

protruding, placed at about middle of posterior border of scutum. Anterior sensillary setae thin, but thicker than the filamentous posterior sensillary setae; all with slight setules in distal two-thirds, longer distally.

Metric data as in Table I.

Dorsal idiosomal setae about 41 in number, pigmented, blunt-ended, with short, barbed setules; anterior setae in indistinct rows across dorsum; posterior setae form a denser group.

Ventral surface of idiosoma: two sternalae between coxae I, pigmented, pointed, lightly setulose; sternalae II vestigial, presenting as small domes *c.* 5 across, between coxae II; between coxae III two intercoxalae 28 long, similar to sternalae I. Behind coxae III *c.* 11 setae similar to dorsals, 27–36 long, arranged approximately 2, 4, 4, 1, with a denser grouping towards posterior pole.

Legs fairly short and thick, similar to those of *Smaris prominens* (see Womersley & Southcott 1941); lengths (including coxae and claws): I 380, II 370, III 410. Coxalae and other leg scobalae pigmented, setulose, pointed. Supracoxala to leg I a slender, blunted peg, 5 long.

Leg specialized setae: SoGeI.77pd(23), VsGeI.90pd(4), SoTiI.50d(38), SoTiI.70pd(33), CpTi.75d(8)+SoTiI.76d(28), SoTiI.78d(12), VsTiI.83pd(6), SoGeII.51pd(15), SoTiII.03d(16), SoTiII.78d(10), SoGeIII.52d(14), SoTiIII.03d(12).

Tarsus I with SoTaI.37d(45), curved, strong, pointed; FaTaI.40ad(6); tarsus I also with an accompanying trichobothria to the solenoidala, with several long setules, at .44d, seta 40 long. Tarsus II with SoTaII.35d(18), slender, nearly recumbent. FaTaII appears as a minute vestigial structure immediately alongside, i.e. posterior to, SoTaII. All tarsi with a long, slender, blade-like empodium, 23–27 long, over-reaching lateral claws, which are paired on each tarsus, about 18 long, each a pad with a number of long ventral onychotrichs.

Gnathosoma robust, pyriform, 77 long by 75 wide (combined). Cheliceral digits S-shaped, 16 long, sharp-pointed. Protorostral (galcal) seta simple, slender, pointed, 14 long. Deutorostral seta simple, conical, 7 long. Tritorostral setae simple, slender, pointed, 21 long. Palpal setal formula 0, 0, 1, 1, 3, 7 (including solenoidala and terminala (eupathidala)); all setae (except palptarsal solenoidala) pointed; femorala, genuala and tibialae 1 and 2 setulose. Odontus pointed, hook-like, with two dorsal supplementary spurs behind tip. Palpal supracoxala dorsal in position, a clavate rod 5 long.

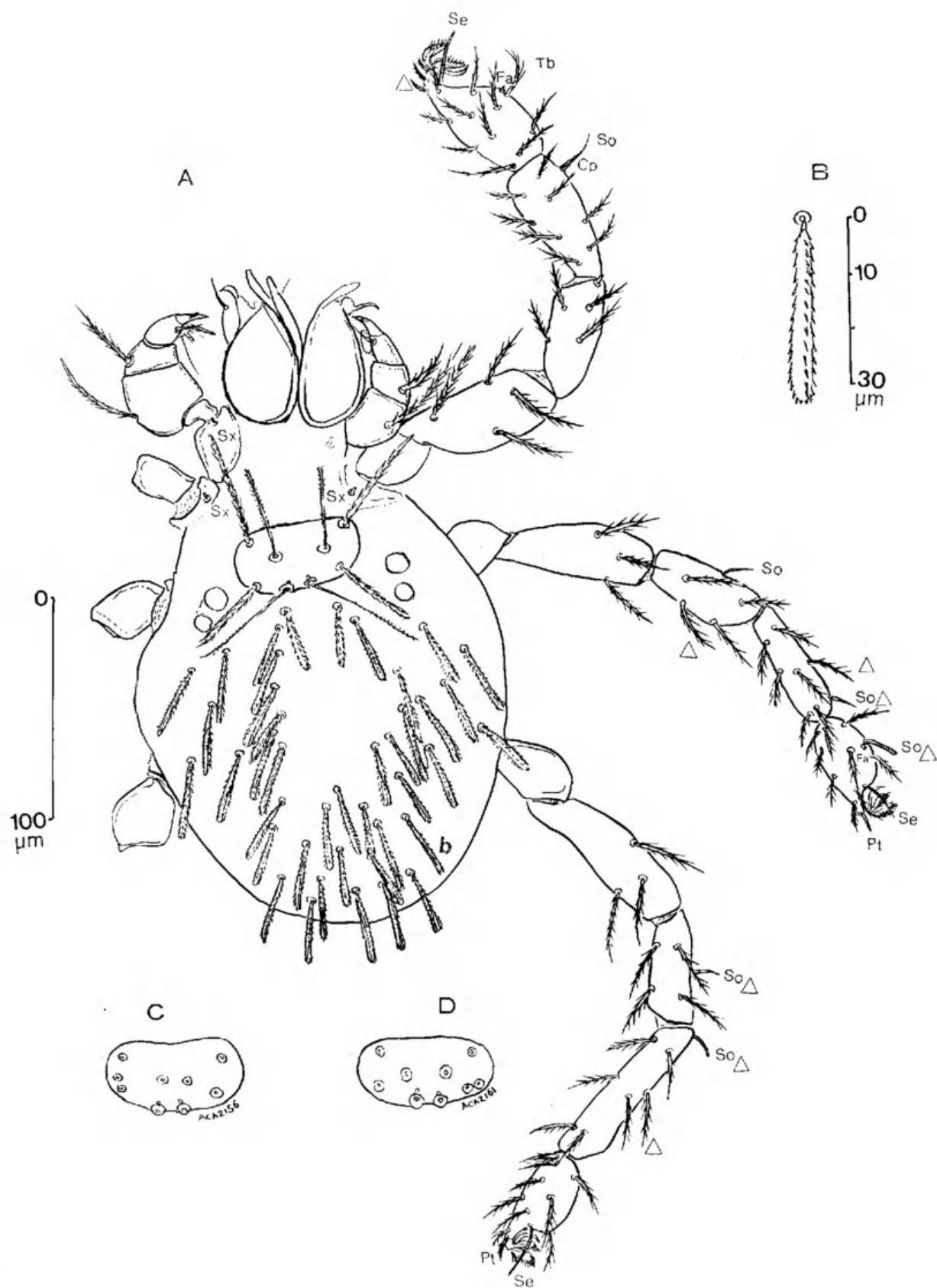


FIGURE 1. *Smaris arenicola* sp. nov., larva. A, B holotype; A, Dorsal view, on left legs omitted beyond trochanters; B, Dorsal idiosomal seta ('b' in A). C, D Paratypes: C, Teratological dorsal scutum of ACA2156; D, teratological dorsal scutum of ACA2161. (Each to nearest scale.)

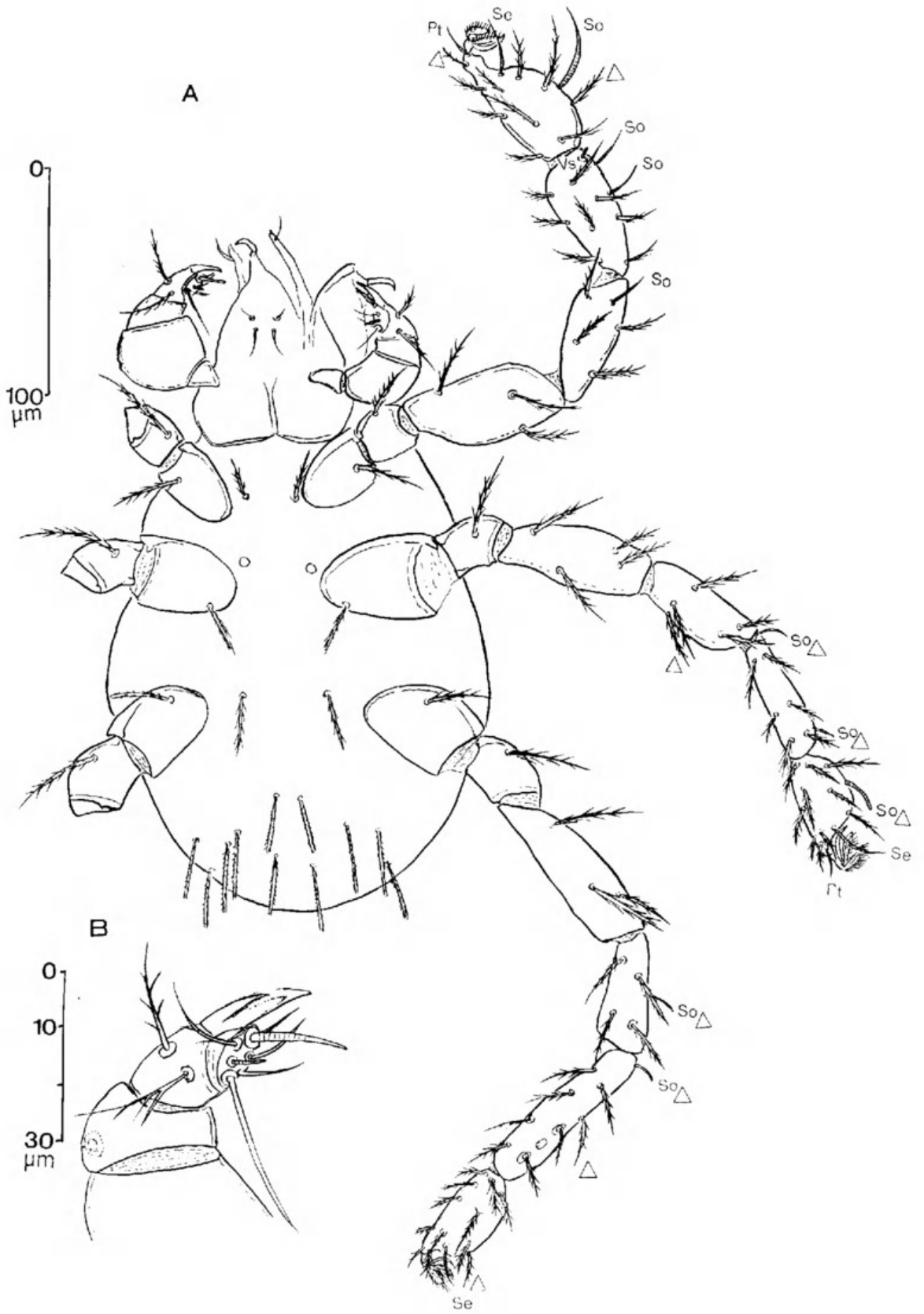


FIGURE 2. *Smaris arenicola* sp. nov., larva, holotype. A, Ventral view, on left legs omitted beyond trochanters. B, Tip of palp, ventral view, further enlarged.

TABLE 1. Metric data for *Smaris arenicola* sp. nov. larvae (*for maximum values)

Character	Holotype	n	range	mean	s.d.	c.v.
AW	47	22	43-49	45.5	1.37	3.0
PW	50	22	42-53	48.3	2.35	4.9
SBa	22	21	19-23	22.1	1.01	4.6
SBp	16	21	13-16	15.0	0.921	6.1
LX	8	21	6-12	8.81	1.21	13.7
ASBa	20	21	15-22	17.8	1.83	10.3
AME	2	21	1-3	2.10	0.436	20.8
ISD	15	21	14-17	15.0	0.805	5.4
L	38	21	34-39	35.8	1.34	3.7
W	63	21	58-72	63.7	3.44	5.4
AAS	16	21	14-16	15.1	0.831	5.5
A-P	20	21	15-20	16.9	1.64	9.7
AL	56	21	45-64	55.1	3.54	6.4
PL	43	22	36-47	42.1	2.83	6.7
ASE	40	21	36-44	39.7	1.93	4.9
PSE	65	19	60-73	66.2	3.92	5.9
DS	31-38	22	38-45*	41.0*	1.79*	4.4*
'Oc.'	37	22	36-42	38.1	1.98	5.2
MDS	32	22	32-38	34.4	1.99	5.8
PDS	31-38	22	38-45*	40.8*	2.05*	5.0*
GeI	68	22	60-69	64.7	1.93	3.0
TiI	66	22	60-69	64.7	2.12	3.3
TaI(L)	68	22	64-73	68.5	2.39	3.5
TaI(II)	33	22	27-35	32.2	2.56	7.9
TiI/GeI	0.97	22	0.92-1.07	1.00	0.0340	3.4
GeII	62	22	55-64	59.3	2.44	4.1
TiII	66	22	62-68	65.6	1.89	2.9
TaII(L)	50	22	47-60	52.8	3.15	6.0
TaII(H)	27	22	20-31	26.4	3.06	11.6
TiII/GeII	1.06	22	1.02-1.19	1.11	0.0490	4.4
GeIII	68	22	65-72	67.9	1.77	2.6
TiIII	93	22	86-93	89.9	2.04	2.3
TaIII(L)	55	22	49-61	56.3	2.64	4.7
TaIII(H)	26	22	20-29	25.0	2.29	9.2
TiIII/GeIII	1.37	22	1.28-1.38	1.32	0.0360	2.7
AW/ISD	3.13	21	2.75-3.36	3.04	0.187	6.1
ISD/A-P	0.75	21	0.75-1.07	0.887	0.0913	10.3
AW/A P	2.35	21	2.15-3.00	2.71	0.260	9.6
StI	18	22	18-29	22.4	2.97	13.3
CxI	42	22	40-53	44.0	2.59	5.9
CxII	22	21	20-31	23.3	2.51	10.8
CxIII	31	21	26-36	32.1	2.78	8.6
TiI/AW	1.40	22	1.32-1.56	1.42	0.0668	4.7
TiIII/AW	1.98	22	1.83-2.12	1.98	0.0666	3.4
AW/AL	0.84	21	0.70-1.02	0.829	0.0599	7.2
AL/AAS	3.50	20	2.81-4.27	3.65	0.341	9.3
TiIII/TiI	1.41	22	1.28-1.44	1.39	0.0402	2.9
TiII/PW	1.32	22	1.22-1.57	1.36	0.0768	5.6
L/W	0.60	21	0.47-0.64	0.56	0.0416	7.4
PW/AW	1.06	22	0.93-1.18	1.06	0.0545	5.1
AL/PL	1.30	21	1.13-1.52	1.31	0.112	8.5

Etymology

The specific epithet *arenicola* means 'sand-dwelling' (Latin), a reference to the site of capture.

Biology

All larvae were captured free. In an attempt to find possible hosts larvae were introduced individually into small tubes, and various small arthropods introduced as potential hosts. These included various insects: small moths, small hemipterans (aphids, psyllids, a ?mirid), small Diptera and wingless Psocoptera; also a small spiderling. However, no attempt at parasitization by any of the mites was observed.

Genus *Sphaerotarsus* Womersley

Sphaerotarsus Womersley, 1936: 119; Womersley & Southcott 1941: 63, 73; Southcott 1960: 149; 1961a: 177; 1961b: 144; 1963: 211; 1995: 57, 63.

Definition of larva

One eye on each side. Anterior sensillary bases anterior to AL scutalae bases; posterior sensillary bases posterior to PL scutalae bases. Palpal tibial claw (odontus) apically simple or with narrow terminal split, and an outstanding basal accessory tooth. Genu I with 3–6 solenoidalae. Tibia I with four solenoidalae.

KEY TO LARVAL *SPHAEROTARSUS*

- PDS to 127 µm long
.. *S. leptopilus* Womersley & Southcott, 1941
- PDS to 86 µm long *S. monticolus* sp. nov.

Sphaerotarsus monticolus sp. nov.

(Figs. 3A,B, 4A,B)

Material examined

Holotype. South Australia. Mt. Lofty, 5–20.x.1991, R. V. Southcott, larva ACA2556, in damp soil and litter in *Eucalyptus obliqua* forest, sample TX320, site at Map: Adelaide 6628 111, 1:50,000, MR 897282 (138°41'47" E., 34°58'03" S.), sample collected 5.x.1991, extracted live by Berlese funnel 20.x.1991. Cleared with 50% lactic acid, mounted in Hoyer's medium.

Paratypes. South Australia. Hope Forest, 11.ix.1980, RVS, in moss under *Eucalyptus baxteri* forest, at Map Reference Milang 1:63,360 617393 (138°36'19"E., 35°18'06"S.), site TX198,

extracted by Berlese funnel 14–23.ix.1980. Stirling, at Map Reference Adelaide 1:50,000, 2nd Edtn., 934258 (138°44'0"E., 34°59'30"S.), 11.xi.1984, RVS, sample TX232 of soil, litter and grass under *Eucalyptus hueberiana*, extracted by Berlese funnel 17.xi.1984.

Diagnosis of larva

PDS to 66 µm long.

Description of larva (from slide-mounted holotype)

Colour in life: idiosoma orange, legs pale orange. Idiosoma 325 long, 220 wide. Total length to tip of cheliceral digits 410; in life these dimensions were 300, 200, 380 respectively.

Dorsal scutum trapezoidal, with rounded anterior end and acute posterior end; scutum minutely porose. Scutum has a sclerotized ridge enclosing the anterior and posterior sensillary areas, of a tear-drop shape, the point posteriorad, and within the bases of the four scutalae. Scutalae pointed, with many fine, pointed setules. Anterior sensillary setae thicker than the filamentous posterior sensillary setae; all sensillary setae with fine setules in distal half of setal shaft.

Metric data as in Table 2.

Eyes 1+1, lateral to scutum, 18 across.

Dorsum of idiosoma with 24 setae, pigmented, expanding slightly distally, blunt-ended, with many fine setules; setae arranged approximately 6, 4, 2, 4, 2, 4, 2.

Ventral surface of idiosoma: sternalae I pointed, setulose; sternalae II absent; anterior to coxae III a pair of intercoxalae similar to sternalae I, 36 long, 60 apart. Behind coxae III are 10 pointed, setulose setae, arranged 4, 2, 2, 2.

Legs somewhat longer than idiosoma; lengths (including coxae and claws): I 400, II 395, III 495. Leg scobalae pointed, lightly setulose. Supracoxala to leg I blunted, 4 long.

Leg specialized setae: TbGeI.44ad(25), TbGeI.44pd(22), SoGeI.60pd(23), SoGeI.67d(16), SoGeI.76pd(17), VsGeI.90d(3), TbTiI.48pd(28), TbTiI.53ad(29), TbTiI.54pv(27), TbTiI.54av(29), SoTiI.61pd(30), SoTiI.67d(30), SoTiI.77pd(30), CpTiI.80ad(9)+ScTiI.82ad(30), SoTiI.86d(25), VsTiI.95pd(2), VsGeII.88d(1), SoTiII.11d(14), SoTiII.86d(10), SoTiII.09d(18).

Tarsus I with SoTaI.17ad(20), TbTaI.20pd(22), CpTaI.40ad(9)+SoTaI.42ad(22), FaTaI.58ad(1), CpTaI.70d(6)+TbTaI.71d(29). Tarsus II with SoTaII.39d(20). Lateral tarsal claws with a few slender onychotrichs; empodium slender, over-reaching lateral claws.

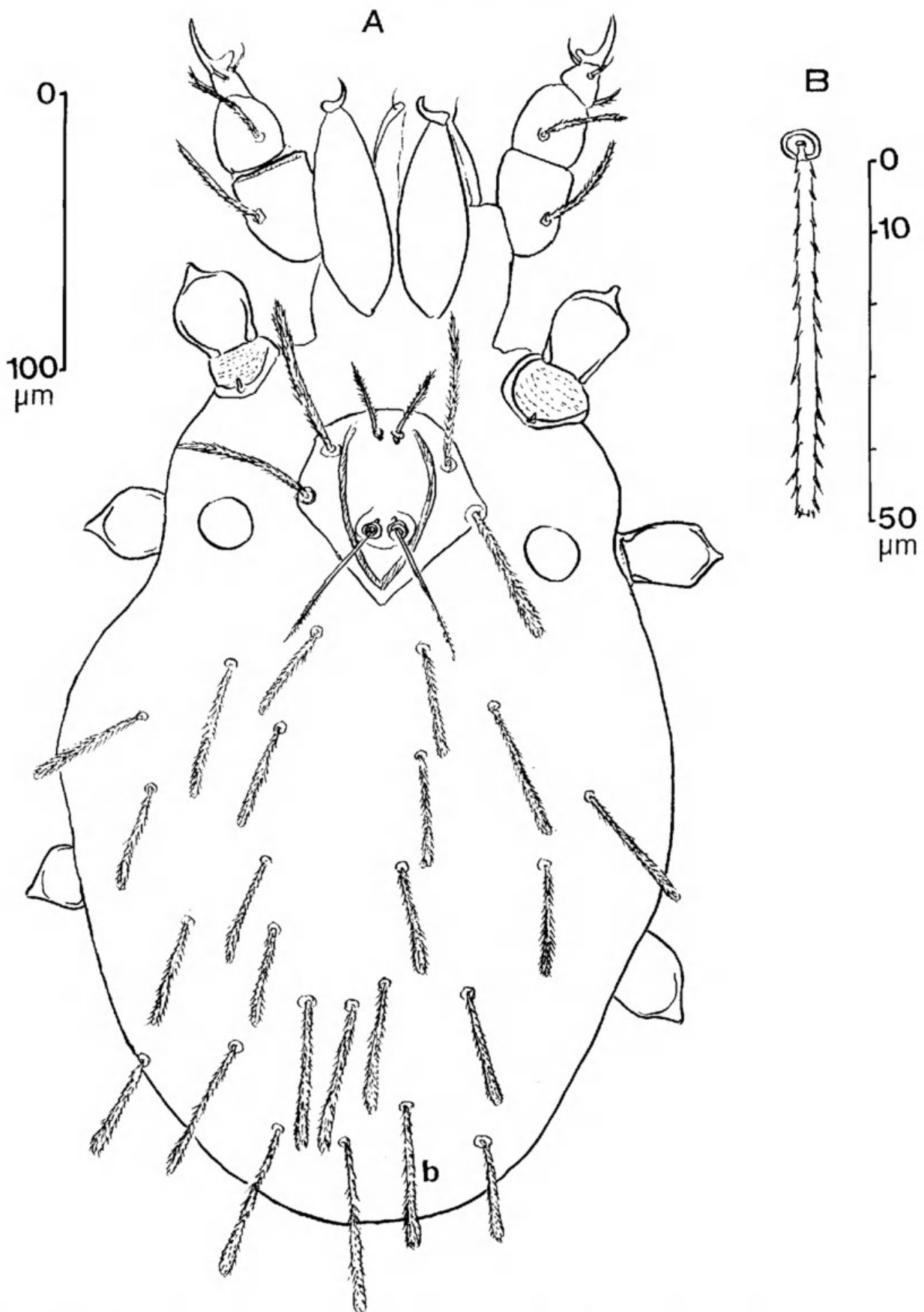


FIGURE 3. *Sphaerotarsus monticolus* sp. nov., larva, holotype. A, Dorsal view, legs omitted beyond trochanters. B, Dorsal idiosomal seta ('b' in A), further enlarged.

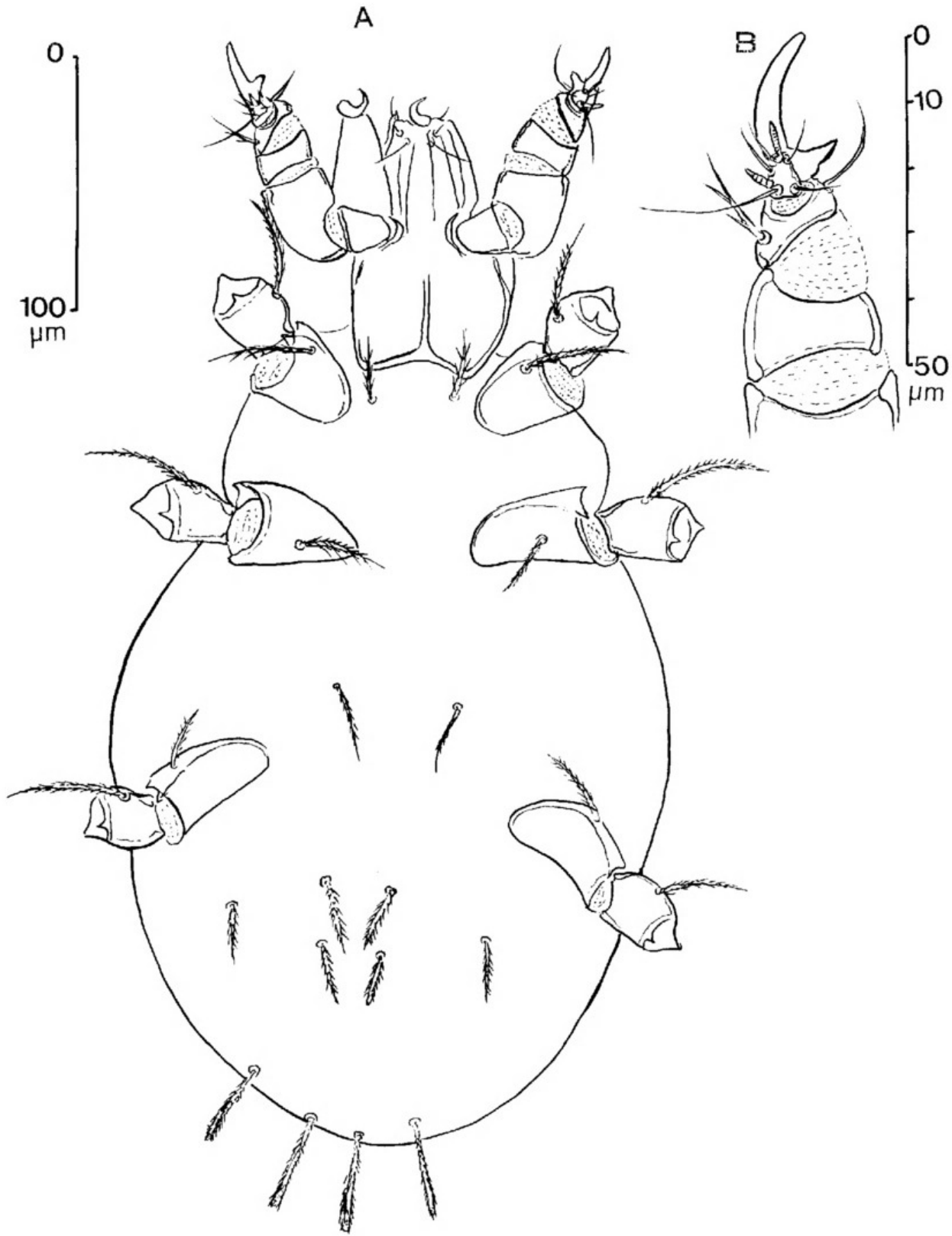


FIGURE 4. *Sphaerotarsus monticolus* sp. nov., larva, holotype. A, Ventral view, legs omitted beyond trochanters. B, Tip of palp, ventral view, further enlarged.

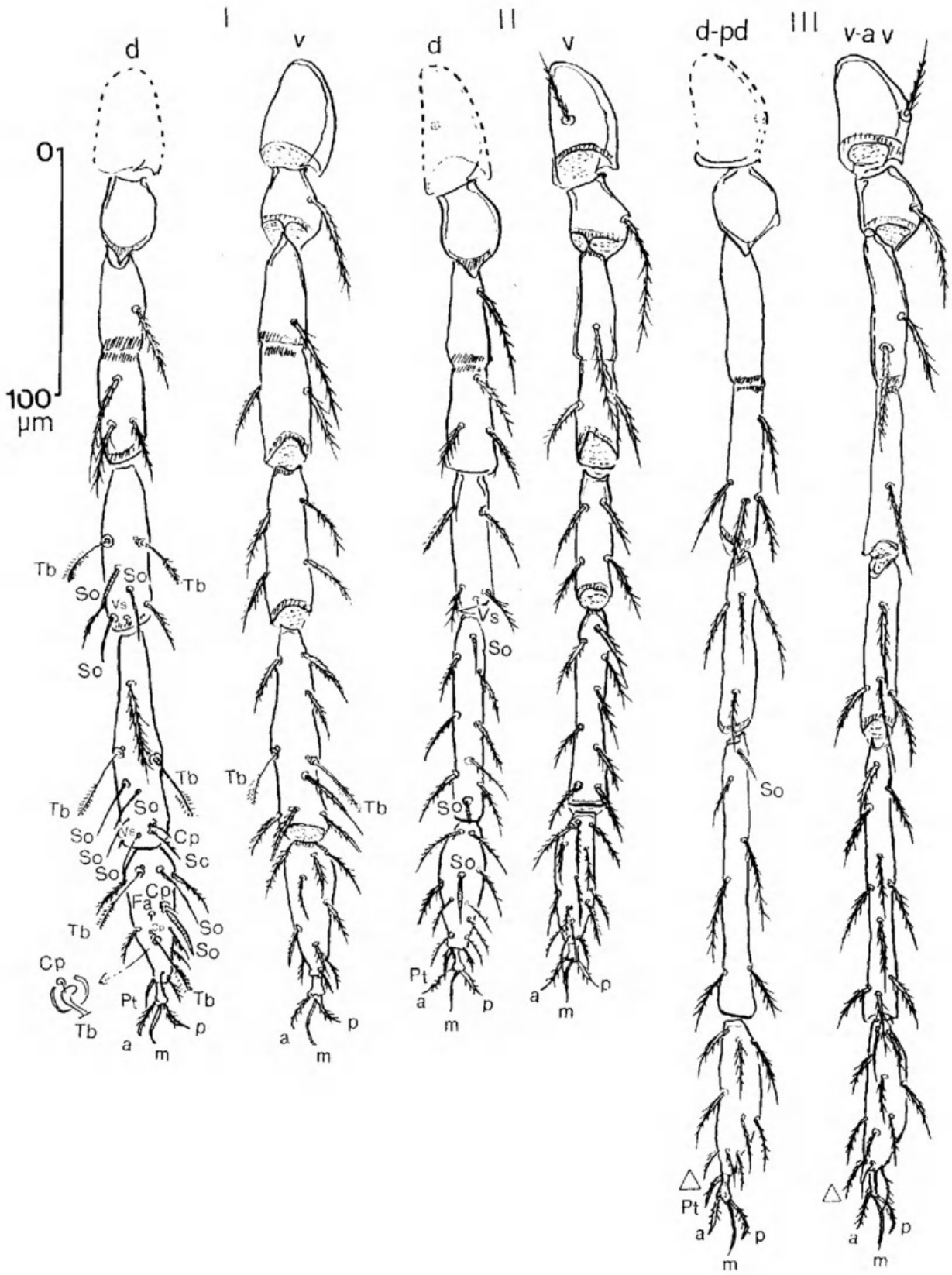


FIGURE 5. *Sphaerotarsus monticolus* sp. nov., larva, holotype. Legs I, II, III. (All to scale shown.)

TABLE 2. Metric data for *Sphaerotarsus monticolus* sp. nov. larvae (*for maximum values)

Character	Holotype	n	range	mean	s.d.	c.v.
AW	43	10	36-47	41.7	2.98	7.2
PW	55	10	47-66	56.8	6.44	11.3
SBa	8	10	6-13	10.6	2.17	20.5
SBp	12	10	11-14	12.2	1.40	11.5
LX	17	10	15-23	20.1	3.00	14.9
ASBa	10	10	9-16	13.4	2.76	20.6
AME	0	10	0-1	0.10	0.316	3.2
ISD	35	10	30-38	34.5	2.99	8.7
L	66	10	63-78	72.1	5.24	7.3
W	64	10	59-75	67.3	6.38	9.5
AAS	19	10	15-22	17.5	2.01	11.5
A-P	19	10	14-30	21.7	5.29	24.4
AL	58	10	57-78	66.6	7.88	11.8
PL	57	10	57-80	67.8	9.26	13.7
ASE	21	10	21-29	25.9	2.85	11.0
PSE	49	10	49-68	57.5	6.43	11.2
DS	42-66	10	55-86*	73.5*	10.5*	14.2*
'Oc.'	45	10	45-73	58.5	9.92	17.0
MDS	45	10	40-73	54.4	11.8	21.8
PDS	66	10	55-86*	73.5*	10.5*	14.2*
GeI	73	10	72-82	76.5	3.37	4.4
TiI	91	10	82-97	89.6	4.93	5.5
TaI(L)	55	10	52-67	60.4	5.19	8.6
TaI(H)	22	10	22-33	27.2	9.15	33.6
TiI/GeI	1.25	10	1.11 1.25	1.16	0.0372	3.2
GeII	60	10	56-85	62.0	4.00	6.5
TiII	85	10	76-86	82.3	4.27	5.2
TaII(L)	52	10	51-60	55.7	3.71	6.7
TaII(II)	18	10	18-26	22.4	2.41	10.8
TiII/GeII	1.02	10	1.02 1.40	1.28	0.107	8.3
GeIII	78	10	72-90	82.0	6.86	8.4
TiIII	124	10	114-140	127.0	8.56	6.7
TaIII(L)	63	10	62-75	66.8	4.54	6.8
TaIII(H)	17	10	17-24	21.5	2.22	10.3
TiIII/GeIII	1.59	10	1.48-1.74	1.56	0.0707	4.5
AW/ISD	1.23	10	1.05-1.67	1.24	0.184	14.9
ISD/A-P	1.84	10	1.20-2.29	1.66	0.340	20.5
AW/A-P	2.26	10	1.54-3.36	2.04	0.596	29.2
StI	34	10	29-35	32.9	1.79	5.4
CxI	49	10	49-62	55.6	4.03	7.3
CxII	37	10	34-48	38.0	4.22	11.1
CxIII	34	10	33-41	37.6	3.57	9.5
TiI/AW	2.12	10	1.81-2.28	2.16	0.184	8.5
TiIII/AW	2.88	10	2.66-3.50	3.08	0.242	7.9
AW/AL	0.74	10	0.51-0.82	0.635	0.0901	14.2
AL/AAS	3.05	10	2.59-4.59	3.85	0.608	15.8
TiIII/TiI	1.36	10	1.36-1.50	1.44	0.0505	3.5
TiII/PW	1.55	10	1.27-1.61	1.43	0.144	10.0
L/W	1.03	10	1.03-1.17	1.07	0.0572	5.3
PW/AW	1.26	10	1.01-1.61	1.40	0.198	14.2
AL/PL	1.02	10	0.88 1.09	0.988	0.0601	6.1

Gnathosoma comparatively slender; cheliceral bases 64 long by 50 wide (combined); cheliceral blades 16 long, slender, curved, pointed. Protorostral setae simple, pointed, 9 long. Deutorostral setae small, pointed, *c.* 5 long. Tritorostral setae slender, simple, pointed, *c.* 18 long. Palpi fairly robust, with setal pattern 0, 0, 1, 1, 3, 7 including solenoidala and eupathidala (terminala). Palpal femorala and genuala blunt-ended, setulose; palpal tibiala 1 pointed, setulose; palpal tibialae 2 and 3 simple, pointed. Odontus simple, with strong ventral, conical, blunted tooth. Supracoxala not identified.

Etymology

The specific epithet is an adjective, meaning 'mountain dwelling' (Latin).

Biology

Some observations were made on the living

larva ACA2121. On capture it appeared active and healthy; it was identified in life by being weighted down on a slide by a small cover glass, and examined at 400 diameters magnification. After release it became quite active again. It was placed in a small dry tube, and droplets of water given. Various small arthropods recovered from the berlesate were offered as potential hosts over several days: a small coccid (Hemiptera), 7–8 Collembola (?Isotomidae) and an immature psocopteran. However, no attempt at parasitization was observed during the nine days it survived in the tube,

ACKNOWLEDGMENTS

The work was done with the support of a grant from the Australian Biological Resources Study.

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