

# On some Silverfish Taxa from the Mildura Region (Inland South-eastern Australia) (Zygentoma: Lepismatidae: Ctenolepismatinae)

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**ABSTRACT.** Five species of the genus *Acrotelsella* Silvestri, 1935 are described and locality records reported. The male of *Acrotelsella parlevar* Smith, 2016 is also described and the distribution of the species expanded to the Australian mainland. Molecular data (COI and 28S) are presented and discussed.

## Introduction

The Australian silverfish fauna is poorly known although some progress has been made in recent years. Smith (2017) reviewed the fauna noting that the genus *Acrotelsella* Silvestri, 1935 is to be found in all states including Tasmania with many undescribed species in existing collections. The genus is also known from south-east Asia, India and China, the Seychelles, Kenya, Madagascar, Somalia, Saudi Arabia, French Polynesia, Central and northern South America (Colombia, Venezuela, Ecuador and Panama) and the Caribbean. The systematics of the genus is poorly understood and it will be necessary to describe many more species before a coherent phylogeny emerges. Furthermore, the published descriptions of most species are quite old and do not contain details currently considered as necessary to define species adequately. Redescription of many of these species will be necessary and it is possible that some of the species described here may eventually be considered as synonyms of existing named, but inadequately or incorrectly described, species. It may also eventually become necessary to reconsider the status of genera near *Acrotelsella* such as *Hemitelsella* Smith, 2016 and *Qantelsella* Smith, 2015, however this should wait until further material, especially from Western Australia, is described and supported with molecular data.

The first author has collected silverfish in various parts of Australia over the last ten years. In many cases a leg was removed from at least one specimen from each collection event and stored at 4°C for eventual DNA extraction. The second author has since generated COI and/or 28S data on 470 of these specimens. This work concentrates on material collected in the semi-arid areas of south-western New South Wales and north-western Victoria around the regional city of Mildura but has also incorporated some specimens collected in other parts of Australia which have been shown to be of the same species. The use of slide mounted adult specimens from a wide geographical area (46 of which are also defined by molecular data) has facilitated an analysis of the variability of a number of morphological characters in the genus which might be useful for species delimitation when molecular data is unavailable.

This work describes five species attributed to the genus *Acrotelsella sensu lato* (*A. albicaudata* sp. nov., *A. auricoronata* sp. nov., *A. mallee* sp. nov., *A. tanni* sp. nov. and *A. thommoi* sp. nov.) all found in the area centred around Mildura, but with ranges extending into New South Wales, Queensland and South Australia. Molecular data (COI, 28S) is presented for all five species. The description of the Tasmanian species *A. parlevar* Smith, 2016 is revised, including now also that of the male, using material collected from several localities in New South Wales and Victoria.

**Keywords:** Zygentoma; Silverfish; Thysanura; taxonomy; new species; barcode; *Acrotelsella*

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## Materials and methods

### Specimen collection, measurement and deposition

The material was collected by the first author on several field trips and also by John Tann of the Australian Museum participating in the Bush Blitz Species Discovery Programme (2019) campaign in Mungo National Park. Holotype and some paratype or voucher specimens of the other species described here, have been deposited in the entomological collections of the respective natural history museum of the state in which they were collected i.e. Museum Victoria in Melbourne (NMV) and the Australian Museum in Sydney (AMS). The remaining specimens have been deposited in the AMS and have been allocated museum database numbers starting with a “K” in the lists of material examined. Where a specimen has been dissected and mounted on more than one slide, the parent specimen is allocated a “K” number and the two slides receive the same number with suffixes “.001” and “.002”; only the parent number is listed against the specimens in this manuscript. Two specimens from Western Australia carry the author’s data base number only (gbs001473, gbs001474) and will be kept within the Australian Museum collection until their status is resolved. Some non-type voucher specimens deposited in the collection of the NMV also only have the authors’ data base numbers.

Locality co-ordinates for specimens collected by the author, were made using a hand-held Garmin eTrex®10 GPS with a claimed accuracy usually under five metres. Some specimens were collected in 70–80% ethanol with a leg or whole specimen placed into 100% ethanol up to several months later. Other specimens were collected directly into 100% ethanol. Some of the whole specimens were soaked in DNA extraction buffer for 1–2 hours prior to dissection and slide mounting; a process which tends to degrade the integrity of the antennae and terminal filaments but generally leaves the specimen in reasonable condition for further descriptive work. All specimens are now stored in 75–80% ethanol unless noted as slide mounted.

Measurement data of whole specimens in alcohol and dissection methods used are as described in Smith (2013). Dissected specimens were each mounted on 1–2 two slides using Tendeiro medium, mostly with the head and thorax mounted on one slide and the abdomen on a second slide. The position of the anterior trichobothrial areas of the pronotum were measured according to the method shown in Smith *et al.* (2021), the dimensions of the thoracic sterna, urotergite X and the processes of coxites IX were taken from drawings using a drawing attachment with an Olympus CX31 stereomicroscope. Antennal sensilla are described using the

terminology of Adel (1984). Roman numerals are used to indicate abdominal segment number. The lateral combs of the nota are described using the terminology of Molero-Baltanás *et al.* (2010) where N = the comb associated with the posterior trichobothrial and N-1 is the next more anterior, etc. In many cases there can be a single macrochaeta in the most anterior position more or less on the margin, however this macrochaeta was not counted as a comb in this manuscript.

The following abbreviations are also used: HW: head width (in millimetres); H+B: head and body length (in millimetres); L/W: length to width (ratio); NP: National Park; NSW: New South Wales; PI, PII, PIII: legs of pro-, meso- and metathorax respectively. The term *macrochaetae* refers to the larger stronger bristles, *setae* refers to smaller thinner bristles (usually simple), *setulae* to the very small, usually straight, *setae* and *cilia* to the curly thin hairs, often associated with the combs, setal collar or notal margins. Left and right refer to the animal when the dorsal surface is observed with the head forward. Measurement data, including the number of macrochaetae in the combs, represent a subsample of the non-juvenile specimens in the type series not just the holotype.

Character variability was analysed using slide mounted adult material from a number of localities with the number of specimens of each species examined shown in Table 1 below.

Characters assessed include: chaetotaxy of head including anterior frons, peri-antennal groups, bushes of clypeus and labrum, the presence of scales on the scape and pedicel, the type of sensilla in the distal antennal segments, segments of maxillary palp with scales, the shape of the ultimate article of the labial palp and the number of papillae, the number of lateral combs of nota and the number of macrochaetae, the position of the trichobothrial areas and the comb with which the anterior trichobothrium is associated, the position of the trichobothrium relative to the number of macrochaetae and the margin, the gap between the posterior combs relative to pronotal width, the size and shape of the thoracic sterna, and their chaetotaxy, the presence of scales on the tarsal articles, the number of macrochaetae in the combs of the urotergites, the L/W ratio of urotergite X and the angle formed by its posterior margins as well as whether this is sharp or slightly rounded, and the chaetotaxy of the lateral margins, the presence or absence of medial combs on the urosternites, the number of macrochaetae in each of the sublateral urosternal combs and the distance between the combs relative to their average length, the shape of the inner posterior corners of coxites VIII in the females, the L/W of the inner processes of coxites IX in the female and whether combs are present, the number of divisions in the ovipositor and the apical chaetotaxy.

As far as possible, the morphology of the species described here was compared with published descriptions.

**Table 1.** Specimens used in character variability study.

species	number of males	number of females	number of locations
<i>Acrotelsella mallee</i> sp. nov.	4	7	10
<i>Acrotelsella auricoronata</i> sp. nov.	0	7	3
<i>Acrotelsella albicaudata</i> sp. nov.	1	1	1
<i>Acrotelsella tanni</i> sp. nov.	4	2	4
<i>Acrotelsella thommoi</i> sp. nov.	2	2	2
<i>Acrotelsella parlevar</i> Smith	8	4	10

**Table 2.** Specimens used for molecular analysis. Museum accession numbers (*coll. no.*), BOLD process ID, GenBank accession numbers for 28S and COI, and voucher type status (*status*) are given.

species	sample ID	coll. no.	BOLD	GenBank 28S	GenBank COI	status
<i>Ctenolepisma longicaudatum</i>	gbs001836	K.377675	ZYI065-18	MK185707	MT674899	—
<i>Acrotelsella albicaudata</i> sp. nov.	gbs004041	T-22586	ZYIII008-22	OP028348	OP028305	holotype
<i>Acrotelsella albicaudata</i> sp. nov.	gbs004042	K.261327	ZYII330-21	OP028364	OP028320	paratype
<i>Acrotelsella albicaudata</i> sp. nov.	gbs004053	K.377968	ZYII332-21	OP028345	OP028302	paratype
<i>Acrotelsella auricoronata</i> sp. nov.	gbs003958	K.261297	ZYII319-21	OP028350	—	—
<i>Acrotelsella auricoronata</i> sp. nov.	gbs004033	K.377985	ZYII327-21	OP028326	OP028281	—
<i>Acrotelsella auricoronata</i> sp. nov.	gbs004039	K.377986	ZYII006-18	OP028354	OP028310	—
<i>Acrotelsella auricoronata</i> sp. nov.	gbs004040	K.261278	ZYII329-21	OP028352	OP028308	—
<i>Acrotelsella auricoronata</i> sp. nov.	gbs004044	gbs004044	ZYII097-18	OP028347	OP028304	—
<i>Acrotelsella auricoronata</i> sp. nov.	gbs004055	K.377987	ZYII082-18	OP028341	OP028297	—
<i>Acrotelsella auricoronata</i> sp. nov.	gbs004060	K.377988	ZYII125-18	OP028327	OP028283	—
<i>Acrotelsella auricoronata</i> sp. nov.	gbs005281	K.541640	ZYII151-18	OP028346	OP028303	holotype
<i>Acrotelsella auricoronata</i> sp. nov.	gbs005282	K.541641	ZYII050-18	OP028355	OP028311	paratype
<i>Acrotelsella auricoronata</i> sp. nov.	gbs005283	K.261337	ZYII199-18	OP028323	OP028278	paratype
<i>Acrotelsella auricoronata</i> sp. nov.	gbs005649	K.377783	ZYII099-18	OP028344	OP028301	—
<i>Acrotelsella auricoronata</i> sp. nov.	gbs005653	K.377786	ZYII062-18	OP028363	OP028319	—
<i>Acrotelsella auricoronata</i> sp. nov.	gbs005663	K.377791	ZYII047-18	OP028340	OP028296	—
<i>Acrotelsella</i> aff. <i>auricoronata</i>	gbs003971	K.261326	ZYII322-21	OP028325	OP028280	—
<i>Acrotelsella erniei</i>	gbs001438	K.377609	ZYI066-18	—	MK185701	paratype
<i>Acrotelsella mallee</i> sp. nov.	gbs004020	K.261284	ZYII325-21	OP028339	OP028295	paratype
<i>Acrotelsella mallee</i> sp. nov.	gbs004028	T-22588	ZYII042-18	OP028342	OP028298	paratype
<i>Acrotelsella mallee</i> sp. nov.	gbs004037	T-22589	ZYII136-18	OP028351	OP028307	paratype
<i>Acrotelsella mallee</i> sp. nov.	gbs004045	gbs004045	ZYIII009-22	OP028343	OP028300	—
<i>Acrotelsella mallee</i> sp. nov.	gbs004057	K.261324	ZYII024-18	OP028359	OP028315	paratype
<i>Acrotelsella mallee</i> sp. nov.	gbs004058	K.261325	ZYII333-21	OP028337	OP028293	paratype
<i>Acrotelsella mallee</i> sp. nov.	gbs004061	K.541634	ZYIII011-22	OP028331	OP028287	paratype
<i>Acrotelsella mallee</i> sp. nov.	gbs004324	K.541632	ZYII038-18	OP028332	OP028288	paratype
<i>Acrotelsella mallee</i> sp. nov.	gbs004336	K.541633	ZYII337-21	OP028362	OP028318	paratype
<i>Acrotelsella mallee</i> sp. nov.	gbs004340	K.541623	ZYII179-18	OP028335	OP028291	paratype
<i>Acrotelsella mallee</i> sp. nov.	gbs005276	K.541621	ZYII034-18	OP028329	OP028285	holotype
<i>Acrotelsella</i> aff. <i>mallee</i>	gbs004341	K.541624	ZYII117-18	OP028353	OP028309	—
<i>Acrotelsella parlevar</i>	gbs002470	K.377969	ZYIII007-22	OP028349	OP028306	—
<i>Acrotelsella parlevar</i>	gbs002571	K.541629	ZYII023-18	OP028361	OP028317	—
<i>Acrotelsella parlevar</i>	gbs004032	K.377960	ZYII162-18	OP028360	OP028316	—
<i>Acrotelsella parlevar</i>	gbs004052	K.541628	ZYIII010-22	OP028334	OP028290	—
<i>Acrotelsella parlevar</i>	gbs004054	K.541631	ZYII071-18	OP028358	OP028314	—
<i>Acrotelsella parlevar</i>	gbs004063	gbs004063	ZYII170-18	OP028338	OP028294	—
<i>Acrotelsella parlevar</i>	gbs004624	K.261103	ZYI067-18	MK185706	MT674895	holotype
<i>Acrotelsella parlevar</i>	gbs005269	K.377961	ZYII100-18	OP028324	OP028279	—
<i>Acrotelsella parlevar</i>	gbs004056	gbs004056	ZYII069-18	OP028330	OP028286	—
<i>Acrotelsella tanni</i> sp. nov.	gbs003989	K.261259	ZYII323-21	OP028322	OP028277	—
<i>Acrotelsella tanni</i> sp. nov.	gbs004328	K.377977	ZYII060-18	OP028336	OP028292	—
<i>Acrotelsella tanni</i> sp. nov.	gbs004335	K.541638	ZYII128-18	OP028356	OP028312	—
<i>Acrotelsella tanni</i> sp. nov.	gbs005529	K.377775	ZYII116-18	OP028357	OP028313	holotype
<i>Acrotelsella tanni</i> sp. nov.	gbs005530	K.377776	ZYII074-18	OP028321	OP028276	paratype
<i>Acrotelsella tanni</i> sp. nov.	gbs005655	K.377788	ZYII144-18	OP028328	OP028284	paratype
<i>Acrotelsella thommoi</i> sp. nov.	gbs001192	K.541637	ZYII251-21	—	OP028299	paratype
<i>Acrotelsella thommoi</i> sp. nov.	gbs004035	gbs004035	ZYII159-18	OP028333	OP028289	—
<i>Acrotelsella thommoi</i> sp. nov.	gbs004036	gbs004036	ZYII328-21	—	OP028282	—
<i>Hemitelsella clarksonorum</i>	gbs004625	K.261105	ZYII241-21	MZ364336	MZ364329	holotype
<i>Hemitelsella hortorum</i>	gbs006161	E109767	ZYII242-21	MZ364338	MZ364331	holotype
<i>Hemitelsella luismendesii</i>	gbs005912	K.377942	ZYII355-21	OL665124	OL521843	paratype
<i>Hemitelsella luismendesii</i>	gbs005913	21-000419	ZYII356-21	OL665121	OL521840	holotype
<i>Hemitelsella luismendesii</i>	gbs005914	K.377943	ZYII357-21	OL665123	OL521842	paratype
<i>Hemitelsella luismendesii</i>	gbs005915	21-000420	ZYII358-21	OL665120	OL521839	paratype
<i>Hemitelsella mutilloides</i>	gbs006162	E109768	ZYII243-21	MZ364341	MZ364334	holotype
<i>Hemitelsella mutilloides</i>	gbs006163	E109769	ZYII244-21	MZ364342	MZ364335	paratype
<i>Hemitelsella mutilloides</i>	gbs006164	K.377941	ZYII245-21	MZ364340	MZ364333	paratype
<i>Hemitelsella transpectinata</i>	gbs006166	K.541612	ZYII246-21	MZ364339	MZ364332	—
<i>Hemitelsella transpectinata</i>	gbs006167	K.261328	ZYII247-21	MZ364337	MZ364330	—
<i>Qantelsella louisae</i>	gbs003917	T-228755	ZYI068-18	MK185709	MK185705	holotype



However, descriptions of *A. scotti* (Carpenter, 1916) and *A. elongata* (Carpenter, 1916) both from the Seychelles, are considered far too short, even for inclusion in the genus *Acrotelsella*, and have been excluded from any discussion.

*Lepisma hawaiiensis* Silvestri, 1904 was transferred to *Acrotelsa* by Escherich (1905). Zimmermann (1948) transferred it to *Acrotelsella*. It has a triangular urotergite X but it also has parameres and therefore clearly does not belong in *Acrotelsella* nor even to the Ctenolepismatinae. John Irish (pers. comm. 2022) has examined the type material from the Instituto di Entomologia Agraria, Portici, Italy, finding the types to consist of a single microscope slide on which are incomplete parts of one male and one female (only coxites IX and genitalia, and urotergite X of both sexes; coxite VIII of female; and one labium). They are labelled simply ‘*Lepisma hawaiiensis* cotypi Silv. Hawaii’ and are unsuitable for redescription of the taxon. Based on the little that there was to see, including the unbarbed macrosetae and presence of male parameres, he considered them a probable species of *Allacrotelsa*, near to the North American *Allacrotelsa spinulata* (Packard, 1873). This species should be considered as *species inquirenda*.

*Acrotelsella suqutrensis* Mendes, 2004 while fitting the current definition of *Acrotelsella*, is clearly not closely related to the Australian fauna because of its unusual cephalic chaetotaxy.

The following species may be comparable to the Australian members of the genus but lack sufficient information for any meaningful comparison: *A. voeltzkowi* (Escherich, 1910) from Madagascar, *A. wygodzinskyi* (Hazra, 1980) from India, *A. pacifica* Silvestri, 1935, *A. procedens* Silvestri, 1935 (Marquesas Islands, Sumatra, Admiralty Islands, Philippines) and *A. devriesiana perspinata* Silvestri, 1908 (southwestern Australia).

### Molecular

DNA extraction, PCR, DNA sequencing, DNA data set assembly were performed as previously described (Smith *et al.*, 2021).

DNA consensus sequences, sequence trace files, and specimen collection data were uploaded to BOLD (<https://boldsystems.org>) where they are accessible as public dataset DS-ACROMIL (<https://doi.org/10.5883/DS-ACROMIL>). The concatenated genes dataset contains 58 28S sequences and 61 COI sequences from 61 taxa; of these 44 28S sequences and 46 COI sequences were newly derived for this study. Details of the specimens subjected to molecular analysis, including BOLD and GenBank accession numbers, are provided in Table 2.

MEGA v. 10.0.5 (Kumar *et al.*, 2018) was used to calculate DNA distances. Phylogenetic analyses were performed on the CIPRES Science Gateway v3.3 (Miller *et al.*, 2010). Each gene was analysed separately, and a combined data set (concatenated genes) was also analysed. IQ-TREE v.2.1.2 (Nguyen *et al.*, 2015) was used for ML analyses. Default parameters were accepted except as follows: The concatenated data set was partitioned by gene and by codon position for a total of 4 partitions (28S, COI nt1, COI nt2, COI nt3). Partition type was set to the Edge-unlinked partition model. Automatic model selection was implemented using ModelFinder (Kalyaanamoorthy *et al.*, 2017) (option “-m TEST”). Tree searches used the more thorough and slower NNI search (option “-allnni”) with

perturbation strength set to 0.9, and 10,000 ultrafast bootstrap replicates were performed.

Models for Bayesian Inference (BI) were selected using ModelFinder as above, except that model choice was limited to the models available in MrBayes (option “-mset mrbayes”). BI used MrBayes v.3.2.7a (Ronquist *et al.*, 2012). The BI analyses were set to run for 30 million generations, with a sample frequency of 1,000, using 2 runs, setting the number of chains to 4. The stopping rule was used to end the analysis when the average standard deviation of split frequencies dropped below 0.01, indicating convergence of the chains, and the burnin fraction was set to 0.25.

## Results

### Molecular

ML analyses of the 28S and COI genes and both ML and Bayesian analyses of the concatenated dataset yielded the same terminal groupings of taxa with only minor differences in relationships among groups. The ML tree is shown in Figure 1, with support values from both ML and Bayesian analyses shown above branches.

The molecular data identify two clades. One contains more slender species with a primary type ovipositor and elongated inner processes on coxites IX of the female (*A. auricoronata* sp. nov., *A. erniei* Smith, 2015, *A. tanni* sp. nov., *A. thommoi* sp. nov. and *A. parlevar*). As the type species *Acrotelsella producta* (Escherich, 1905) also has these characters, this clade probably represents *Acrotelsella* Silvestri, 1935 *sensu stricto*. The second clade contains more robust species with secondary ovipositors and generally shorter inner processes and will be considered here as *Acrotelsella sensu lato*. This clade however also includes the genera *Hemitelsella* Smith, 2016 and *Qantelsella* Smith, 2015. In addition, several other described *Acrotelsella* species, for which molecular data is lacking, have these characters (e.g., *A. sinensis* Silvestri, 1942, *A. devriesiana* (Silvestri, 1905), *A. westralis* (Nicolls and Richardson, 1926), *A. escherichi* Womersley 1939 and *A. wygodzinskyi* (Hazra, 1980). We also have molecular data on several undescribed species in this clade which display quite diverse morphology. Until we can better understand the morphology of this group (see morphology discussion below) we have decided to continue describing species under *Acrotelsella sensu lato*, recognizing that this clade will require further revision when more data is available.

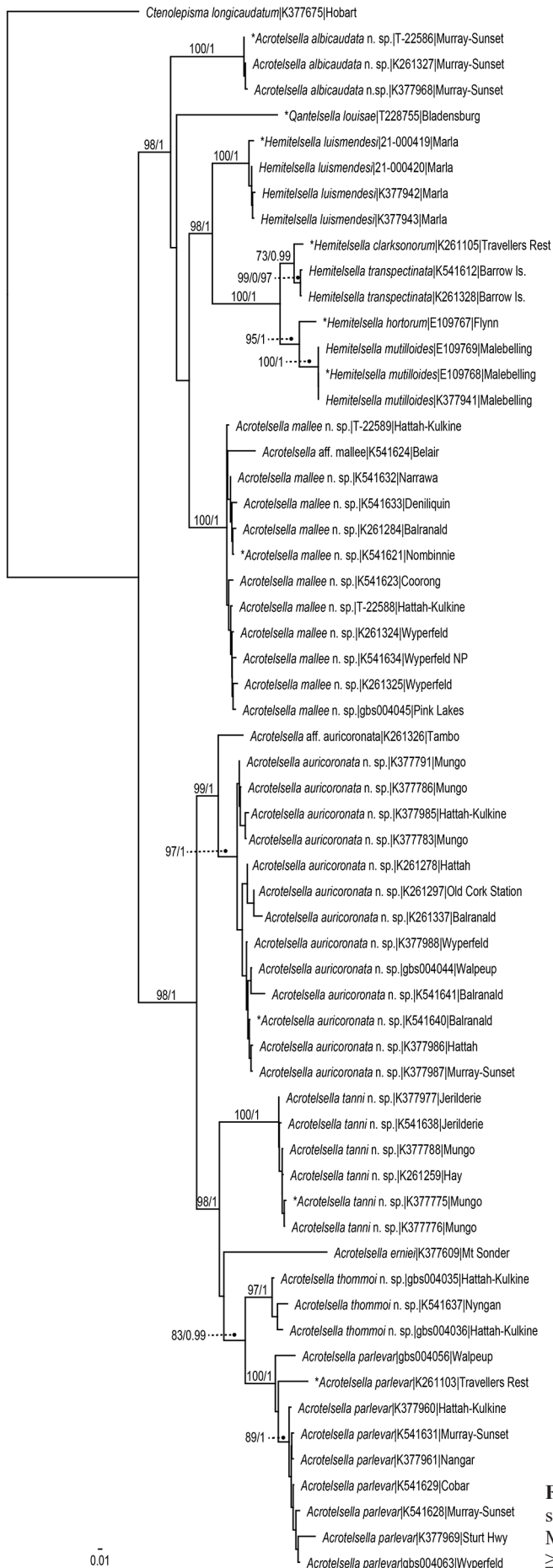
### Variability

#### Molecular

For the COI gene maximum uncorrected DNA distances (“p-distance”) within species were 1.2% within *A. albicaudata* sp. nov., 2.3% within *A. tanni* sp. nov., 3.2% within *A. thommoi* sp. nov., 6.0% within *A. mallee* sp. nov., 6.4% within *A. auricoronata* sp. nov. and 10.7% within *A. parlevar*. The minimum uncorrected distance between *Acrotelsella* species was 10.5% between *A. thommoi* sp. nov. and *A. parlevar*. This was the only case observed where within-species distances exceeded between-species distances, however the two species are clearly separated in the tree.

The specimens identified as *A. aff. mallee* (K.541624) and *A. aff. auricoronata* (K.261326) were 6.8–9.0% and 8.3–11.8% distance from their associated species. They have not been assigned to species.





There was no variation in the 28S gene within species, except for *A. parlevar*, where specimen gbs004056 had a single nucleotide substitution relative to the remaining samples of that species.

## Morphology

**Chaetotaxy of head.** This character appears to be of value but hard to quantify. *Qantelsella* and *Hemitelsella* species have fairly weak 1+1 bushes on the anterior corners of the frons, these bushes are much stronger on most Australian *Acrotelsella* although somewhat intermediate for *H. luismendesi* Smith and Mitchell, 2022. *Acrotelsella suqutrensis* has very unusual chaetotaxy compared to any other species.

Species of *Qantelsella* are unique in lacking a peri-antennal group of macrochaetae but may have an isolated trichobothrium-like seta. The clypeus and labrum of all species have bushes of varying size, density, spacing and arrangement but all *Acrotelsella* species described in this work are similar in having 1+1 bushes on each of the clypeus and labrum. This character would seem to be of value at a level higher than species.

**Annulations of the antennae.** The antennae display distinct annulations of pigment in *Qantelsella maculosa* Smith, *Q. louisae* Smith, 2015, *A. producta*, *A. devriesiana*, *A. sinensis*, *A. impudica* Escherich (*sensu* Wygodzinsky, 1959), *A. suqutrensis* and *Acrotelsella procedens*, *A. albicaudata* sp. nov. and *A. auricoronata* sp. nov. Distinct annulations are absent from *Q. aurantia* Smith, 2015, *Hemitelsella transpectinata* (Smith, 2015), *H. mutilloides* Smith & Mitchell, 2021, *H. hortorum* Smith & Mitchell, 2021, *H. luismendesi* Smith & Mitchell, 2022, *A. erniei*, *A. mallee* sp. nov., *A. tanni* sp. nov., *A. parlevar*, *A. thommoi* sp. nov. and *A. voeltzkowi* Escherich, 1910.

The character is useful to separate species but does not appear to reflect higher level phylogeny.

**Types of antennal sensilla.** Basiconic sensilla (types B and C) and circular sensilla were often seen on the antennae but could be very difficult to find, especially with antennae that are darkly pigmented. The type and arrangement of such sensilla may be useful but probably impractical without resort to scanning electron microscopy.

**Scales on pedicel.** This is a potentially useful character. Scales are clearly visible on the pedicel of *A. mallee* sp. nov. and *A. albicaudata* sp. nov. but absent from all other species described in this manuscript as well as *A. erniei* and all described species of *Qantelsella* and *Hemitelsella*. The character is not mentioned in most earlier descriptions.

**Scales on maxillary palp.** Scales are clearly visible on article two of the palp in all *Acrotelsella sensu lato* species examined and are probably present on article three in smaller numbers but can be difficult to see. They are probably absent from all *Qantelsella* and most *Hemitelsella* species but a few scales were observed on the palps of one specimen of *H. luismendesi*.

**Figure 1.** ML tree for concatenated COI and 28S sequences for 61 specimens. Asterisk indicates holotype. Numbers above branches are ML bootstrap values/Bayesian posterior probabilities, shown only if  $\geq 70$  and 0.9, respectively.

**Number of papillae on labial palp.** This appears to be fairly consistent in most species of *Acrotelsella* especially when the number of papillae is seven or less. Once this number is exceeded there appears to be some variability, but the number of papillae can be difficult to count in slide mounted material, especially if there is a lot of pigment present.

**Arrangement and position of anterior trichobothrial area of pronotum.** Trichobothrial areas were noted occasionally by early authors, but it was not until the work of Mendes (best summarized in Mendes, 1986b) that the usefulness of this character became apparent, so this character cannot be considered at the moment for the earlier described species. All Australian specimens of *Acrotelsella sensu lato*, as well as *Hemitelsella* and *Qantelsella* so far examined as slide material by the first author have open trichobothrial areas (type 1 arrangement of Mendes) as does *A. annamita sensu Mendes*, 1989.

The location of the anterior trichobothrial areas along the margin may be a useful character to separate some species, for example, for *A. mallee* sp. nov. the anterior area is located 0.43–0.49 along the margin, whereas all other species lie 0.28–0.42, except for *A. albicaudata* sp. nov. where it is somewhat intermediate (0.39, 0.44 in two specimens measured).

**The comb associated with the anterior trichobothrial areas.** There is almost no variation observed on the meso and meta nota with anterior trichobothrial area associated with comb N-2 of the mesonotum and comb N-1 on the metanotum, with the rare exception of combs being absent or supernumerary on one side only of occasional specimens.

On the pronotum, the anterior trichobothrial area is associated with comb N-2 for *A. mallee* sp. nov. (as well as species of *Hemitelsella* Smith and *Qantelsella* Smith) but with comb N-3 for the remaining *Acrotelsella* species, again with the occasional exception (N-2 or N-4) on one side of some individuals. It is probably important to ascertain this character on several specimens due to these occasional aberrations, but the character may eventually be useful to differentiate *Acrotelsella sensu stricto* species from the rest.

**Number of macrochaetae associated with the trichobothrial areas.** This character has some value but is slightly inconsistent. *Acrotelsella tanni* sp. nov. and *A. erniei* almost always (six of seven specimens) have two macrochaetae associated with the anterior comb of the pronotum, where all other species only have one, with the exception of two specimens of *A. parlevar* one of which has two macrochaetae on both sides and the other with two on one side and only one on the other.

On the posterior lateral comb of the pronotum, *A. auricoronata* sp. nov. always has only a single macrochaeta laterad of the trichobothrium. This arrangement was only seen on a single specimen of *A. tanni* sp. nov. and then only on one side. All other specimens have two, three or four (*A. thommoi* sp. nov. always two, *A. parlevar* where 12 of 13 specimens have two, all *A. mallee* sp. nov. (except on one side of one specimen) with three, *A. tanni* sp. nov. mostly with three but one smaller specimen with only one and two on different sides. There may be an instar effect with this character, where older specimens have more macrochaetae.

The number of macrochaetae associated with the anterior trichobothrial area may also be useful on the meso and metanota. Ten of twelve specimens of *A. mallee* sp. nov.

have only one macrochaeta on the mesonotum and eleven of twelve on the metanotum. Both nota of all *A. auricoronata* sp. nov. also have only a single macrochaeta. *Acrotelsella erniei* and all *A. parlevar* have two, while *A. thommoi* sp. nov. mostly have one but occasionally two on one side and *A. tanni* sp. nov. mostly has two but occasionally three on the mesonotum. *Acrotelsella albicaudata* sp. nov. showed almost equal numbers with one or two macrochaetae.

**Spacing of posterior combs of pronotum.** This character may be of some use at the species level; but does not seem useful to separate the major clades identified by molecular data. *Hemitelsella* species have the posterior combs positioned quite laterally with the gap between them equal to 55–65% of total width of the pronotum. The gap for *A. mallee* sp. nov. is 43–49% and *A. auricoronata* sp. nov. 50–55%; most other *Acrotelsella sensu stricto* species lie between 39 and 51%.

**Shape of thoracic sterna.** This is quite useful especially for species such as *A. auricoronata* sp. nov., *A. giubana* Mendes, 1988 and *A. escherichi* where it is distinctly trapezoidal. Some species of *Qantelsella* Smith also have trapezoidal sterna. In other species the sterna are parabolic or rounded.

**Arrangement of combs on thoracic sterna.** The arrangement of combs appears useful although many earlier papers only report on the combs of the metathoracic sternum. The number of combs, especially on the prothoracic sternum, can be quite variable. Even on the meso- and metathoracic sterna there can be variation as combs merge or separate, however the number of combs can still be quite useful with some species such as *A. mallee* sp. nov. having 3+3 or 3+4 combs on the metathoracic sternum while most other species have 1+1, 1+2, 2+2 or rarely 2+3.

In addition to the number of combs, one species *A. parlevar* stands out as the bristles are not aligned in single rows but in complex over-lapping rows on all sterna. In other species the macrochaetae are arranged in lines or curves, sometimes with one or two macrochaetae a little offset from the line but not consistently in complex groups.

The number of macrochaetae within each comb can be very variable and only useful to distinguish between certain species where one always has many macrochaetae per comb (e.g., 14–20 in *A. parlevar*) and the other with much smaller numbers (e.g., 2–11 in *A. thommoi* sp. nov.).

**Scales of legs.** The femora and tibiae of all species in *Acrotelsella sensu lato*, as well as *Qantelsella* and *Hemitelsella*, have scales that are similar in shape to those on the nota but smaller in size. *Acrotelsella sensu lato* species usually have scales on the basal tarsal article (shape uncertain) but scales appear to be absent on all tarsal articles of *Qantelsella* species and most *Hemitelsella* (exception *H. luismendesi*).

**Urotergal combs.** There appears to be little differentiation between the *Acrotelsella sensu lato* species examined here regarding the urotergal combs. All have 1+1 combs on urotergite I, 3+3 on urotergites II–VII and 2+2 on urotergite VIII. The number of macrochaetae varies considerably within each species possibly depending on age. For example, for *A. parlevar* the number of bristles in the lateral combs ranges from six to 13, in the sublateral combs from four to eight and in the submedial combs from five to 11.

**Urotergite X.** Urotergite X in *Acrotelsella sensu lato* species is triangular and often acutely so. In some species the apex is, however, slightly rounded, although still more or less triangular. In species of *Qantelsella* the apex is distinctly rounded, and in *Hemitelsella* it is predominantly rounded but acutely triangular in *H. luismendesi*.

It is possible to express the shape of this tergite as a L/W ratio or by measuring the angle between the lateral margins. Sometimes this angle is more acute in one gender than in the other. There is a lot of similarity between the bulk of species but *A. tanni* sp. nov. has a long, very acute urotergite X ( $40^\circ$  in the females and  $50\text{--}58^\circ$  in the males), whereas in *A. mallee* sp. nov. the angle is  $64\text{--}86^\circ$  for both sexes, and in *A. parlevar* ( $47\text{--}53^\circ$  in the females and  $52\text{--}60^\circ$  in the males). The character might be helpful for some comparisons.

The number of combs on the sides of urotergite X is not very helpful, with most species having three to five, occasionally six combs, on each side each with 1–7 macrochaetae.

**Urosternal combs.** Although there is considerable variation within a species, some species have clearly longer combs than other species. The use of a ratio of the gap between each comb divided by the average width of each comb (excluding the cilia) is quite clear cut in some cases. *Acrotelsella mallee* sp. nov. has ratios of 1.7–4.8, *A. albicaudata* sp. nov. 3.1–4.4, *A. auricoronata* sp. nov. 7.4–21.2, *A. tanni* sp. nov. 2.7–8.4, *A. thommoi* sp. nov. 3.5–10.3 and *A. parlevar* 2.4–5.8. The ratio is largest on the anterior urosternites and smallest on the most posterior so the ranges mentioned here could be narrowed considerably if the measurement was made to compare just one or two values e.g., urosternite III and/or urosternite VII.

*Acrotelsella erniei* is still the only species of this genus so far found to have medial urosternal combs. The available molecular data places it firmly within *Acrotelsella sensu stricto* suggesting that this character is not reflective of a subgeneric status, unlike the situation observed in the genus *Ctenolepisma* Escherich, 1905 which is divided into two subgenera mostly based on the presence or absence of medial urosternal combs.

**Shape of coxites VIII in the females.** This is an interesting and useful character. In some species the posterior margin is very straight, almost parallel to the comb and almost perpendicular to the inner margin with the inner posterior corner being of small radius (perhaps only  $\frac{1}{5}$  of the length of the posterior margin to the end of the straight section). In other species the posterior margin is quite rounded with a very short straight region that is difficult to define; here the radius of the curve is about half the length of the posterior margin and the angle between this margin and the inner margin is often  $>100^\circ$ . While there is some variation within a species in the size (or interpretation) of this posterior margin, it is usually quite easy to tell between straight or rounded margins.

**Length and shape of inner processes of coxites IX.** Females of all Australian *Acrotelsella sensu stricto* species have much longer inner processes on coxites IX which are apically broad and quite round in comparison to those in females of other Ctenolepismatinae (L/W 2.4–5.2). The situation with *Acrotelsella sensu lato* is not quite as clear. *Hemitelsella* species have short processes (L/W 0.68–1.1).

Intermediate length combs occur in *A. albicaudata* sp. nov. L/W 1.5, L/W 1.6–2.8 in *A. mallee* sp. nov. While useful in some cases, this character needs to be used with caution, at least until the phylogeny of *Acrotelsella* species becomes better understood.

The shape of these processes in *Hemitelsella* species is also round but short, while those in *Qantelsella* are short and apically acute.

**Combs on inner processes of coxites IX.** Usually absent but when present, variable in both number and length. In the case of *A. parlevar* short combs are present (1–3 macrochaetae) on 4 of 11 specimens, suggesting that this is not a reliable character. The specimens showing these combs are all male but other male specimens do not have combs. It is probably quite a reasonable character, especially if the combs are long (e.g., half the width of the process) but the situation with shorter combs is less certain.

**Ovipositor.** The armature of the apical divisions of the ovipositor is very important and it appears that it may be possible to divide the genus into two groups, one with simple, primary type ovipositors (*Acrotelsella sensu stricto*) and one with various types of armature (modified spines or conules). This separation is also supported by the molecular data. There are also differences in the size and shape of the spines, the number of spines and the number of divisions on which they occur. Some variation in numbers can be seen between individuals of the same species but it is probably possible, with further study, to separate species largely on the basis of these spines, when present.

The number of divisions in the ovipositor is also useful although somewhat variable within species, e.g., *Acrotelsella auricoronata* sp. nov. 25–30, *A. parlevar* 15–20, *A. tanni* sp. nov. 19–21, *A. mallee* sp. nov. 11–15.

**Number of pairs of styli.** This character appears to be constant in adult specimens but its use a character to separate *Hemitelsella* (one pair) from *Acrotelsella* (two pairs) is now questionable. *Acrotelsella albicaudata* sp. nov. has only a single pair of styli and short coxites IX in the female, like *Hemitelsella* but the remaining characters e.g., chaetotaxy of the head are more like those seen in *Acrotelsella* suggesting it is intermediate between the two genera. *Acrotelsella suqutrensis* from Saudi Arabia also has only a single pair of styli but quite different head chaetotaxy. *Acrotelsella sinensis* Silvestri, 1942 from China and *Acrotelsella procedens* from the Marquesas are reported to have three pairs of styli however Mendes redescribed the latter on the basis of material from Sri Lanka and Thailand reporting only two pair of styli.

**Presence of scales on terminal filaments.** Scales are present on the terminal filaments of all Australian *Acrotelsella sensu lato* as well as *Hemitelsella* and *Qantelsella* (with the possible exception of *Q. maculosa* Smith, 2016). The shape of the scales needs further investigation, which would be best done with scanning electron microscopy. Certainly, the terminal filament scales on the clade with more robust species with secondary ovipositors can be quite diverse, including lanceolate scales and others where the ribs are not well defined and they converge somewhat towards the central basal attachment as shown in figures 8 and 9.



## Systematics

### Family Lepismatidae Latreille, 1802

#### Subfamily Ctenolepismatinae Mendes, 1991: 11

#### *Acrotelsella* Silvestri, 1935

*Acrotelsa* Escherich, 1905: 105 pro parte.

*Stylifera* Stach, 1932: 333, 345 pro parte.

*Acrotelsella* Silvestri, 1935: 307.

Type species: *Acrotelsa producta* Escherich, 1905 by original designation.

#### *Acrotelsella mallee* sp. nov.

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#### Figs 2–34

**Holotype** ♀ (HW 1.21) NEW SOUTH WALES: Nombinnie Nature Reserve 33.15719°S 145.87153°E 139m asl, 8.vii.2016, Graeme Smith, leaf litter, AMS K.541621 (on two slides). **Paratypes** 1♀ (HW 1.16) ca 15km south of Balranald 34.76606°S 143.53946°E 71m asl, 23.ix.2013, Graeme Smith, mallee leaf litter, AMS K.541622 (on two slides); 1 juvenile ♀ (HW 0.75) same data as previous, AMS K.261284 (on one slide); 1 juvenile (HW 0.60) same data as previous, AMS K.377957 (in alcohol); 1♀ (HW 1.13) Narrawa 34.41924°S 149.09932°E 495m asl, 4.xi.2014, Graeme Smith, leaf litter, AMS K.541632 (on two slides); 3♂♂ (HW 1.05, 1.05, 1.08) same data as previous K.377964 (in alcohol); 1♂ (HW 1.05); 1♀ (HW 1.20) south of Deniliquin 35.82380°S 144.94626°E 108m asl, 5.xi.2014, Graeme Smith,

leaf litter, AMS K.541633 (on two slides); 1 juvenile ♀ (HW 0.85) same data as previous, AMS K.377963 (in alcohol). VICTORIA: Wyperfeld N.P., Snowdrift 35.43029°S 141.91111°E 80m asl, 26.ix.2013, Graeme Smith, leaf litter, top of dune, AMS K.261325 (on two slides); 1♂ (HW 0.98) same data as previous, AMS K.261324 (on two slides); 1♂ (HW 1.10) same data as previous, AMS K.261325 (on two slides); 1♂ (HW 0.93) same data as previous, AMS K.377965 (in alcohol); 1♀ (HW 1.05) Pink Lakes turnoff, west of Underbool 35.16731°S 141.70452°E 60m asl, 25.ix.2013, Graeme Smith, hand collected in dry mallee leaf litter, NMV gbs004045 (on two slides); 1♂ (HW 1.05) Hattah-Kulkyne N.P. 34.69770°S 142.38873°E 59m asl, 24.ix.2013, Graeme Smith, dry leaf litter under small leaved shrub, top of sand dune, NMV T-22589 (on two slides); 1♀ (HW 1.13) Hattah-Kulkyne N.P. dune near Lake Mournpell campsite 34.70198°S 142.33780°E 57m asl, 24.ix.2013, Graeme Smith, leaf litter on sand under small bush, NMV T-22588 (on two slides); 1♂ (HW 1.05) 1 juvenile ♀ (HW 0.75) 1 juvenile (HW 0.55) same data as previous, AMS K.377958 (in alcohol); 1♀ (HW 1.10) Wyperfeld N.P., along road north of Hopetoun 35.53558°S 142.32764°E 99m asl, 27.ix.2013, Graeme Smith, leaf litter of Acacia or pea?, AMS K.541634 (on two slides); 1♀ (HW 1.13) same data as previous, AMS K.377967 (in alcohol); 1♂ (HW 1.05). SOUTH AUSTRALIA: Coorong 35.91°S 139.42°E, 8.xi.2014, Penelope Greenslade, Melaleuca, AMS K.541623 (on two slides).

**Other material examined but not included in type series.** 1♀ (HW 1.23) SOUTH AUSTRALIA: Belair N.P. 36°s site 35.01°S 138.65°E, 2–9.xi.2014, M. A. Nash, pitfall, AMS K.541624 (on two slides); 1♀ (HW 1.23) same data as previous, AMS K.377966 (in alcohol).

**Diagnosis.** This species belongs to the group of species with secondary ovipositors, a group in which most currently named species have been inadequately described. It appears to differ from other species by the presence of 7–8 papillae on the labial palp, the 3+3 arrangement of combs on the metasternum and the presence of several short combs along the inner margin of coxites IX of the female.

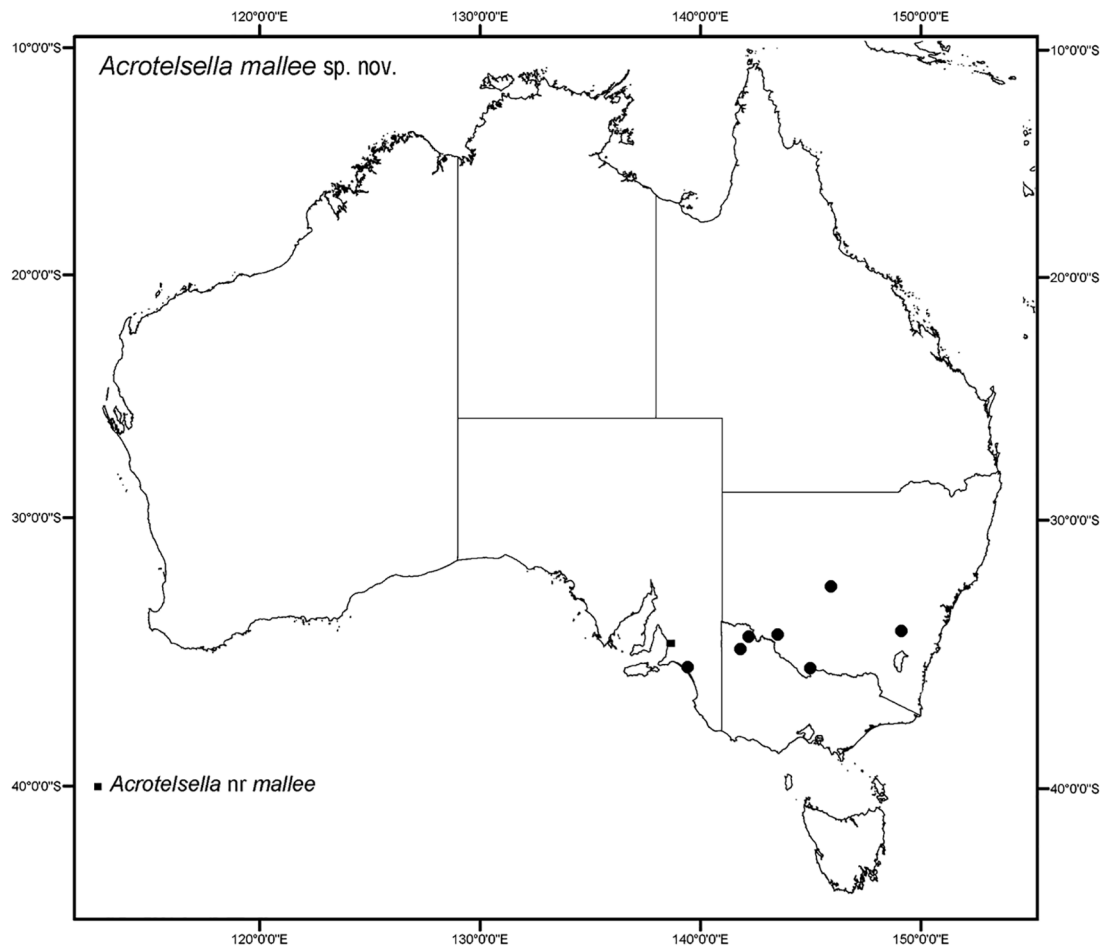


Figure 2. Known distribution of *Acrotelsella mallee* sp. nov. and a closely related taxon.



Figure 3. *Acrotelsella mallee* sp. nov., Balranald, NSW.

### Description

**Appearance:** Medium sized silverfish, somewhat stocky in form, thorax wider than the abdomen. Scale pattern when live see figure 3, antennae evenly brown, terminal filaments appear annulated, distinct light margins to thorax. In alcohol specimens become very dark almost as soon as they contact the alcohol.

**Body length:** H+B up to 8.3 mm, HW 1.21 mm; thorax: length 2.5 mm or 0.27–0.33 H+B; width 2.05 mm with the mesonotum being slightly wider than the pronotum and not much wider than the metanotum. Antennae incomplete, maximum preserved length 4.9 mm or >0.6 H+B; terminal filaments all broken, maximum preserved length of terminal filaments 4.1 mm or >0.5 H+B.

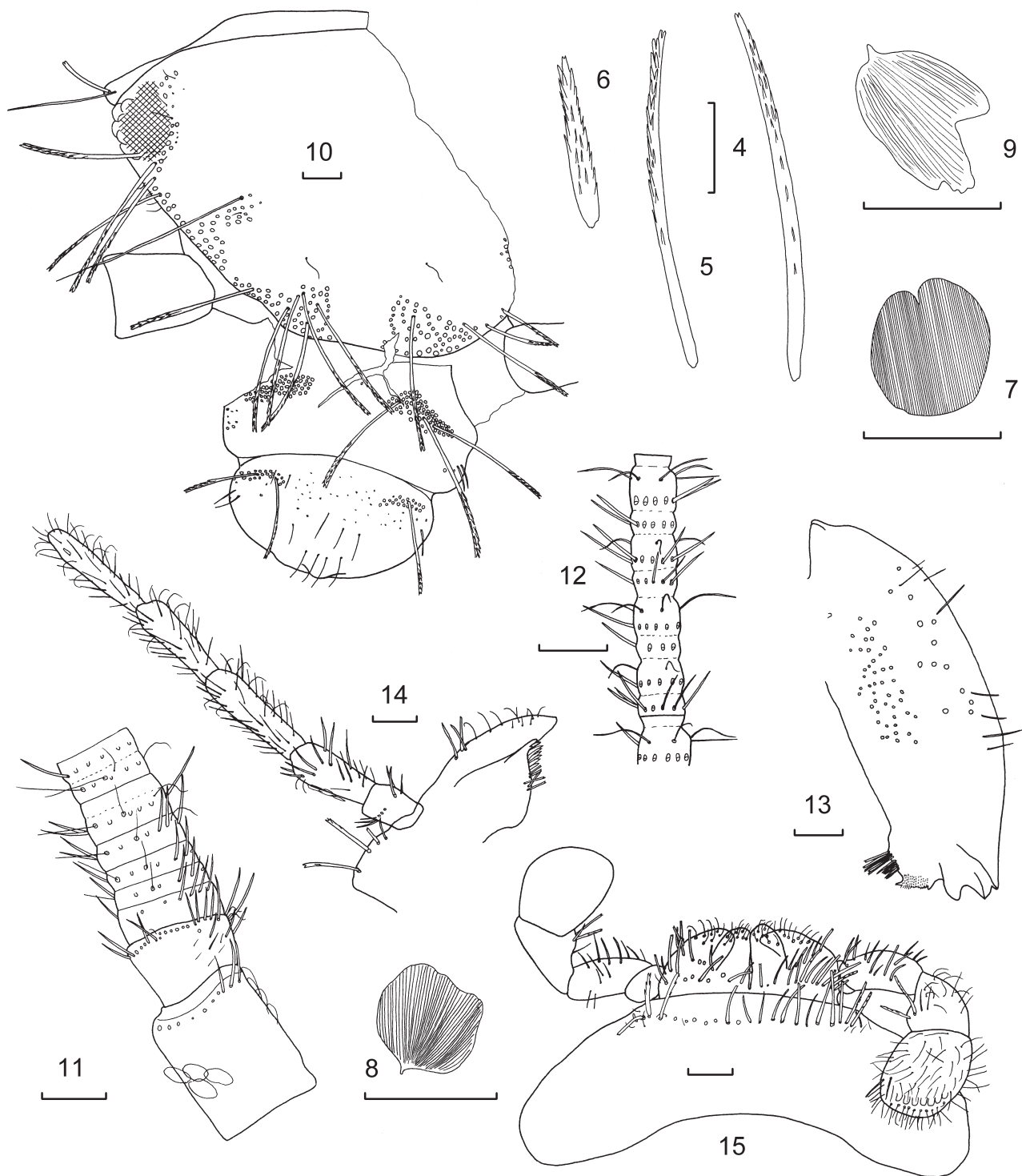
**Pigmentation:** Cuticle overall quite dark with specimens becoming very dark when they are placed into alcohol. The intensity of darkness makes it difficult to observe macrochaetae insertions in some places. Some variability in darkness noted between specimens. Flagellum of antennae without annulations, moderate orange-brown pigment evenly distributed; pedicel quite darkly pigmented overall or restricted to apical ring of pigment, scape with or without pigment. Frons without darker regions, labrum and clypeus without pigment, mandibles and maxillae without pigment among bushes of macrochaetae, maxillary and labial palps with orange-brown pigment, the distal article of the maxillary palp moderately and evenly pigmented, penultimate article with moderate pigment overall but more intense distally, second and third articles with pigment

dorsally, also stronger distally. Labial palp ultimate and penultimate articles overall light to dark pigment, second article darker, especially distally. Nota and thoracic sterna without obvious pigment. Precoxa of legs with darker brown pigment, which also occurs on the shoulder of the coxa but not along the outer margin. Trochanter with pigment along posterior margin. Femora fairly evenly pigmented, tending to darker at the posterior bulge and the anterior distal corners. Tibia darkly pigmented overall. First tarsal article with more pigment distally, remaining articles with some light pigment. Abdominal segments quite dark (sclerotized or pigment?) becoming darker in the posterior segments; coxites IX quite dark. Ovipositor well pigmented brown basally with pigment absent from distal four divisions. Cerci and median filament annulated, mostly dark divisions except for first annulus which is light in colouring and apex of distal division distad of the ring of macrochaetae. Abdominal styli light basally with orange pigment in distal half becoming more intense distally, styli VIII the same or sometimes with much less pigment.

**Macrochaetae:** Variable, subtly pectinate, curved and tapered (Fig. 4), strongly pectinate (Fig. 5), carrot-shaped and strongly pectinate (Fig. 6), dark brown to straw coloured.

**Scales:** With numerous sub-parallel ribs that do not surpass the margin of the scale (Fig. 7), those dorsal are brown, those ventral brown or hyaline. Scales found on top of head, on pedicel and scape, mandible, on second and third articles of maxillary palp, all nota, all thoracic sterna, legs (except for trochanter and distal three articles of tarsi), all urotergites and urosternites, styli IX, medial filament and cerci. Scales of palps, styli, terminal filaments (Figs. 8, 9) of variable shape, sometimes without clearly defined ribs.

**Head:** (Fig. 10) wider than long, with 1+1 not very dense bushes of macrochaetae aligned in subparallel rows on the antero-lateral corners, with a distinct gap in chaetotaxy between these two bushes. Eyes dark chestnut in alcohol preserved material. There is a small gap behind each bush in the row of macrochaetae along the margin which extends inwards to a contiguous large peri-antennal group and its long thin trichobothrium-like seta; the marginal row continues back and up over the eyes about two macrochaetae wide. Clypeus with 1+1 very dense bushes of strongly pectinate macrochaetae as well as a few curved setae laterally; a single macrochaeta and scattered cilia medially between the bushes. Labrum also with 1+1 dense bushes but with fewer pectinate macrochaetae as well as many simple setae scattered over the face. — Antennae fairly long, scape (Fig. 11) not long with a preapical ring of setae; pedicel with preapical ring of simple setae and cilia as well as setae scattered over face; first annulus/interval of flagellum with a subapical ring of simple setae; next annulus with ring of simple setae and two trichobothria; subsequent intervals with single ring of setae and cilia across the middle of the annulus and two short trichobothria per annulus; intervals of flagellum begin to subdivide from the fifth interval. About two thirds the length of the antennae the intervals are subdivided into eight annuli (Fig. 12) with the most distal annulus bearing a proximal ring of setae and a subapical ring of cilia and a trichobothrium; rod-like basiconic sensilla (type B) seen on fourth and ultimate annuli. Further distally the intervals are divided into ten annuli but trichobothria were no longer observed (lost?), basiconic sensilla seen on fifth and ultimate annuli; poculiform sensilla were seen clearly in at least two

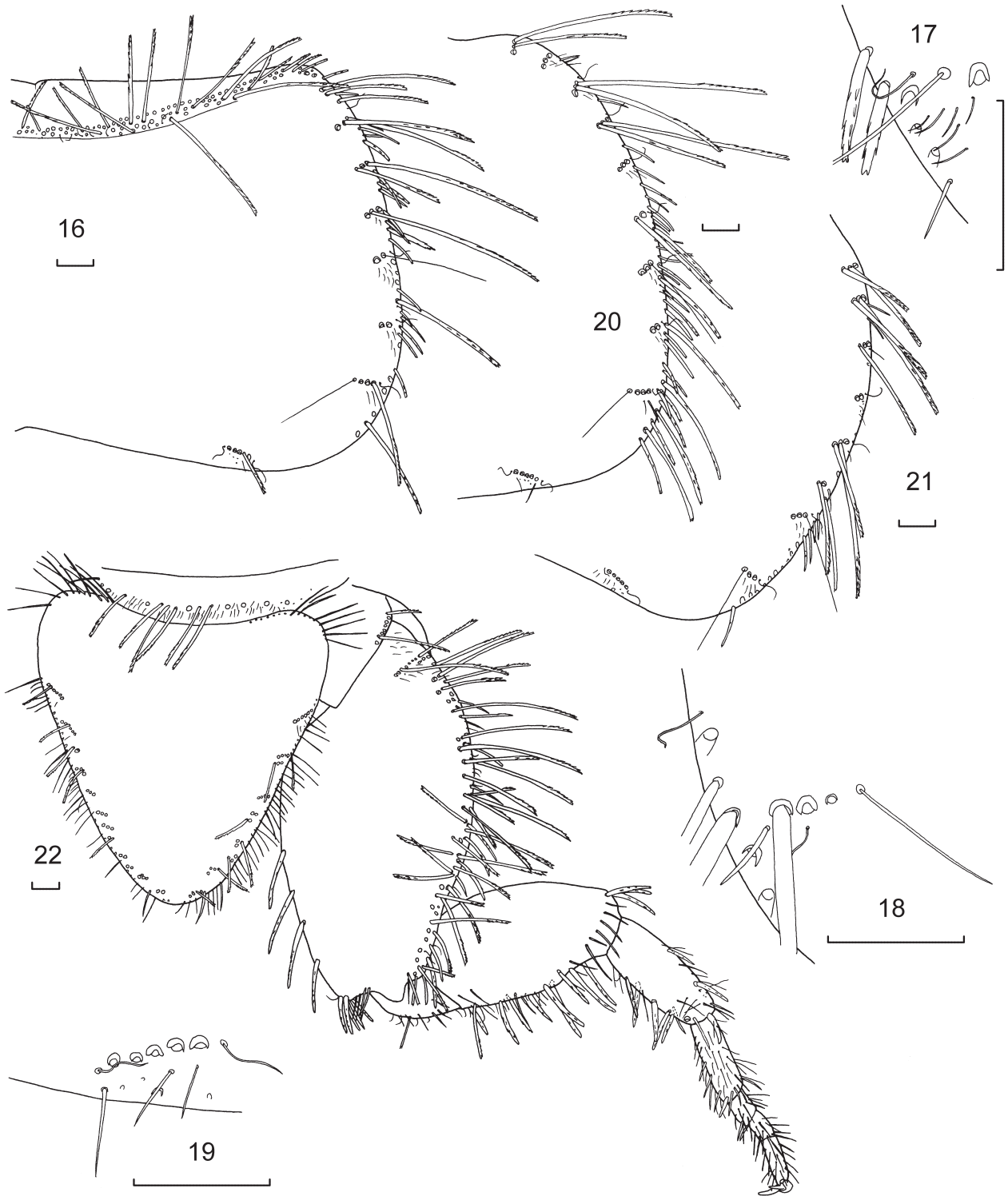


**Figures 4–15.** *Acrotelsella mallee* sp. nov. holotype ♀ unless otherwise indicated by specimen number (4) long pectinate macrochaeta of coxa of PI; (5) pectinate macrochaeta, peri-ocular; (6) carrot-shaped pectinate macrochaeta of tibia of PII; (7) darker scale from coxa of PIII; (8) and (9) scales from median dorsal appendage; (10) head (cross-hatched area obscured by eye pigment, posterior left side missing); (11) antenna, scape, pedicel and basal intervals of flagellum; (12) idem, most distal surviving complete interval; (13) mandible (K.261325); (14) maxilla (K.261324); (15) labium, smaller chaetotaxy and papillae omitted from one palp (K.261324). Scale bars = 0.1 mm.

specimens (NMV T-22589, K.261324) in the very distal annuli but were not seen with confidence in other specimens, which could possibly be explained if these sensilla were only present in the most distal articles on more or less intact antennae or perhaps the sensilla were obscured by the very dark integument and unfortunate orientation. — Mandibles (Fig. 13) typical for *Acrotelsella* with well-developed molar

and incisor areas; a group of about 10–15 strong apically bifurcated but simple setae distally adjacent to the pectinate molar area and a bush of around seventy strong, pectinate macrochaetae externally as well as scattered simple setae. — Maxilla (Fig. 14) with two or three thick minutely apically bifurcated and slightly pectinate macrochaetae as well as 2–6 smaller setae externally proximal to the palp, the

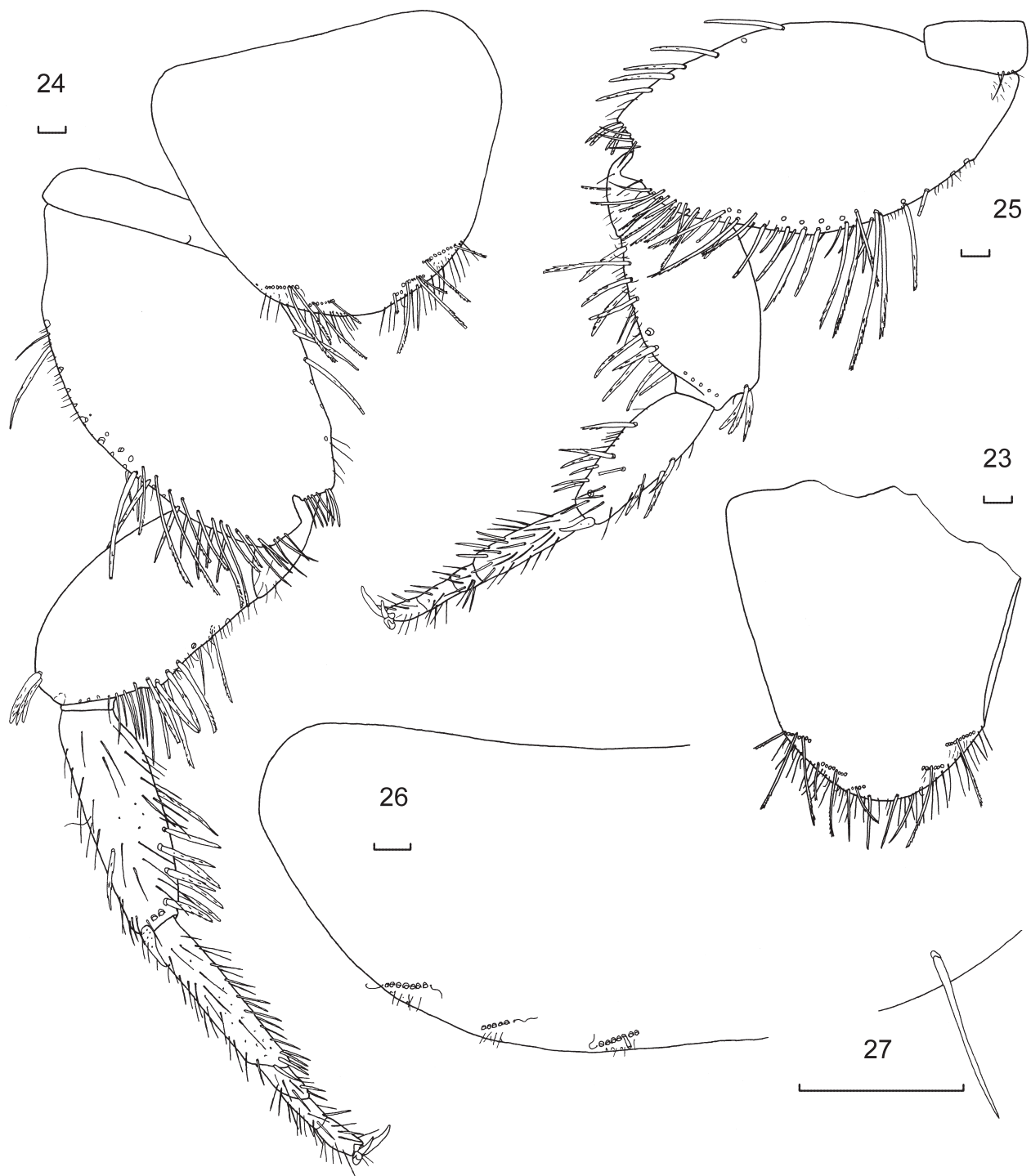




**Figures 16–22.** *Acrotelsella mallee* sp. nov. holotype ♀ (16) pronotum, right side; (17) left anterior trichobothrial area of pronotum; (18) left posterior trichobothrial area of pronotum; (19) left posterior comb of pronotum; (20) mesonotum, right side; (21) metanotum, right side; (22) prothoracic presternum, sternum and PI. Scale bars = 0.1 mm.

lacinia with three strong teeth, one set further back than the other two, followed by about seven lamellate processes and a row of 5–7 short simple setae, galea longer than lacinia with about 3–5 strong, smooth, simple or apically bifurcate setae externally in its basal half and several cilia distally; maxillary palp very long and thin, apical article 4.8–6.2 times longer than wide and 1.0–1.3 times as long as the penultimate

article which is the longest article, the ultimate article with a thick sausage-shaped sensillum subapically (thin-walled basiconic sensillum type C of Adel, 1984), last two articles of palp with fine setae only, third article with some slightly stronger setae subapically, second and third articles also with scales, although these can be hard to find on the third article. — Labium (Fig. 15) short and broad, postmentum

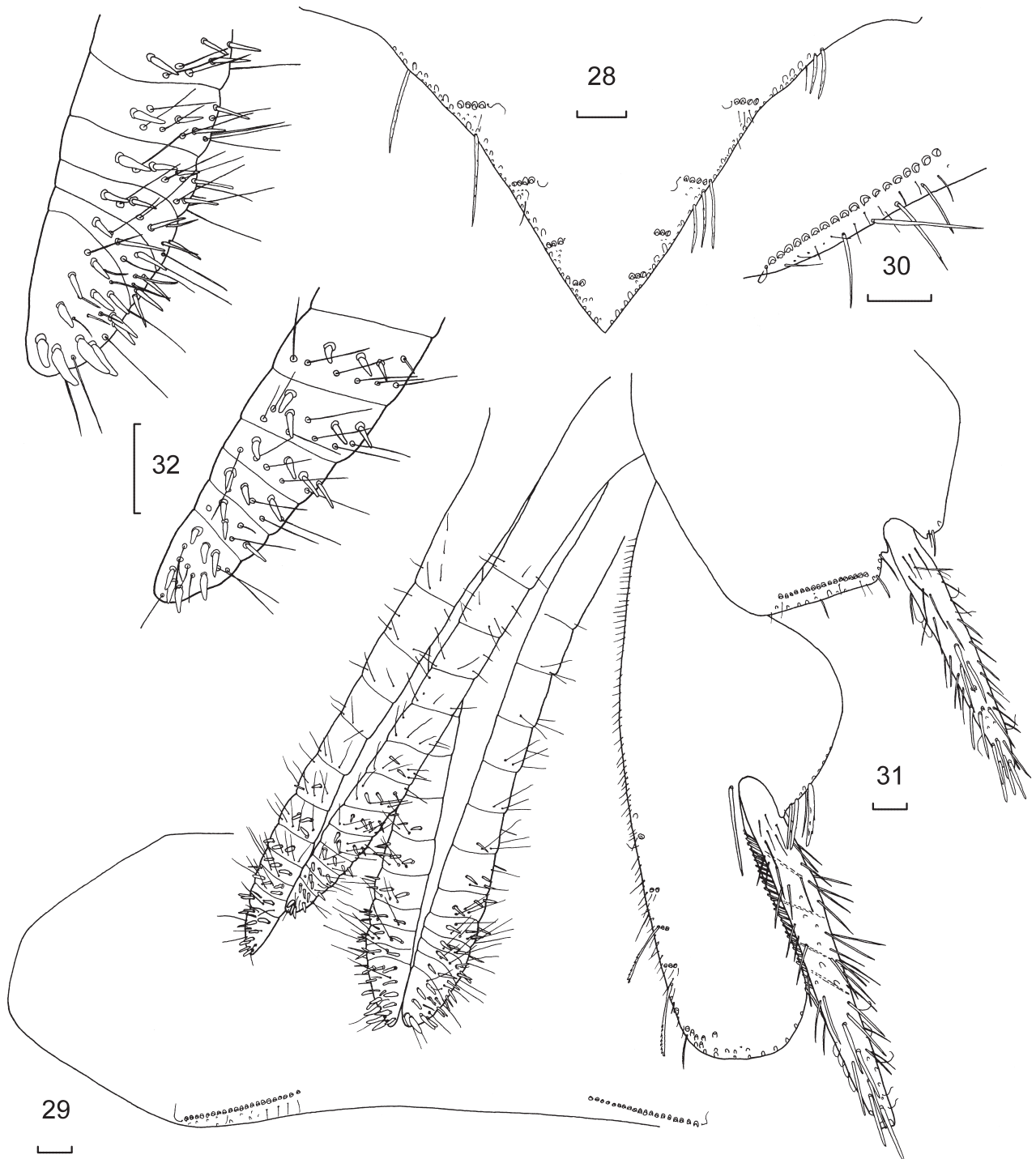


**Figures 23–27.** *Acrotelsella mallee* sp. nov. holotype ♀ (23) mesothoracic sternum; (24) metathoracic sternum and PIII; (25) PII; (26) urotergite III; (27) urotergite IX, right infralateral seta. Scale bars = 0.1 mm.

with transverse row of apically bifurcate setae, a few laterally with distinct pectinations, prementum with transverse and oblique rows of strong apically bifurcated setae, apically with long curved setulae; labial palp short, apical article not expanded medially, about as long as wide (0.8–1.31) with row of seven papillae of compact type arranged in a single curved row near the outer margin, with a single very small rod-like basiconic sensillum (type B) on the outer margin, covered with numerous fine setae as well as longer fine setae.

*Thorax:* Pronotum (Fig. 16) with dense setal collar of both longer and shorter strongly pectinate macrochaetae,

about three macrochaetae wide, without slight medial gap; lateral margins with many strong, shorter and longer, curved, slightly pectinate macrochaetae as well as a few cilia, with 6–8 combs of 1–3 macrochaetae along each margin. Two open trichobothrial areas; the anterior trichobothrial area (Fig. 17) is slightly forward of the midpoint (0.43–0.49) and associated with comb N-2 (rarely N-3), the comb composed of only a single macrochaeta with the trichobothrium between the macrochaeta and the margin and a cilium laterad of the trichobothrium; the posterior trichobothrial area (Fig. 18) is located about 0.71–0.82 of the distance

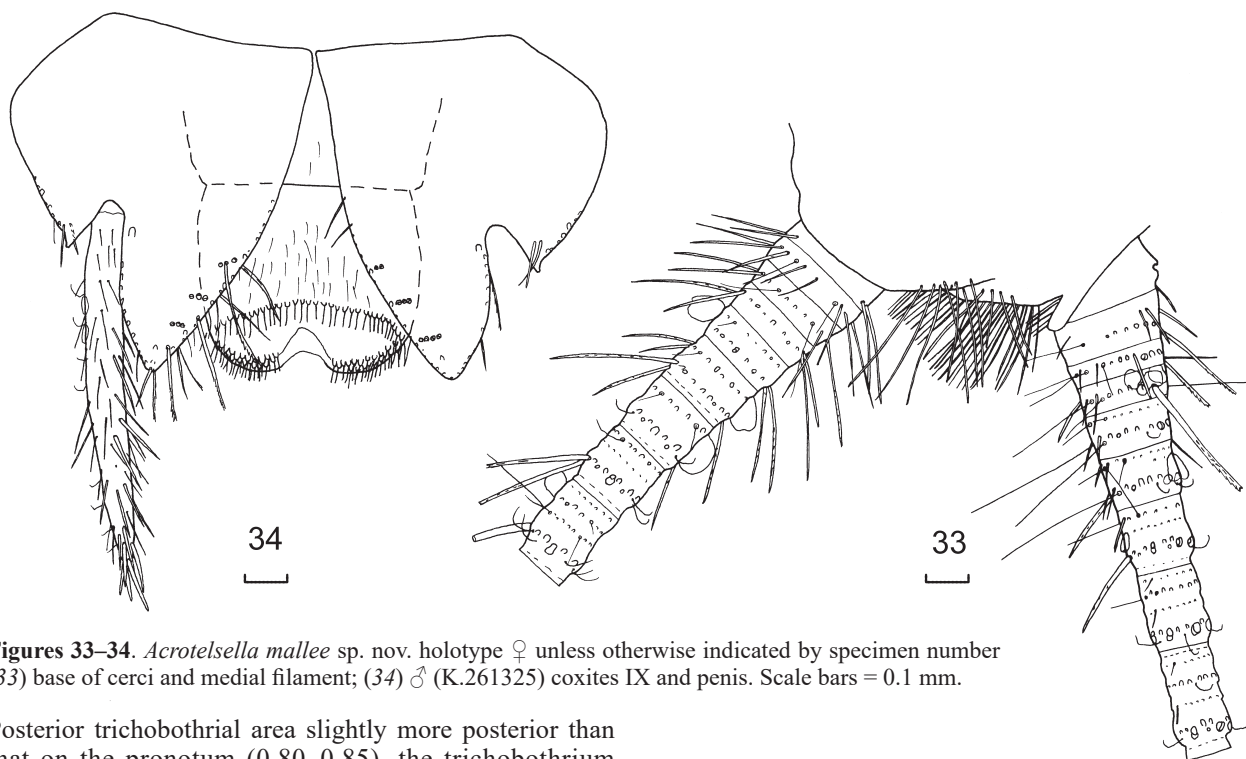


**Figures 28–32.** *Acrotelsella mallee* sp. nov. holotype ♀ (28) urotergite X; (29) urosternite IV; (30) urosternite VII, detail of right comb; (31) coxites VIII and IX with ovipositor; (32) apex of gonapophyses. Scale bars = 0.1 mm.

along the margin and is associated with the last comb (N), this comb composed of three macrochaetae (rarely two) with the short trichobothrium at the mediad end and a cilium at the laterad end; all combs associated with a few setulae, sometimes quite numerous. Posterior margin of all nota with 1+1 combs of 3–7 macrochaetae insertions associated with several setulae between the comb and the margin and a cilium at each end, the macrochaetae are mostly lost but in several specimens (probably all) the most laterad or second most laterad is occupied by a long thin trichobothrium-

like macrochaeta (Fig. 19); these combs not particularly widely spaced (gap between them 50–54% of total width of pronotum). — Mesonotum (Fig. 20) with lateral chaetotaxy similar to pronotum with 9–10 combs of 1–3 (rarely four) macrochaetae, the anterior trichobothrial area located 0.59–0.70 along the lateral margin, associated with comb N-2 composed of one macrochaeta (occasionally two) with the trichobothrium located between the macrochaeta and the margin, with a few setulae posterior to the comb and a cilium between the trichobothrium and the margin.





**Figures 33–34.** *Acrotelsella mallee* sp. nov. holotype ♀ unless otherwise indicated by specimen number (33) base of cerci and medial filament; (34) ♂ (K.261325) coxites IX and penis. Scale bars = 0.1 mm.

Posterior trichobothrial area slightly more posterior than that on the pronotum (0.80–0.85), the trichobothrium located medial to the comb usually of three macrochaetae (sometimes fewer) and with 1–3 setulae or stronger setae posterior to the comb.—Metanotum (Fig. 21) similar to mesonotum with 6–9 combs of 1–3 macrochaetae, the anterior trichobothrial area associated with comb N-1 of one or two macrochaetae about 0.70–0.78 the distance along the margin, the trichobothrium located between the margin and the macrochaeta, the posterior trichobothrial area associated with the most posterior comb (0.81–0.89 along the margin) of 2–3 macrochaetae.

Presternum narrow, with transverse row of spaced pectinate macrochaetae with numerous fine setulae below and between these macrochaetae (Fig. 22). — Prothoracic sternum (Fig. 22) parabolic, about as long as wide at its base (L/W 0.86–1.00), antero-lateral corners with about 20 simple marginal setae, posterior three quarters of lateral margins with fringe of setae and some cilia as well as 5–12 short combs on each side each composed of 1–6 short pectinate macrochaetae, combs sometimes lying quite close to each other and lying in two overlapping rows, often with a strong seta on the margin near the end of the comb but not counted in the number of macrochaetae per comb, these strong marginal or submarginal smooth macrochaetae also present distally and at irregular locations along the lateral margins. — Mesosternum (Fig. 23) only a little larger than prosternum (1.1–1.2 times as long) about as long as wide at its base (L/W 0.96–1.13), anterolateral corners glabrous, posterior third of margins with many long thin setae and cilia and 3–4 combs on each side distally, the more anterior composed of 5–10 pectinate macrochaetae and the more posterior composed of 1–4 pectinate macrochaetae; all combs with several curved setulae beneath them, larger smooth, tapered macrochaetae distally at or past the level of the more distal combs. — Metasternum (Fig. 24) of similar length to prosternum except wider (L/W 0.78–0.87), apically rounded, with marginal setae and cilia along distal ¼ of lateral margins and 3+3 (occasionally two or four) combs

of 1–9 pectinate macrochaetae.

Legs quite long, tibia L/W ratio of PI 2.1–3.2, PII 2.7–3.5, PIII 3.6–4.3; tarsi L/W ratio PI 5.1–7.5, PII range 7.4–8.3, PIII 8.9–11.3. PI (Fig. 22) with a comb of 3–8 pectinate macrochaetae laterally on the distal margin of the precoxa. Coxa with scales and a group of about 6–9 macrochaetae on the anterolateral corners usually arranged in two close rows, followed by a field of strong pectinate macrochaetae along the external margin about two the three macrochaetae wide, the margin with curved slightly pectinate macrochaetae, the macrochaetae behind the margin pectinate and usually grouped into combs of two or three; inner margin with a four lightly pectinate macrochaetae and several smooth and delicately pectinate setae of varying thickness distally over the articulation. Trochanter with a small pectinate macrochaeta and several setae, cilia and setulae. Femur posteriorly with a long thin pectinate macrochaeta nine tapered or slightly carrot-shaped pectinate macrochaetae along the posterior margin and a line of smooth setae posteriorly, dorsal margin with at least three short curved pectinate macrochaetae over the articulation. Tibia of PI with six (?) stout, carrot-shaped, mildly pectinate macrochaetae along the ventral margin as well as several longer, thinner, smooth setae and a row of shorter setae near the distal margin; anterior margin with two pectinate macrochaetae and a stronger seta near the distal margin, dorsal margin with two short, curved, mildly pectinate macrochaetae spaced along the margin and a few smooth setae subdistally, with usual tibial spur bearing a few setae. Tarsi with four articles, the basal article of PI about half the total length of the tarsus, its join with the next article not particularly oblique, the surface of all tarsal articles with numerous simple setae, those ventral near the distal end of the basal three articles more robust and with more rounded tips. On some specimens a raised oval area is visible on the second tarsal article. Pretarsus with two long curved lateral claws and a shorter curved medial claw. PII and PIII (Figs. 25, 24) similar to PI except the

antero-lateral groups of macrochaetae on the coxa absent; legs progressively longer from PI to PIII (L tibia PI/PIII 0.51–0.73, L tarsus PI/PIII 0.58–0.67 and the relative length of the basal tarsal article is progressively longer, being about 0.6 of the total length on PIII).

**Abdomen:** Urotergite I with 1+1 lateral combs of 4–6 macrochaetae each associated with a cilium at both ends, and 2–3 small marginal setae and several setulae between the comb and the margin, urotergites II–VII with 3+3 combs of macrochaetae as in Table 3 (Fig. 26), the lateral combs with two cilia as well as 2–4 small marginal setae 3–8 setulae, the sublateral combs with a cilium at the mediad end as well as 2–3 small marginal setae and 2–5 setulae, the submedial combs with a cilium at the laterad end as well as 2–5 small marginal setae and 4–6 setulae; urotergite VIII with 2+2 combs (lacking the sublateral), also with a cilium at each end of both combs as well as 2–4 marginal setae and 5–6 setulae, urotergite IX glabrous except for a single marginal seta in the infralateral position (Fig. 27) on some specimens, it is present on one side only of the holotype, both sides in NMV T-22589, K.261324, K.541623 and K.261325 but absent in K.541622, K.261284, NMV T-22588 and K.541624. — Urotergite X (Fig. 28) equilateral triangle (64–86°), wider at base than long (L/W 0.43–0.62) with many long fine pectinate tapered setae along entire margin, and (3–4)+(3–4) combs of 1–7 macrochaetae per comb (all lost) as well as a few setulae posterior to each comb, and most combs with a cilium at the mediad end.

Urosternite I and II glabrous, urosternites III–VII with 1+1 lateral combs of 10–23 pectinate macrochaetae (Figs. 29, 30) each with several marginal setae and several setulae between the comb and the margin as well as a cilium at the laterad end of every comb (occasionally not present). The distance between the lateral combs 1.7–4.8 times the average width of these combs, the ratio being largest on urosternite III and decreasing posteriorly.

Genital region of ♀ as in Figure 31. Two pairs of styli, those on IX long and slender with robust setae apically and along the length of the stylus, styli of VIII similar and not much smaller. Coxites VIII with long combs of 17–23 macrochaetae and about half this number of marginal setae and a few setae in between the two, the coxites with straight truncate posterior margin and a slightly obtuse angle with the inner margin, the corner being moderately rounded the curve occupying only 1/5 to 1/4 the length of the posterior margin. Each coxite IX with long internal process which

is quite broad, about 1.6–2.8 times longer than wide at its base and 5.4–7.6 times longer than the short pointed external process, the inner processes not quite reaching the apex of the ovipositor; outer process with stout setae along the outer margin, inner process with numerous, quite long, closely packed setae along the outer margin adjacent to the stylus, a long smooth macrochaetae inserted mediad of the base of the stylus, the inner margin with 5–7 combs of 1–5 pectinate macrochaetae. — Ovipositor (Fig. 31) not very long (1.1–1.4 HW), of secondary type, only just surpassing the apex of the long internal processes of coxites IX, both pairs of gonapophyses consisting of longer basal divisions becoming progressively shorter distally except for the last divisions which are about as long as the previous two or three together, 11–15 divisions in total; the apical seven divisions armed with modified spines or conules which become more numerous distally, the last divisions with 7–10 modified spines (Fig. 32); all divisions also with short fine trichobothria-like setae.

Cerci (Fig. 33) first division almost glabrous except for single small seta externally, second division with sub-basal semi ring of a few small setae and a medial ring of setae, a trichobothrium and a pectinate macrochaeta externally, third division with a single ring of setae, trichobothria and some pectinate macrochaetae towards the outer margin, fourth interval similar but also with basal semi-ring of scales and a trichobothria and the subapical ring also contains some cilia, fifth division similar although it is uncertain whether the basal ring is of small setae or scales, sixth and seventh divisions with basal ring of setae and trichobothria followed by a semi-ring of scales then a subapical ring of setae, macrochaetae, cilia and some trichobothria, eighth and ninth divisions with four rings the most basal and third probably mostly of scales but also a small trichobothrium and a small seta respectively; subsequent divisions lost from holotype. — Median dorsal appendage, first division with only a couple of long thin delicately pectinate setae near the outer margins, following three divisions with single rings of long thin setae and trichobothria, divisions 5–7 with two rings, the more basal with a small trichobothrium some setae and some scales, the subapical ring with setae, trichobothria, cilia and macrochaetae, following division with an additional ring of scales between the sub-basal and subapical rings, ninth similar but with an additional ring of scales basally.

**Male:** Similar to female except urosternite VIII entire with posterior margin between the combs slightly concave. Coxites IX in ♂ separated (Fig. 34) with internal process broad and much shorter than that of the female being only 1.0–1.1 times longer than wide at its base and 2.8–3.9 times longer than the short pointed external process, the inner processes not quite reaching to half the length of the stylus; outer process with stout setae along the outer margin, inner process with setae along both margins, as well as 3–4 submarginal combs of 1–4 macrochaetae along the inner margin, as well as a long smooth macrochaetae inserted mediad of the base of the stylus. Penis typical with numerous glandular setae apically, each set on a protuberance. Parameres absent.

**Habitat.** This species was mostly collected in dry leaf litter.

**Etymology.** The species is named mallee which is the vegetation type predominant in much of the habitat of this species in south-western NSW and north-western Victoria. It is treated as a noun.

**Table 3.** Number of macrochaetae per bristle comb — *Acrotelsella mallee* sp. nov.

segment	urotergite			urosternite
	lateral	sublateral	submedial	
I	4–6	—	—	—
II	4–7	2–5	4–7	—
III	5–8	2–5	5–7	11–18
IV	5–9	4–6	5–8	13–20
V	6–10	5–6	3–8	13–21
VI	6–11	5–6	5–9	13–20
VII	6–10	4–6	5–8	11–21
VIII	6–11	—	5–9	10–23
IX	—	—	—	—

## Remarks

As indicated above, both morphology and molecular data, which also includes several further undescribed species, suggest that species with a secondary ovipositor may form a separate clade from the rest of the genus *Acrotelsella*. However more taxonomic work is required before this question can be resolved.

Given the weak descriptions of many older species it is difficult to be certain of the position of *A. mallee* sp. nov. relative to other species which appear to have a secondary type ovipositor. It differs from *A. annamita* Silvestri, 1948 because the Vietnamese species lacks transverse combs on coxites IX. Furthermore *A. annamita* has three pairs of styli versus two in *mallee* and the spines on the ovipositor are restricted to the last division in *A. annamita*. The inner processes of coxites VIII of female in *A. annamita* are more rounded and obtuse compared to truncate and straight in *A. mallee* sp. nov. Urotergite X appears to be more elongate in *annamita* and the anterior trichobothrial area of pronotum much further forward on *annamita* (0.32 versus 0.43–0.49). *Acrotelsella mallee* sp. nov. has (3–4)+(3–4) combs on the mesosternum and 3+3 combs on metanotum whereas *A. annamita* has only 2+2 and 1+1 combs respectively. *Acrotelsella annamita* has five labial palp papillae versus seven in *mallee*.

*Acrotelsella impudica* (Escherich, 1905) also has a secondary ovipositor but the modified spines are unusually tapered and curved compared to the Australian *Acrotelsella* species and Escherich's species has short curved inner processes on both coxites VIII and IX. However, *A. impudica* sensu Wygodzinsky, 1959 lacks the curved coxites IX but they are still quite short, and the inner processes of coxites VIII are curved and resemble the more usual *Acrotelsella* shape and it has five labial palp papillae. This species needs to be redescribed.

Although the description of *A. devriesiana* Silvestri, 1908 is far from complete by today's standards, it also has a secondary type ovipositor and coxites VIII are of similar shape. It clearly differs from *A. mallee* sp. nov. in having only 1+1 combs on the metathoracic sternum (versus 3+3) and urotergite X appears to be more acute (56° versus 64–86°). It also appears to lack transverse combs on the inner margin of coxites IX whereas *A. mallee* sp. nov. has 3–7 combs each of 1–5 macrochaetae. The specimens Silvestri mentions from Dongarra probably should not be included with *A. devriesiana* as the ovipositor is much longer than the coxites and it lacks styli on coxites VIII. The subspecies *perspinata* is also clearly different because it has only 2+2 combs on the metasternum, 2+2 lateral combs on coxites IX and a long line of 12 papillae on the labial palp.

*Acrotelsella devriesiana westralis* (Nicholls & Richardson, 1926) is inadequately described with no details of the female however it probably belongs in this group. It also has 3+3 combs on both the thoracic meso- and metasterna and has transverse combs on coxites IX of the male however it appears to have an unusual arrangement of five labial palp papillae in a circular group. More material is required to investigate these issues. With evolving understanding of the species limits in *Acrotelsella*, this subspecies should probably be considered as a full species, as initially proposed by its describers.

*Acrotelsella silvestri* Womersley, 1939 may or may not fit into this group. It has spines on the ovipositor but they appear to be completely different to those of other species in

being scale like. It is not clear from the illustration whether there are combs on the inner processes of coxites IX but they are quite short. Too many other characters have not been included in the description for further comment.

## *Acrotelsella albicaudata* sp. nov.

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Figs 35–66

**Holotype** ♂ (HW 1.13) VICTORIA: Murray-Sunset N.P. 34.73984°S 142.01870°E 111m asl, 25.ix.2013, Graeme Smith, leaf litter under *Acacia* sp., NMV T-22586 (on two slides). **Paratypes** 1 ♀ (HW 1.08) same data as holotype, NMV T-22587 (on two slides); 1 juvenile (HW 0.78) same data as holotype, AMS K.261327 (on two slides); 1 ♂ (HW 1.40) VIC: Murray-Sunset N.P. Pioneer track 35.03444°S 141.73926°E 52m asl, 26.ix.2013, Graeme Smith, *Eucalyptus* leaf litter on top of ridge, AMS K.377968 (in alcohol, about to moult).

**Diagnosis.** In the field, this species can easily be distinguished from other described *Acrotelsella* by the very white tail filaments. Additional characters differentiating the species include the presence of only a single pair of styli in both sexes, seven papillae on the last article of the labial palp, the secondary type ovipositor and the short internal processes of coxites IX of the female which lack transverse combs.

## Description

**Appearance:** Medium-sized silverfish, with thorax a bit wider than the abdomen which tapers posteriorly. Scale pattern as in Figure 36, in alcohol mottled brown with some dorsal scales much darker than others. Eyes dark brown. Antennae with darker annulations, terminal filaments extraordinarily white.

**Body length:** Up to H+B 8.6 mm, HW 1.38 mm; thorax: length 2.6 mm or 0.30–0.32 H+B; width 2.25 mm with the pronotum being slightly narrower than the mesonotum, the mesonotum slightly wider than the metanotum, all nota of about the same length; antennae incomplete, maximum preserved length 4.2 mm or >0.5 H+B; terminal filaments all broken, maximum length of cercus 2.9 mm or >0.46 H+B; median dorsal appendage maximum preserved length 3.4 mm (>0.54 H+B), but not very long.

**Pigmentation:** Flagellum of antennae with distinct annulations; pedicel with very distinct dark ring at its apex. Frons with darker pigment along the sides of the head and through the anterior bushes, labrum and clypeus without pigment. Mandibles and maxillae without pigment among bushes of macrochaetae, ultimate article of maxillary palp with reddish brown pigment in the medial third and only light pigment in the other two thirds, penultimate article with dark pigment in the distal half, third article with dark pigment in distal third, second article with dark pigment in distal third and lighter pigment proximally. Labial palp with quite dark pigment on much of the apical and subapical articles with dark pigment distally on the second article, basal article with very little pigment. Nota and thoracic sterna without obvious pigment. Precoxa of legs very darkly pigmented. Coxae with quite dark pigment in the anterior “shoulders: extending down the outer margin among the bristles. Trochanter with darker more reddish pigment along posterior margin especially distally. Femora with dark reddish pigment along most of the posterior margin, especially distally and also on anterior margin distally, the



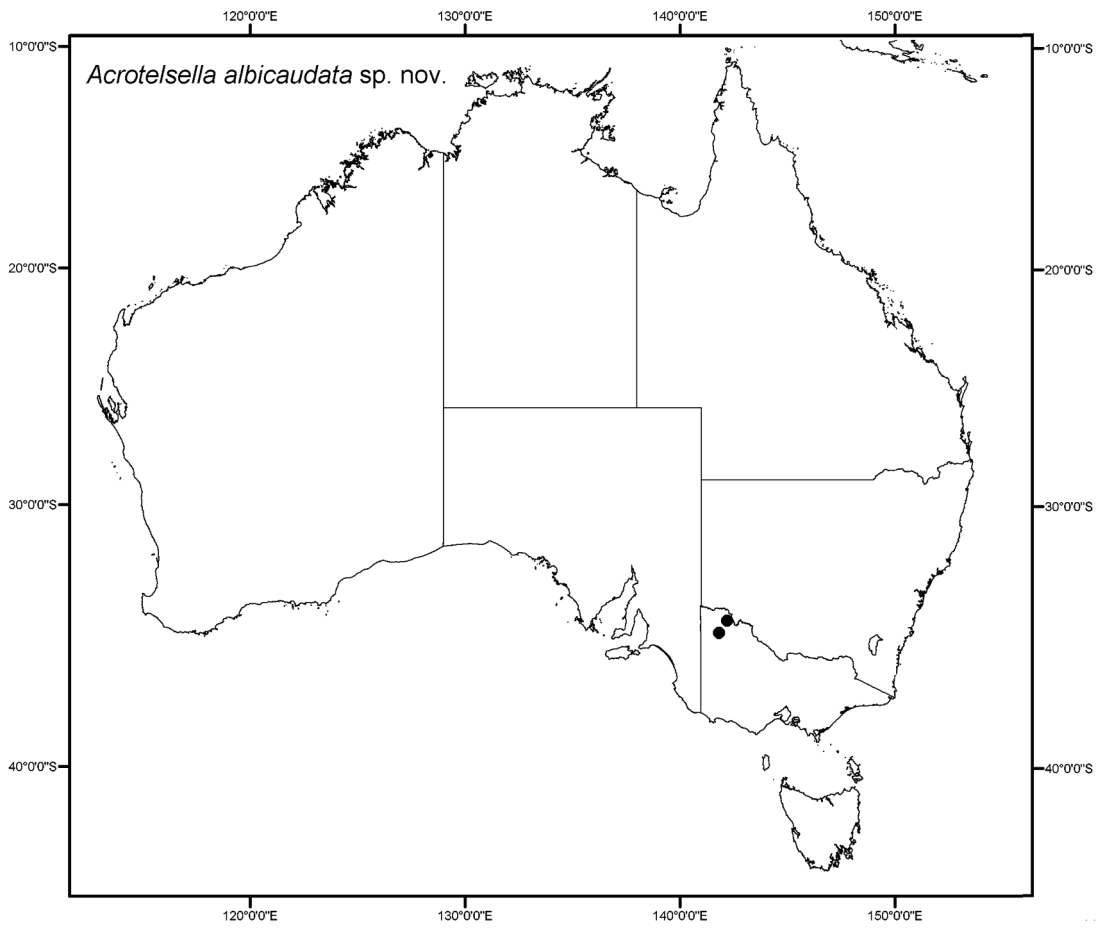


Figure 35. Known distribution of *Acrotelsella albicaudata* sp. nov.

density of the pigment along the posterior margin as well as on subsequent leg articles makes it difficult to discern sockets of setae and perhaps even macrochaetae. Tibia with dark pigment around all of distal margin. First tarsal article dark distally, remaining legs articles without pigment. Abdominal segments without obvious pigment dorsally, ventrally the posterior urosternites and coxites pigmented, especially coxites IX around the stylus insertion. Ovipositor without pigment. Cerci and median filament very white. Abdominal styli with moderate pigment.

**Macrochaetae:** Variable, pectinate or smooth (Figs 37–39), quite dark to straw coloured.

**Scales:** Of quite variable shape with numerous sub-parallel ribs that do not or only slightly surpass the margin of the scale (Fig. 40), the number of ribs and degree of pigmentation varies considerably across the nota but no scales with wide spacings observed. Both ventral and dorsal surfaces with scales with pigmented ribs although this is generally less on the ventral surface; scales of legs can be quite dark. Scales found on top of head, on scape and pedicel, on mandibles, on second and third articles of maxillary palp, all nota, all thoracic sterna, legs (except for trochanter and distal three articles of tarsi), all urotergites and urosternites, styli, medial filament and cerci, those on the terminal filaments hyaline.

**Head:** (Fig. 41) wider than long. Frons with 1+1 not very dense bushes of macrochaetae aligned in subparallel curved rows on the antero-lateral corners separated by a medial gap. Along the margins posterior to these bushes is a very small gap in the row of macrochaetae along the margin above the antennal bases after which there is another bush of pectinate

macrochaetae extending towards the barely isolated peri-antennal groups which consist of about 10 macrochaetae and a long thin trichobothrium-like seta; posterior to these the marginal macrochaetae rows extend to the eyes about two wide with about six macrochaetae above the eyes ending in a group of three or four strong macrochaetae near the posterior margin of the head; sides of head posteriorly with usual long thin trichobothrium-like seta. Clypeus with 1+1 dense bushes of about 50 slightly thinner pectinate macrochaetae as well as a few curved setae laterally. Labrum also with 1+1 dense bushes of about 35 pectinate macrochaetae; face of labrum with scattered simple curved setae and at least one longer thin apically bifurcate seta. Eyes dark chestnut brown. — Antennae probably shorter than H+B, scape (Fig. 42) quite long with scales over surface and a preapical ring of numerous setae; pedicel also with scales, with preapical ring of simple setae and cilia, with a second incomplete ring of smaller setae below this and a few small additional setae on the inner face; first annulus/interval of flagellum with only a few setae in a ring with a subapical ring of simple setae; next annulus with a single ring of simple setae and two trichobothria; subsequent intervals with single ring of setae and two trichobothria with some cilia appearing by the fifth interval. Further intervals of flagellum poorly preserved on slides, becoming quite shrunken, however circular areas that may be poculiform sensilla may be present. The dark pigment also obscures observation of sensilla, but some circular and basiconic sensilla type B were seen. — Mandibles (Fig. 43) typical for *Acrotelsella* with well-developed molar and incisor areas; a group of about seven strong apically bifurcated but



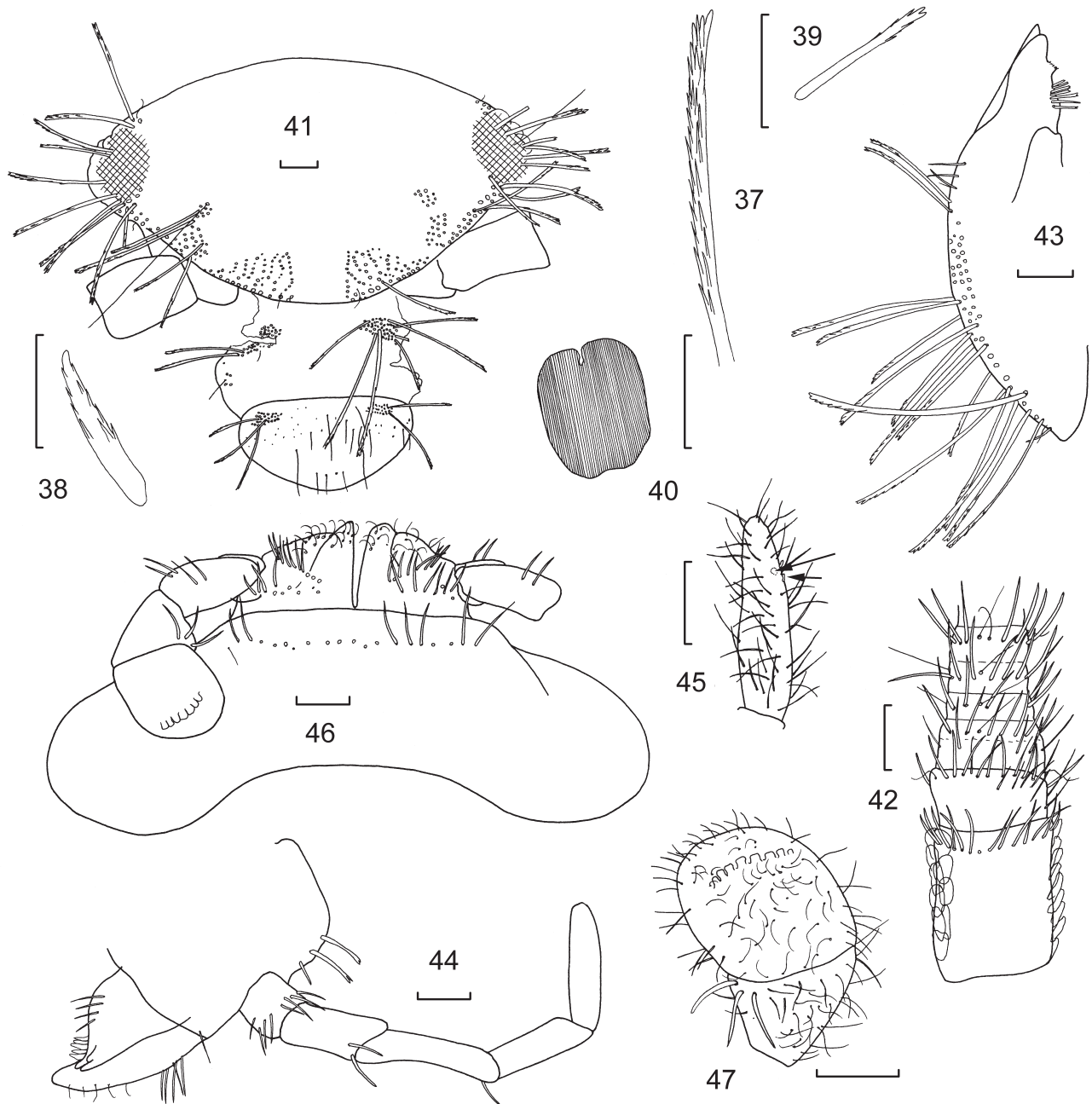
**Figure 36.** *Acrotelsella albicaudata* sp. nov., Murray Sunset N.P.

simple setae distally adjacent to the pectinate molar area and a bush of about 60 pectinate macrochaetae externally as well as scattered simple setae and scales. — Maxilla (Fig. 44) with two thick minutely apically bifurcated but otherwise smooth macrochaetae and a smaller apically bifurcate seta externally proximal to the palp, the lacinia with three strong teeth, one set further back than the other two, followed by 5–7 lamellate processes and a row of just 3–4 thin simple or apically slightly bifurcate setae, galea distinctly longer than lacinia with about 4–5 smooth, simple or apically bifurcate setae externally in its basal half and a few setulae or cilia distally; maxillary palp not particularly long and thin, apical article (Fig. 45) 4–5 times longer than wide and a bit longer than the penultimate article (range 1.0–1.3) which is 0.7 times as long as the third and longest article, the ultimate article with at least one basiconic sensillum type B and two type C, and possibly a circular sensillum although this was very indistinct and may be an artefact, last three articles of palp with fine setae, basal article with ring of thicker setae, second article also with subapical ring of slightly thicker setae. — Labium (Fig. 46) short and broad, postmentum with transverse row of simple setae, prementum with transverse and oblique rows of short strong setae, apically with long curved setulae; labial palp short, apical article subrectangular (Fig. 47), about as long as wide (0.94–1.07) with seven papillae of compact type arranged in a single curved row near the outer margin, these

papillae were difficult to see in the holotype and paratype NMV T-22587 due to the high degree of pigmentation in this and penultimate articles, but were clearly distinguished in the paratype K.377968; no basiconic sensilla were seen but this may also be an artefact of the pigmentation (only one ultimate article of the holotype was preserved and those of paratype NMV T-22587 were too shrivelled to examine), surface covered with numerous fine setae as well as longer fine setae.

**Thorax:** Pronotum (Fig. 48) with setal collar about two to three macrochaetae wide plus cilia and setulae, without gap medially; lateral margins with stronger subtly pectinate as well as smaller setae and some cilia along each margin, with eight combs of 1–3 macrochaetae along each margin. Two open trichobothrial areas; the anterior trichobothrial area 0.39–0.44 along the margin and associated with comb N-3, the comb composed of only a single macrochaeta with the trichobothrium between the macrochaeta and the margin; all combs associated with a few setulae; the posterior trichobothrial area is located 0.77–0.79 along the margin and is associated with the last comb (N), this comb composed of two macrochaetae with the trichobothrium at the mediad end and a cilium at the laterad end. Posterior margin with 1+1 combs of 6–8 macrochaetae (Fig. 49) associated with several setulae between the comb and the margin and a cilium at each end; the combs not widely situated with the gap between them only 43–44% of the width of the pronotum. — Mesonotum (Fig. 50) with lateral chaetotaxy similar to pronotum with nine combs of 1–3 macrochaetae, the anterior trichobothrial area located 0.57–0.61 along the lateral margin associated with comb N-2 composed of two macrochaetae with the trichobothrium located between the macrochaetae and the margin, with one to three setulae posterior to the comb and a cilium between the trichobothrium and the margin. Posterior trichobothrial area slightly more posterior than that on the pronotum (0.83–0.87 along margin), the trichobothrium located mediad to the comb of just one macrochaeta and with one to four setulae posterior to the comb. Posterior margin with quite laterad 1+1 combs of eight macrochaetae with cilia at each end and several setulae or small setae between the comb and the margin. — Metanotum (Fig. 51) similar to mesonotum with eight combs of one to three macrochaetae, the anterior trichobothrial area located 0.71–0.78 along the margin associated with comb N-1 of 1–2 macrochaetae, the posterior trichobothrial area associated with the most posterior comb of only one macrochaeta and the posterior 1+1 combs each of eight macrochaetae with a cilium at each end and several setulae or small setae between the comb and the margin.

Presternum narrow, with single transverse row of subtly pectinate setae (Fig. 52). — Prothoracic sternum (Fig. 52) 0.94 times as long as wide at its base, parabolic, slightly truncate and glabrous apically, antero-lateral corners with fields of about 6–9 large simple small setae, posterior three quarters of lateral margins with fringe of strong setae and some cilia as well as 6+6 or 6+7 combs each composed of 3–9 pectinate macrochaetae with the macrochaetae somewhat irregularly arranged. — Mesosternum (Fig. 53) about as long as wide at its base (L/W 1.02–1.05) and a little longer than prosternum (1.2 times as long) without setae in the anterolateral corners, simple setae along the posterior quarter of the margin and 2+2 or 2+3 combs and 1+1 single pectinate macrochaetae distally, both sets of combs composed of 6–9 pectinate



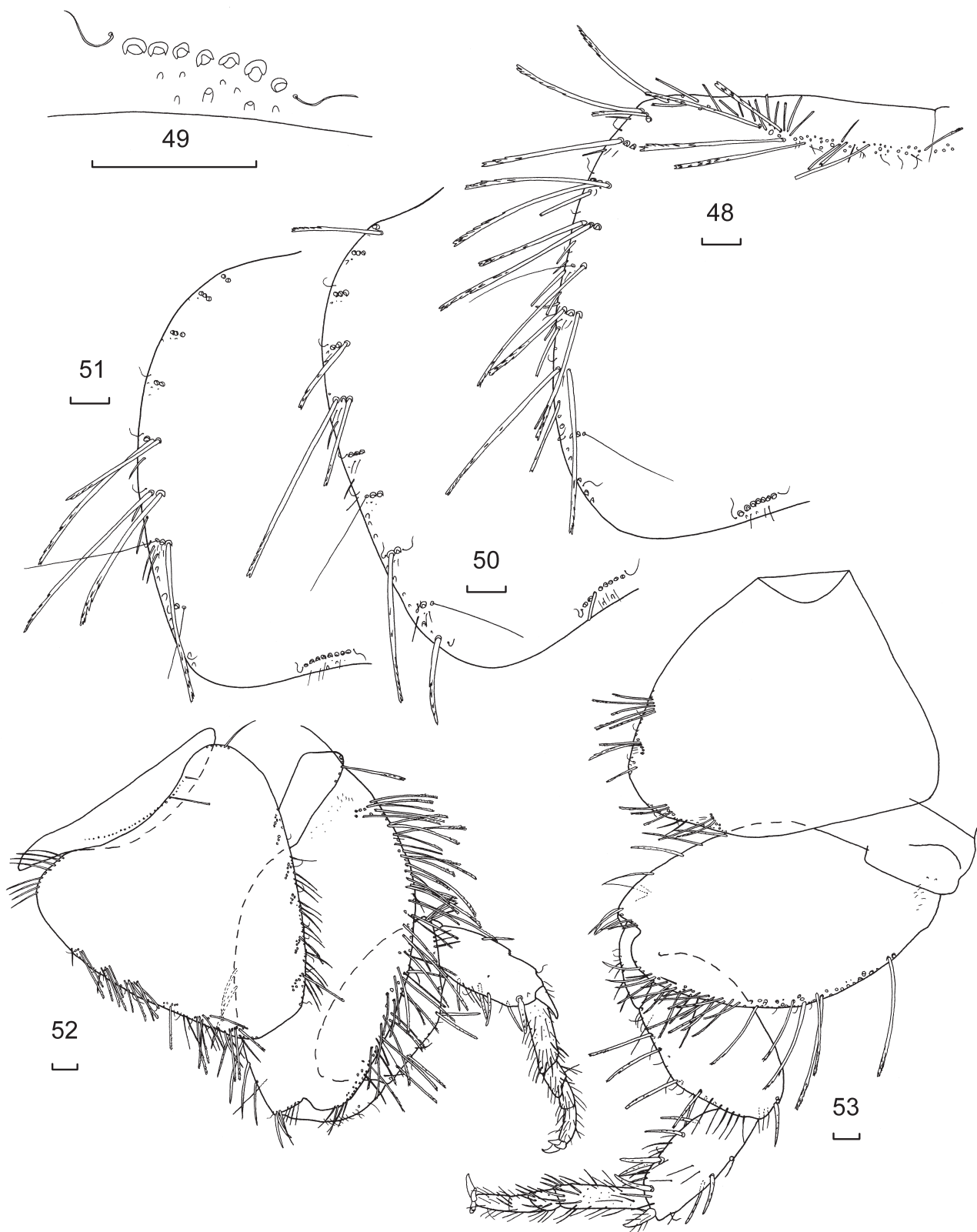
**Figures 37–47.** *Acrotelsella albicaudata* sp. nov. holotype ♂ (37) long pectinate supra-ocular macrochaeta; (38) distal inferior macrochaeta of tibia; (39) marginal macrochaeta of pronotum; (40) darker dorsal scale; (41) head (cross-hatched area obscured by eye pigment); (42) antenna, scape, pedicel and basal intervals of flagellum; (43) mandible; (44) maxilla; (45) idem, apex of ultimate article of palp, showing the location of the sensilla; (46) labium; (47) idem, ultimate article of palp. Scale bars = 0.1 mm.

macrochaetae plus a few posterior setulae. — Metasternum (Fig. 54) a little shorter and wider than the mesosternum (L/W 0.82–0.83), slightly pentangular in shape, apically glabrous with marginal setae and cilia along distal  $\frac{1}{4}$  of lateral margins, with 2+2 combs of pectinate macrochaetae of 4–7 macrochaetae arranged in single but slightly irregular rows and occasionally with 1+1 single submarginal macrochaetae (absent from K.377968) more distally.

Legs fairly robust, tibia L/W ratio of legs PI 2.5 (range 2.3–2.7), PII 2.4 (range 2.2–2.7), PIII 3.4 (range 3.3–3.8); tarsi L/W ratio PI 6.3 (5.0–7.0), PII 7.1 (range 6.7–7.5), PIII 7.8 (range 7.3–8.1). PI (Fig. 52) with a row of about six pectinate macrochaetae laterally on the distal margin of

the precoxa. Coxa with scales and a group of about twelve macrochaetae on the anterolateral corners followed by a field of strong pectinate macrochaetae about 2–3 macrochaetae wide along the external margin; inner margin with six tapered slightly pectinate macrochaetae and three or four smooth strong setae distally over the articulation as well as some smaller setae along the distal margin. Trochanter with a single fine pectinate macrochaeta as well as several fine setae and cilia. Femur posteriorly with six (?) strong pectinate macrochaetae as well as a few small setae and cilia, in addition to three strong macrochaetae on the dorsal surface towards the distal end over the articulation. Tibia of PI with about five or six stout, carrot-shaped, pectinate

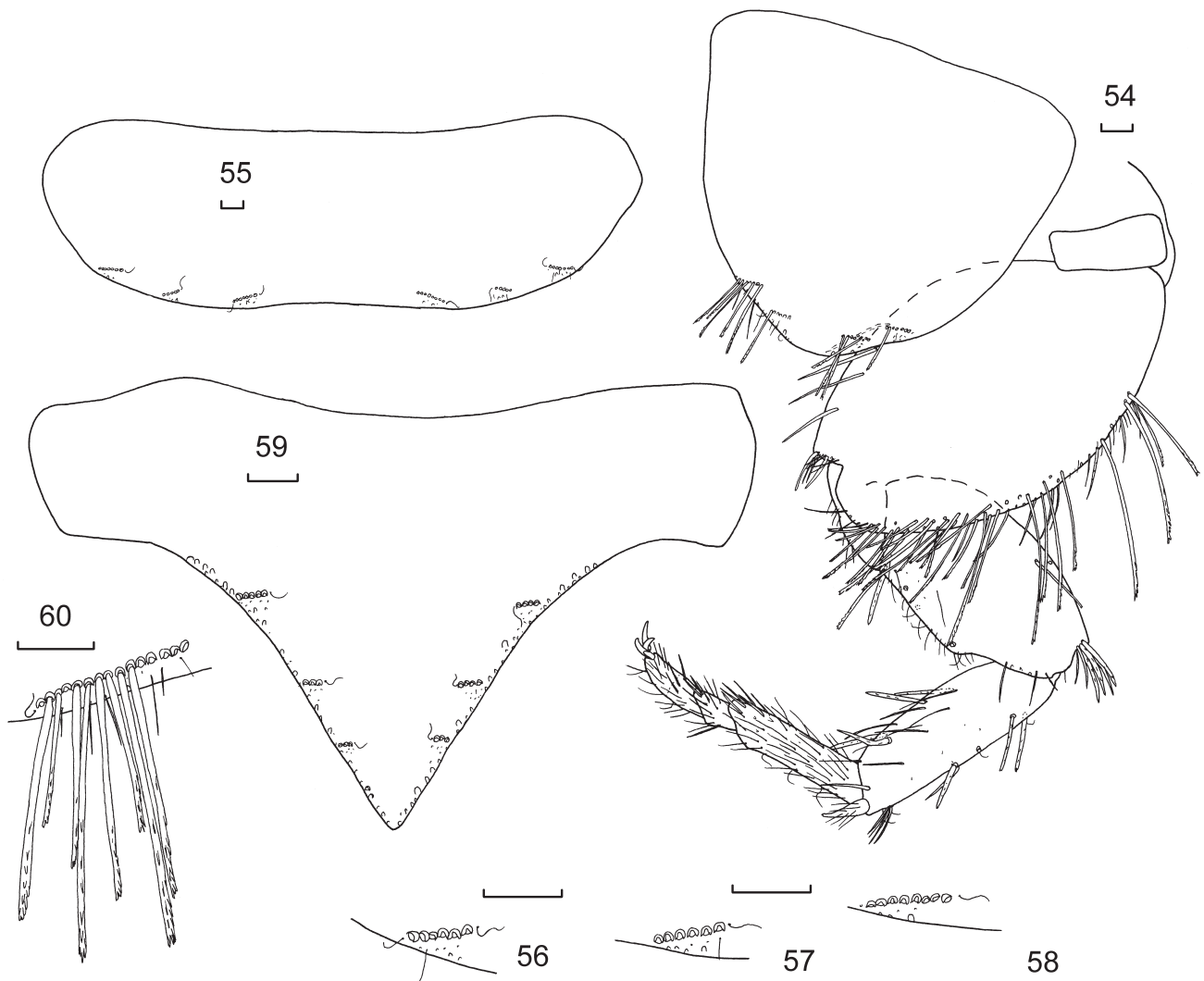




**Figures 48–53.** *Acrotelsella albicaudata* sp. nov. holotype ♂ (48) pronotum, left half; (49) idem, right posterior comb; (50) mesonotum, left side; (51) metanotum, left side; (52) presternum, prothoracic sternum and PI; (53) mesothoracic sternum and PII. Scale bars = 0.1 mm.

macrochaetae along the ventral margin as well as three smaller macrochaetae on the dorsal margin and a few smooth setae over the articulation, the usual apical spur with only a few setae. Tarsi with four articles, the basal article of PI about half the total length of the tarsus, its join with the next article not particularly oblique, the surface of all

tarsal articles with numerous simple setae. Pretarsus with two long curved lateral claws and a shorter curved medial claw. PII (Fig. 53) and PIII (Fig. 54) similar to PI except the antero-lateral groups of macrochaetae on the coxa absent; legs progressively longer from PI to PIII (tibia PI/PIII 0.57–0.65, tarsus PI/PIII 0.69–0.75) and the relative length



**Figures 54–60.** *Acrotelsella albicaudata* sp. nov. holotype ♂ (54) metathoracic sternum and PIII; (55) urotergite V; (56) urotergite III, left lateral comb; (57) idem, left sublateral comb; (58) idem, left submedial comb; (59) urotergite X; (60) right sublateral comb of urosternite IV. Scale bars = 0.1 mm.

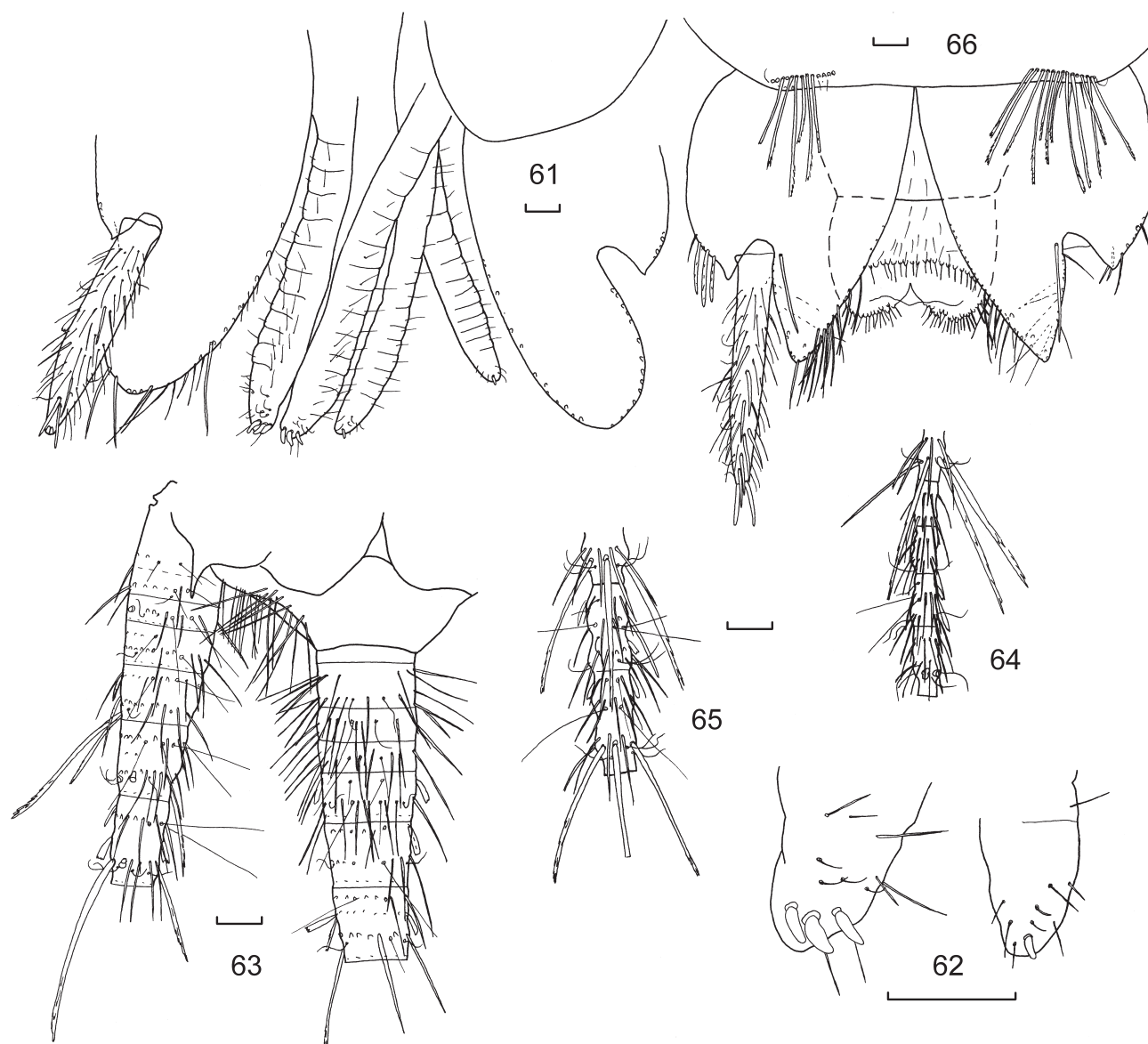
of the basal tarsal article is progressively longer, being about three quarters of the total length on PIII, the last two articles are quite short and the suture between them almost indistinguishable on the holotype.

**Abdomen:** Urotergite I with 1+1 lateral combs of 3–6 macrochaetae each associated with a cilium at either end, 2–4 small marginal setae and 2–3 setulae between the comb and the margin, urotergites II–VII (Figs 55–58) with 3+3 combs of macrochaetae as in Table 4, the lateral and submedial combs each with a cilium at each end, the sublateral combs with just a single cilium at the mediad end, urotergite VIII with 2+2 combs (lacking the sublateral), urotergite IX glabrous; all combs with 1–6 small as well as 3–5 setulae between the comb and the margin. — Urotergite X (Fig. 59) acutely triangular ( $57^\circ$  in K.377968,  $64^\circ$  in holotype but wider  $99^\circ$  in K.261327 but this looks deformed and therefore probably not representative, urotergite lost during dissection of NMV T-22587), wider at base than long (L/W 0.56) with many setae along entire margin both above and below (all lost on holotype), and 3+3 combs of three to five macrochaetae per comb (all macrochaetae lost) as well as several setulae posterior to each comb and a cilium at the mediad end.

Urosternite I and II glabrous with the posterior margin of urosternite I protruding a little in the middle, urosternites III–VII with 1+1 lateral combs of 11–16 pectinate macrochaetae (Fig. 60) each with 4–6 marginal setae and a few setulae between the comb and the margin as well as a cilium at the laterad end of each comb only. The distance

**Table 4.** Number of macrochaetae per bristle comb — *Acrotelsella albicaudata* sp. nov.

segment	urotergite			urosternite
	lateral	sublateral	submedial	
I	3–6	—	—	—
II	4–6	3–5	3–8	—
III	4–7	3–6	4–8	11–14
IV	4–7	2–6	3–8	11–15
V	4–8	3–5	2–8	11–14
VI	4–8	3–5	3–8	11–16
VII	4–8	3–5	3–8	11–14
VIII	4–8	—	4–7	13
IX	—	—	—	—



**Figures 61–66.** *Acrotelsella albicaudata* sp. nov. holotype ♂ unless otherwise indicated with specimen number (61) coxites VIII and IX and ovipositor of female; (62) idem, apex of gonapophyses; (63) base of cerci and medial filament; (64) cercus, most distal surviving divisions; (65) medial filament, most distal surviving division; (66) urosternite VIII and coxites IX with penis and stylus IX (NMV T-22587). Scale bars = 0.1 mm.

between the lateral combs 3.1–4.4 times the average width of these combs, the ratio being largest on urosternite IV and decreasing posteriorly. Only one pair of styli present in both sexes.

Genital region of ♀ as in Figure 61. Styli short with robust setae apically and along the length of each stylus. Coxites VIII with long combs of 12 macrochaetae and a lesser number of setulae and marginal setae, the coxites with almost square inner corners but rounded near the angle. Coxites IX with short, wide, round internal process, about 1.5 times longer than wide at its base and only 3–4 times longer than the short pointed external process, the inner processes just reaching the apex of the ovipositor; outer process with a few setae externally, inner process with several long smooth setae along the outer margins as well as finer setae or setulae and

many scales, inner margin of process with setae insertions and some small setae. — Ovipositor (Figs 61, 62) short, about equal to HW, only just attaining the apex of the short internal processes of coxites IX, both pairs of gonapophyses with very long basal divisions then quite short divisions, about 15–16 divisions in total; of the secondary type, the posterior gonapophyses with three conules apically, the posterior gonapophyses with a single conule.

The contrast in pigment levels between the quite dark anal region, including the sharp horn-like paraprocts and epiproct and the unpigmented terminal filaments is quite striking. Cerci (Figs 63, 64) first division with some small trichobothria and small setae, following two basal divisions much shorter than wide, each with a single ring of setae and trichobothria, divisions four and five somewhat longer



but still shorter than wide with two rings, the most basal with trichobothria and probably scales and small setae, the most dorsal ring with larger setae, cilia and macrochaetae on the dorsal and outer margins, divisions six and seven longer than wide with an inconspicuous medial ring of insertions which appear to be mostly scales, the basal ring with setae, trichobothria and scales, the distal with larger setae, cilia and macrochaetae; most distal surviving divisions (thirteenth) with four subdivisions each with two annuli, each annulus with a ring of chaetotaxy, the most distal ring of large macrochaetae and cilia also with a ring of setae proximal to it; trichobothria appear restricted to the third most distal subdivision, long cilia at the distal end of the second, and third subdivisions; hyaline scales are present on these distal divisions although difficult to distinguish. — Median dorsal appendage (Figures 63, 65), first division very short, glabrous, following division with two rings of fine setae and trichobothria, divisions three and four a little shorter than two, each with a single ring of fine setae and trichobothria, fifth division with two rings, the most basal with scattered trichobothria, scales and a fine seta, the most distal with trichobothria, cilia and long fine setae, division with two rings, the most basal with setae and scales, the most distal with stronger as well as some fine setae, long cilia and trichobothria, division seven with three rings, the middle one appearing to be only scales; most distal surviving divisions (about half length) formed of four annuli, each annulus with two rings of chaetotaxy; trichobothria present on the basal and third annuli, long cilia distally on the second and ultimate annulus; hyaline scales present on the basal ring of some annuli.

Coxite VIII in ♂ entire (Fig. 66) with 1+1 combs of 13 macrochaetae, with a cilium at the laterad end, as well as about six marginal setae and several setulae, the posterior margin similar to other urosternites. Coxites IX in ♂ separated each side with a long smooth macrochaeta (about  $\frac{3}{4}$  the length of the internal process) mediad to the base of the stylus. External and internal margins of internal process with many moderately strong setae and macrochaetae. Outer process small triangular with several stout pectinate setae along the outer margin. Penis typical with numerous glandular setae apically, each set on a protuberance. Parameres absent.

**Habitat.** Collected in dry leaf litter on sandy substrate.

**Etymology.** The species is named *albicaudata* for its striking white tail filaments.

### Remarks

The new species has several characters which place it closer to *Hemitelsella* species. It has only a single pair of styli, the internal processes of coxites IX in the female are short and rounded. The processes of coxites IX however lack transverse combs and the setae of the tarsi lack the rounded tips. Furthermore, the bushes on the head are stronger than those of *Hemitelsella* species and more like those in *Acrotelsella* and the anterior trichobothrial areas of the pronotum are like *Acrotelsella* and associated with comb N-3 rather N-2. As mentioned above, this molecular clade including *Acrotelsella*, *Hemitelsella* and *Qantelsella* species needs further investigation.

## *Acrotelsella auricoronata* sp. nov.

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### Figs 67–97

**Holotype** ♀ (HW 1.40) NEW SOUTH WALES: rest area about 15km west of Balranald 34.62276°S 143.40124°E 58m asl, 9.vii.2016, Graeme Smith, bark spray, AMS K.541640 (on two slides). **Paratypes** 1♀ (HW 1.31) same data as holotype, AMS K.541641 (on two slides); 1♀ (HW 1.38) same data as holotype, AMS K.261337 (on two slides); 1♀ (HW 1.25) same data as holotype, AMS K.261338 (on two slides); 1♀ (HW 1.20) same data as holotype, AMS K.541642 (on two slides); 3♀ 1 juvenile ♀ 4 juveniles (HW not recorded), same data as holotype, AMS K.377979 (in alcohol).

**Other material not included in type series.** 1♀ (HW 1.35) NEW SOUTH WALES: Mungo National Park, Garmpang House 33.490°S 143.101°E, 31.viii.2017, John Tann, bark spray, AMS K.377783 (on two slides); 1♀ (HW 1.28) Mungo National Park 33.355°S 143.139°E, 31.viii.2017, John Tann, bark spray, AMS K.377786 (on two slides); 1♀ (HW 1.15) same data as previous, AMS K.377787 (in alcohol); 1♀ (HW 1.10) Mungo National Park SS2 33.6541°S 143.197°E, 28.viii.2017, John Tann, bark spray, AMS K.377791 (in alcohol); 1♀ (HW 1.18) ca 15km south of Balranald 34.76588°S 143.53964°E 72m asl, 23.ix.2013, Graeme Smith, bark spray to flaky bark mallee, K.377984 (in alcohol); 1 juvenile ♀ (HW not recorded), same data as previous K.261261 (on two slides); 1♀ (HW 1.25) QUEENSLAND: ca 2km east of Old Cork Homestead, 22.92163°S 141.91291°E 142m asl, 10.viii.2013, Graeme & Louise Smith, bark spray to rough bark tree, AMS K.377981 (in alcohol); 1 juvenile ♀ (HW 0.90), same data as previous, AMS K.261297 (on two slides); 2 juveniles (HW not recorded), same data as previous, AMS K.377982 (in alcohol); 1 juvenile ♀ (HW 0.83) 1km east of Tambo 24.87411°S 146.25423°E 395m asl, 13.viii.2013, Graeme Smith, bark spray to gidgee, AMS K.261326 (on slide); 1 juvenile ♀ (HW 0.95) 2 juveniles (HW not recorded), same data as previous, AMS K.377983 (in alcohol); 1♀ (HW 1.33) SOUTH AUSTRALIA: Arkaroola, near spring track 30.28783°S 139.34311°E 300m asl, 16.v.2012, Graeme Smith, under bark of paper bark, AMS K.377980 (in alcohol); 1♀ (HW 1.13) VICTORIA: Hattah-Kulkyne N.P. gate in kangaroo fence 34.68028°S 142.34957°E 57m asl, 24.ix.2013, Graeme Smith, bark spray to mallee/Eucalypt, AMS K.377985 (in alcohol); 1♀ (HW 1.13) same data as previous; NMV gbs004034 (in alcohol); 1♀ (HW 1.35) Hattah 34.75319°S 142.26925°E 46m asl, 25.ix.2013, Graeme Smith, bark spray to Eucalypt, AMS K.377986 (in alcohol); 1♀ (HW 1.15) same data as previous, AMS K.261278 (on slide); 1♀ (HW 1.13) Walpeup 35.14048°S 142.01538°E 110m asl, 25.ix.2013, Graeme Smith, bark spray to rough bark mallee, NMV gbs004044 (in alcohol); 1♀ (HW 1.25) Murray-Sunset N.P. start of Mt Crosby track 35.03393°S 141.75685°E 47m asl, 26.ix.2013, Graeme Smith, bark spray to woollybutt mallee, AMS K.377987 (in alcohol); 1♀ (HW 1.10) Wyperfeld N.P. Casuarina campground 35.44543°S 141.99451°E 63m asl, 27.ix.2013, Graeme Smith, bark spray to Casuarina, AMS K.377988 (in alcohol).

**Diagnosis.** This species can easily be distinguished in the field from other described *Acrotelsella* by the ring of golden coloured scales on the frons (Fig. 68). Preserved specimens are distinguished by the trapezoidal shape of the thoracic sterna with the combs restricted to the posterior half of the prosternum and the presence of only 1+1 combs on the mesosternum, by the presence of only three papillae on the last article of the labial palp, the elongate processes of coxites IX of the female, the curved shape of the medial posterior margin of coxites VIII in the female, the presence of a trichobothrium in the most laterad insertion socket of the posterior combs of the nota and from *Acrotelsella escherichi* by the primary type ovipositor (versus secondary).

### Description

**Appearance:** Medium to large silverfish, with narrow body, thorax not much wider than the abdomen which only tapers slightly posteriorly (Fig. 68). Scale pattern when live overall dark grey or mottled when scales are lost, conspicuous circle of golden scales on frons in specimens with little wear and

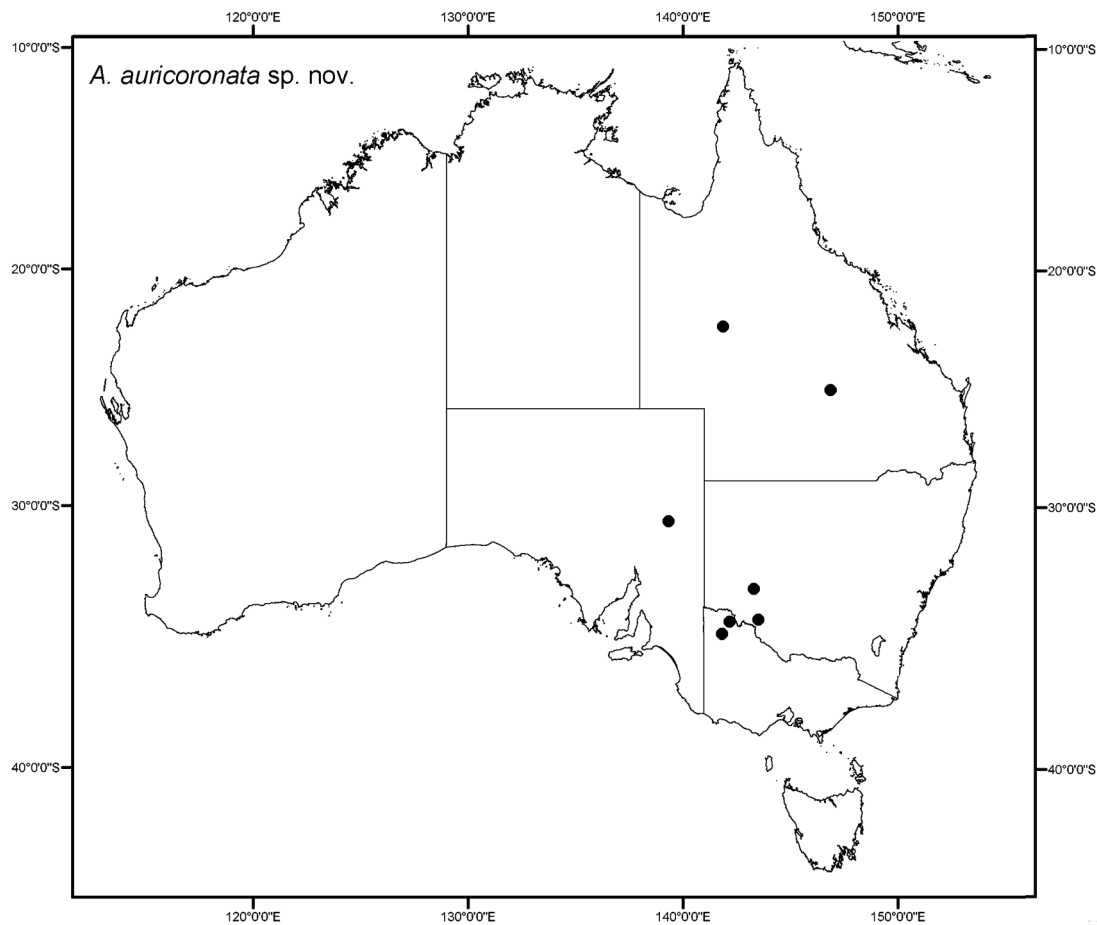


Figure 67. Known distribution of *Acrotelsella auricoronata* sp. nov.

tear and a light margin to urotergite X, legs dark above, antennae distinctly banded especially in basal half, terminal filaments overall dark brown with small lighter regions at the distal end of each division. In alcohol mottled brown.

**Body length:** H+B up to 10.4 mm (♀), HW up to 1.40 mm; thorax: length 2.8 mm or 0.26–0.32 H+B; width 2.2 mm with the pro- and meso-nota being slightly narrower and shorter than the mesonotum; antennae incomplete, maximum preserved length 5.8 mm or >0.6 H+B; terminal filaments all broken, maximum length of cercus 6.8 mm or >0.7 H+B; median dorsal appendage maximum length 7.9 mm (>0.8 H+B).

**Pigmentation:** Antennae distinctly banded, orange-brown pigment in distal half of each interval, annulations becoming less distinct distally as the lighter regions become progressively darker; pigment absent from pedicel and scape. Frons without pigment, even around the eyes, clypeus and frons with strong brown pigment among and below the sublateral groups of macrochaetae, mandibles and maxillae with strong pigment among bushes of macrochaetae, maxillary palp with moderate dark pigment on apical article except lighter at base, penultimate article dark in the distal  $\frac{1}{2}$ – $\frac{3}{4}$ , 2nd and 3rd articles with medium pigment along sides; labial palp ultimate article with light to strong pigment around the margins, penultimate article with light to strong pigment on sides, strongest distally, 2nd article with dark patch of pigment on inner apical corner and sometimes a little around the whole distal region. Nota and thoracic sterna without obvious pigment. Precoxa of legs sometimes with blotchy brown pigment but sometimes without, coxae with some

pigment in the antero-lateral “shoulders” weakly extending along outer margin but sometimes very faint or absent. Trochanter with patch of dark pigment along outer margin especially distally. Femora with dark patch over posterior bulge and distally on outer margin. Tibia with dark pigment distally on outer half. Tarsi with some blotchy pigment on all articles the basal article with quite dark patch. Abdominal segments without obvious pigment except for light pigment over urotergite X except along its margins. Styli with light orange-brown pigment. Ovipositor largely without pigment except for a light scattering of pigment distally. Cerci and median filament distinctly banded in K.377783 with only the basal and distal annuli of each division lacking pigment, K.377786 and holotype almost completely dark except for lighter pigment around distal macrochaetae of each division.

**Macrochaetae:** Variable, pectinate but not strongly so, some smooth (Figs 69–71), hyaline to dark brown.

**Scales:** With numerous sub-parallel ribs that do not surpass the margin of the scale (Fig. 72), those dorsal are brown, those ventral hyaline. Scales found on top of head, on scape, on second and third articles of maxillary palp, all nota, all thoracic sterna, legs (except for trochanter and distal three articles of tarsi), all urotergites and urosternites, styli IX, medial filament and cerci.

**Head:** (Fig. 73) wider than long, with 1+1 moderately dense bushes of macrochaetae aligned in subparallel rows on the antero-lateral corners. Eyes dark brown in alcohol preserved material. There is a small gap in the row of macrochaetae along the margin above the antennal bases after which there is another bush of pectinate macrochaetae,



Figure 68. *Acrotelsella auricoronata* sp. nov., Balranald, NSW.

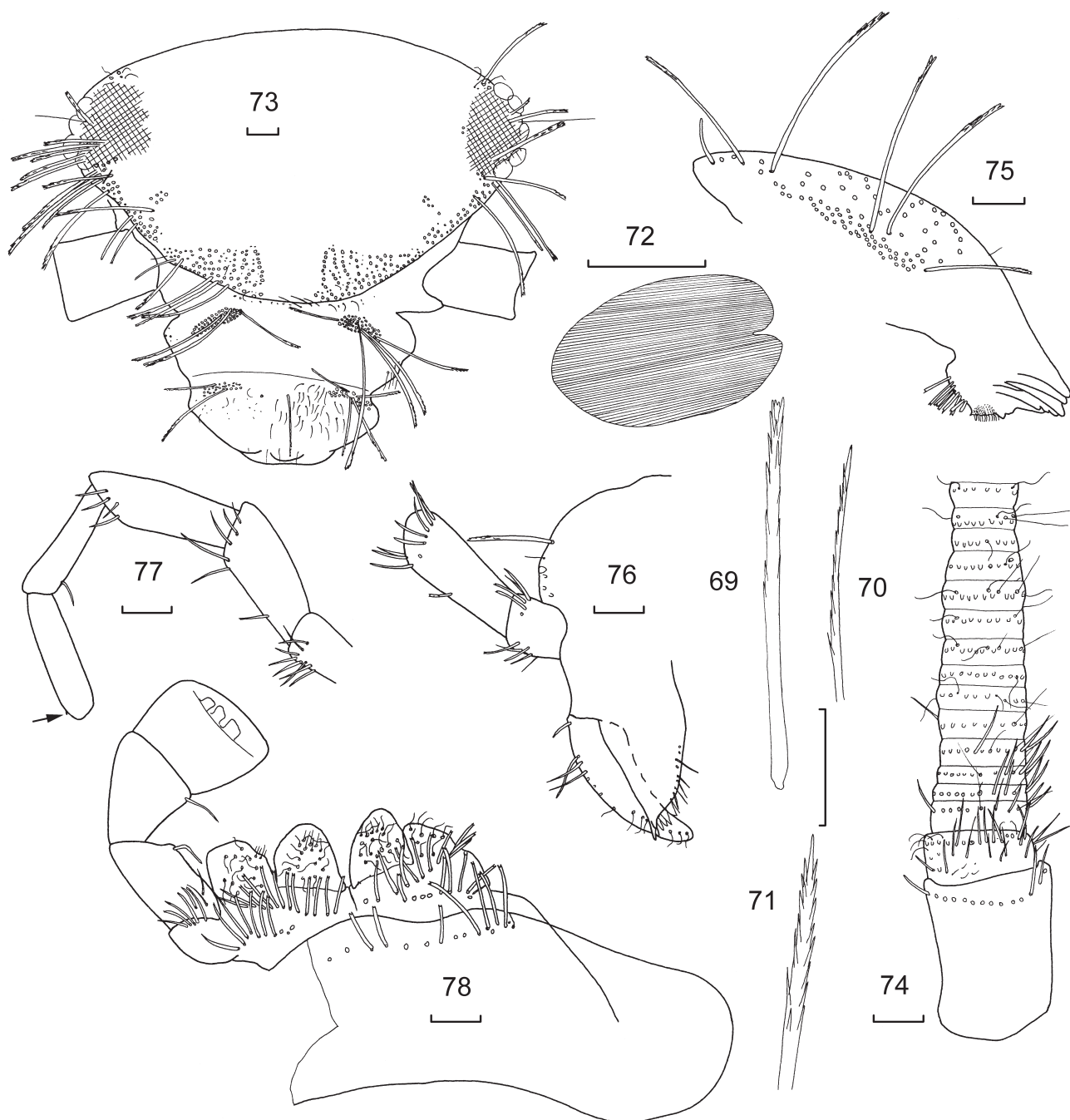
three or four macrochaetae wide extending along the sides and above the eye; the peri-antennal group is small, of only five to six sockets, but more or less isolated by a small gap from the marginal chaetotaxy. Clypeus with 1+1 very dense bushes of strongly pectinate macrochaetae as well as a few curved setae. Labrum also with 1+1 distinct but less dense bushes of pectinate macrochaetae as well as two or three longer thin setae between the groups. — Antennae fairly long, scape (Fig. 74) quite long with scales over surface laterally and a preapical ring of numerous setae; pedicel with preapical ring of simple setae and cilia as well as setae scattered over face; all subsequent annuli of flagellum similar with single ring of simple setae, cilia and trichobothria; obvious subdivision into annuli and intervals is very difficult to interpret in all dissected specimens. Distal intervals insufficiently preserved. — Mandibles (Fig. 75) typical for *Acrotelsella* with well-developed molar and incisor areas; a group of about ten stout apically bifurcated but simple setae distally adjacent to the pectinate molar area and a bush of about 90 pectinate macrochaetae externally. — Maxilla (Fig. 76) with two thick minutely apically bifurcated and faintly pectinate macrochaetae externally proximal to the palp, the lacinia with three strong teeth, one set further back than the other two, followed by several lamellate processes and a row of ten thin simple setae, those nearest the lamellate processes only slightly smaller than the others, galea slightly longer than lacinia with about six strong, smooth, simple or apically bifurcate setae externally in its basal half and several cilia distally; maxillary palp not very long and thin, apical article

(Fig. 77) four times longer than wide (range 3.9–4.6) and 1.3 times as long as the penultimate article (range 1.0–1.5), and 0.9 times as long as the third and longest article, the ultimate article possibly with a very small sausage-shaped sensilla subapically (thin-walled basiconic sensillum type C), basal article with a field of strong setae, second and third articles with subapical ring of slightly stronger setae subdistally, penultimate article with one stronger seta. — Labium (Fig. 78) short and broad, postmentum with transverse row of apically bifurcate setae, prementum with transverse and oblique rows of short strong mostly apically bifurcated setae, apically with long curved cilia and setulae; labial palp short, apical article expanded subrectangular, a little shorter than long (0.82–1.06) with row of only three papillae of compact type arranged in a single row near the outer margin, no other sensilla seen, covered with numerous fine setae as well as longer fine setae.

*Thorax*: Pronotum (Fig. 79) with setal collar about one to three pectinate macrochaetae wide, without gap medially; lateral margins with strong, only vaguely pectinate setae along the margin, with eight combs of one to three pectinate macrochaetae along each margin. Two open trichobothrial areas; the anterior trichobothrial area (Fig. 80) located 0.34–0.42 along the margin associated with comb N-3, the comb composed of only a single macrochaeta with the trichobothrium between the macrochaeta and the margin and a cilium at the mediad side of the macrochaeta; the posterior trichobothrial area (Fig. 81) is located 0.77 of the distance along the margin (range 0.75–0.81) and is associated with the last comb (N), this comb composed of just a single macrochaeta with the trichobothrium at the mediad end and a cilium at the laterad end; all combs associated with a few setulae. Posterior margin of all nota with 1+1 combs of 3–5 macrochaetae and a long trichobothrium-like hair in the insertion at the lateral end and contiguous with the comb of macrochaetae, with a cilium at each end of the comb and a few setae between the comb and the margin (Fig. 82). Gap between the posterior combs 50–55% of the width of the pronotum. — Mesonotum (Fig. 83) with lateral chaetotaxy similar to pronotum with 9–10 combs of 1–3 macrochaetae each associated with a few setulae and a cilium, the anterior trichobothrial area located 0.65 along the lateral margin associated with comb N-2 composed of a single macrochaeta with the trichobothrium located between the macrochaeta and the margin. Posterior trichobothrial area located 0.87 along the margin, the trichobothrium located mediad to the comb of a single macrochaeta. — Metanotum (Fig. 84) similar to mesonotum with 8–10 combs of 1–3 macrochaetae, the anterior trichobothrial area is located 0.76 the distance along the margin associated with comb N-1 (rarely N-2) which has just a single macrochaeta, the posterior trichobothrial area associated with the most posterior comb 0.88 along the margin.

Presternum with transverse row of setae (Fig. 85). — Prothoracic sternum (Fig. 85) large, reaching to about  $\frac{2}{3}$  the length of the coxa, 0.93 times as long as wide at its base (range 0.87–1.02), trapezoidal with concave posterior margin, antero-lateral corners with about 12 simple but robust marginal setae, posterior  $\frac{1}{3}$  to  $\frac{1}{2}$  of lateral margins with marginal setae, posterior margin glabrous; each side with 3–4 short combs of 1–5 pectinate macrochaetae not much longer than the marginal setae. — Mesosternum (Fig. 86) a little larger than prosternum (1.2 times as long), 0.93

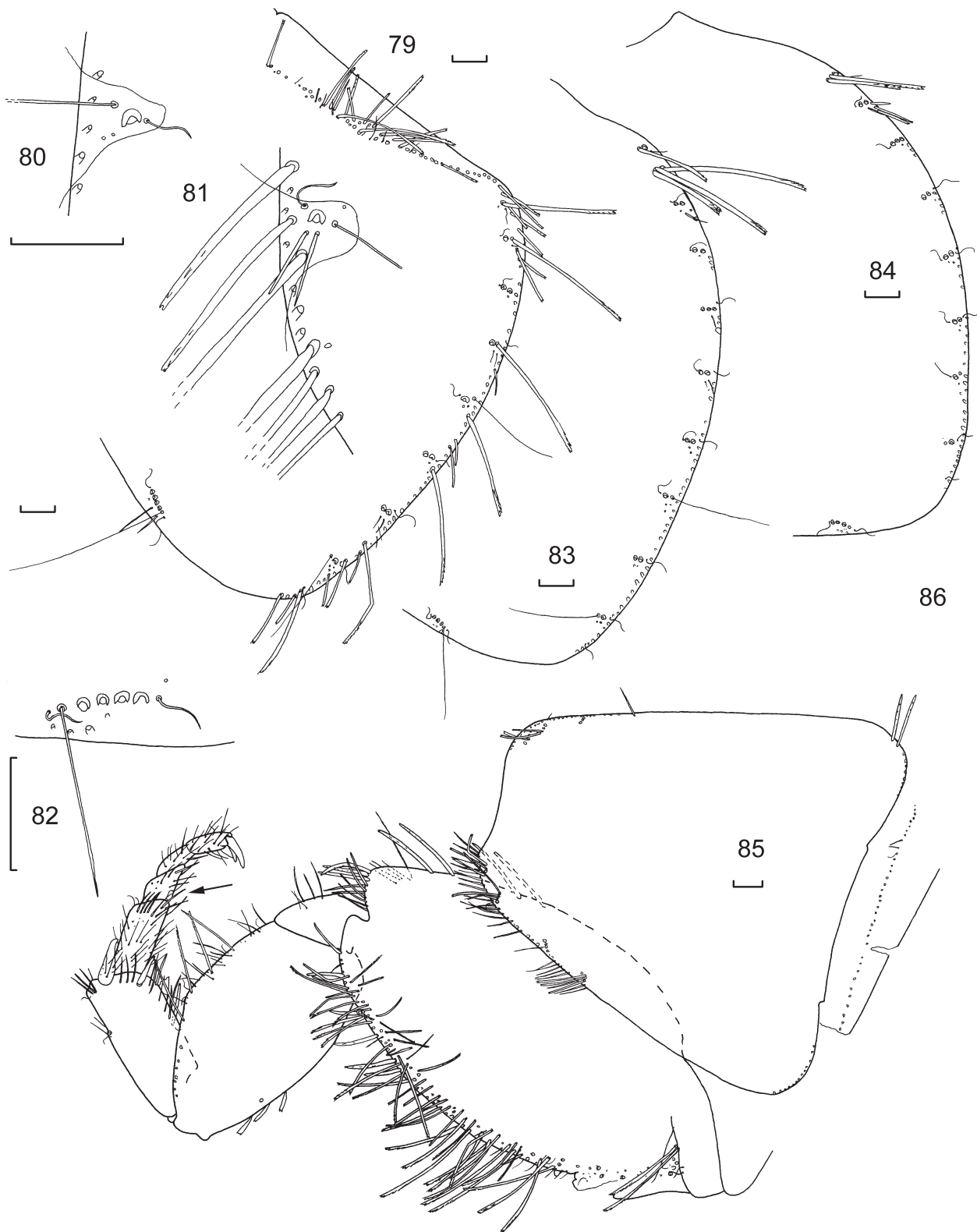




**Figures 69–78.** *Acrotelsella auricoronata* sp. nov. holotype ♀ (69) long pectinate macrochaeta of side of head; (70) finely pectinate macrochaeta of anal region; (71) pectinate macrochaeta of cerci; (72) darker dorsal scale; (73) head (cross-hatched area obscured by eye pigment); (74) antenna, scape, pedicel and basal intervals of flagellum; (75) mandible; (76) maxilla and part of palp; (77) maxillary palp, arrow showing location of basiconic sensillum; (78) labium (left side of submentum damaged, right palp missing). Scale bars = 0.1 mm.

times as long as wide at its base (range 0.84–0.94), with a few fine setae in the anterolateral corners and long, thin simple marginal setae only in the postero-lateral corners near the 1+1, 1+2 or 2+2 combs close together, whose 1–6 pectinate macrochaetae are generally shorter than the smooth marginal setae. — Metasternum (Fig. 87) of similar length and shape to prosternum but much wider (about 1.3 times wider than long (L/W range 0.71–0.79) with 0–1 strong setae in anterior corners and long marginal setae adjacent to 1+1 combs only, these setae can be longer than the macrochaetae of the combs, combs of 2–5 pectinate macrochaetae.

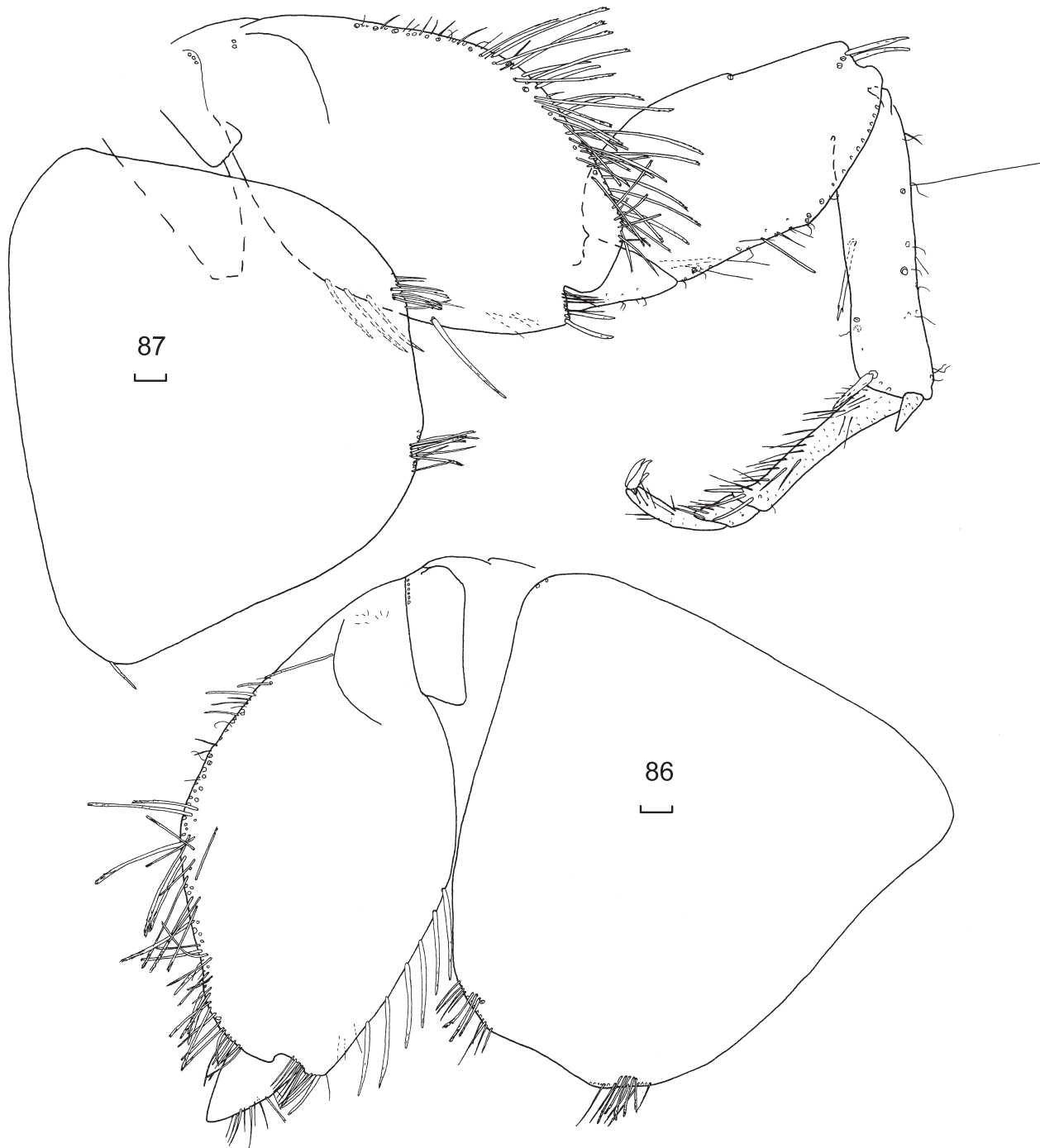
Legs strong, tibia L/W ratio of legs PI 2.6 (range 2.4–2.9), PII 3.0 (range 2.9–3.1), PIII 4.0 (range 3.6–4.2); tarsi L/W ratio PI 5.7 (range 4.8–6.6), PII 7.2 (range 6.5–7.9), PIII 8.5 (range 7.7–10.1). PI (Fig. 85) with a row of six macrochaetae laterally on the margin of the precoxa. Coxa with scales and a group of about seven macrochaetae on the anterolateral corners followed by a field of strong pectinate macrochaetae along the external margin about 2–3 macrochaetae wide; inner margin with a four or five long lightly pectinate macrochaetae and about ten setae of varying thickness distally over the articulation and along the distal margin. Trochanter with a few long setae. Femur posteriorly with about five long but



**Figures 79–85.** *Acrotelsella auricoronata* sp. nov. holotype ♀ (79) pronotum, right half; (80) idem, left anterior trichobothrial area (with fine line delineating extent of scale coverage); (81) idem, left posterior trichobothrial area; (82) idem, left posterior comb; (83) mesonotum; (84) metanotum; (85) part of presternum, prothoracic sternum and PI (arrow indicates position of raised oval region). Scale bars = 0.1 mm.

not thick, pectinate macrochaetae, in addition to simple setae along the margin and just a single macrochaeta on the dorsal or anterior margin. Tibia of PI quite short with just two carrot-shaped, slightly pectinate macrochaetae along the posterior margin (one near each end of the margin) as well as several

longer, thinner, pectinate or smooth setae and a row of shorter setae near the distal margin; anterior margin with one or two macrochaetae as well as 3–4 subdistal macrochaetae over the articulation; apex of tibia with robust apical spur which is covered in numerous setae. Tarsi with four articles, the basal



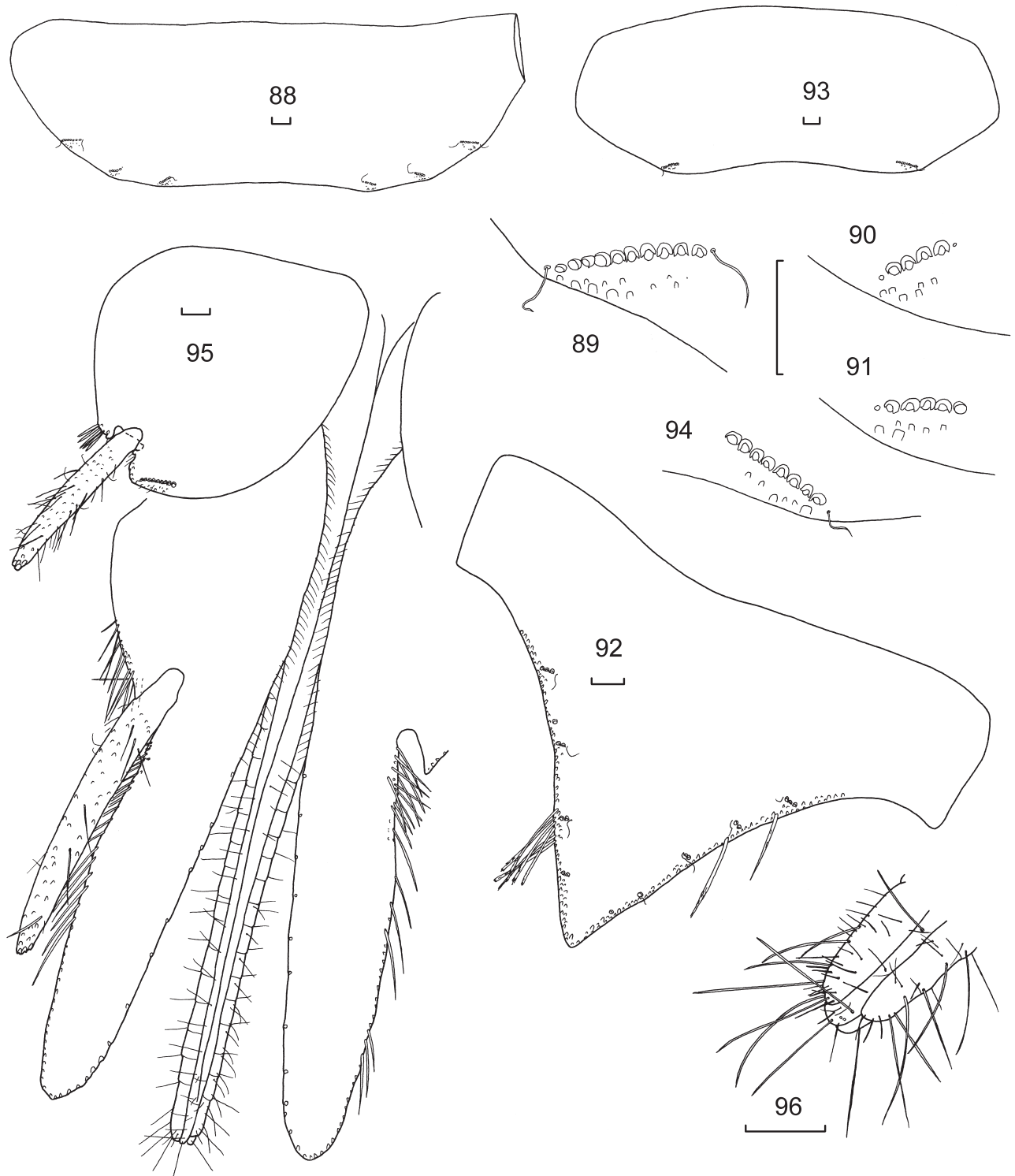
**Figures 86–87.** *Acrotelsella auricoronata* sp. nov. holotype ♀ (86) mesothoracic sternum and coxae of PII; (87) metathoracic sternum and PIII. Scale bars = 0.1 mm.

article of PI about half the total length of the tarsus, its join with the next article not particularly oblique, the surface of all tarsal articles with numerous simple setae, the second article on both PI legs appearing to have a raised oval area basally (sensilla?). Pretarsus with two long curved lateral claws and a shorter curved medial claw. PII and PIII (Fig. 87) similar to PI except the antero-lateral groups of macrochaetae on the coxa reduced to a single macrochaeta on PII, with six strong macrochaetae on the internal margin of the coxa of PII; legs progressively longer from PI to PIII and the relative length of the basal tarsal article is progressively longer, being about two thirds of the total length on PIII. Tibia of PIII with long thin trichobothrium-like seta about 40% along the outer side, twice as long as tibia is wide; second article

of tarsi without raised oval area.

**Abdomen:** Urotergite I with 1+1 lateral combs of 5–6 macrochaetae each associated with a cilium at either end and several setulae between the comb and the margin, urotergites II–VII with 3+3 combs of macrochaetae as in Table 5 (Figs 88–91), urotergite VIII with 2+2 combs (lacking the sublateral), urotergite IX glabrous; all combs usually with a cilium at either end and a similar or slightly larger number of setulae as macrochaetae between the comb and the margin. — Urotergite X (Fig. 92) equilaterally triangular (56–68°), wider at base than long (L/W 0.49–0.64) with many pectinate setae along entire margin both above and below, and (4–5)+(4–6) combs of 1–4 macrochaetae per comb (all lost) without obvious setulae posterior to each comb, and





**Figures 88–96.** *Acrotelsella auricoronata* sp. nov. holotype ♀ (88) urotergite V; (89) urotergite VII, left lateral comb; (90) idem, left sublateral comb; (91) idem, left submedial comb; (92) urotergite X; (93) urosternite V; (94) urosternite VII, left sublateral comb; (95) coxites VIII and IX with ovipositor; (96) apex of gonapophyses. Scale bars = 0.1 mm.

most combs with a cilium at the mediad end.

Urosternite I and II glabrous, urosternites III–VII with 1+1 sublateral combs of 5–11 pectinate macrochaetae (Figs 93, 94) each with 4–8 setae or setulae between the comb and the margin as well as a cilium at the laterad end of each comb only. The distance between the lateral combs 7.4–21.2 times the average width of these combs, the ratio being largest on urosternite III and decreasing posteriorly.

Genital region of ♀ as in Figure 95. Two pairs of styli.

Coxites VIII with combs of 8–9 macrochaetae and a similar number of setulae between the comb and the margin, the coxites with rounded inner corners. Coxites IX with long rounded internal process, about 2.8–4.7 times longer than wide at its base and about 7–10 times longer than the short pointed external process, the inner processes reaching to the apex of the ovipositor; outer process with setulae along the inner margin and several strong finely pectinate setae externally, inner process with numerous long finely pectinate

**Table 5.** Number of macrochaetae per bristle comb —*Acrotelsella auricoronata* sp. nov.

Segment	urotergite			urosternite
	lateral	sublateral	submedial	
I	5–6	—	—	—
II	5–6	4	3–5	—
III	5–7	4–5	4–5	0–6
IV	6–9	4–5	4–5	6–8
V	7–9	4–5	4–5	6–8
VI	8–9	4–5	4–6	6–9
VII	7–10	4–5	4–6	7–11
VIII	8–10	—	4–6	8–9
IX	—	—	—	8–9

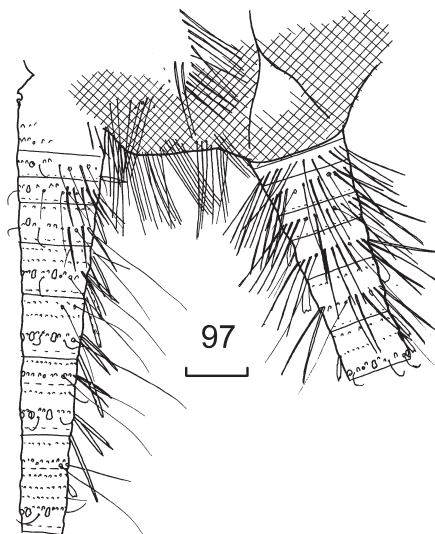
macrochaetae along the outer margins as well as many scales, inner margin of process with setae insertions and many small setae basally. — Ovipositor (Figs 95, 96) not very long, (1.9 HW range 1.7–2.2), only just surpassing the apex of the long internal processes of coxites IX, about 25–30 divisions in total; of primary type with long and fine short setae only.

Cerci (Fig. 97) first division with two partial rings of small setae, following two basal divisions shorter than wide with a single ring of small setae, cilia and several trichobothria, division four with two rings, the most basal of probably of scales only, the more distal of trichobothria, stronger setae, cilia and small macrochaetae; divisions five and six with three rings, the most basal of scales and trichobothria, the middle with scales only and the most distal as on the previous division; division seven with four rings, the most basal and third rings of scales with perhaps some trichobothria, the second of setae, trichobothria and cilia but smaller than those of the most distal ring; division eight with six rings with the basal, third, fourth and fifth of scales and perhaps some trichobothria, the second with stronger seta, trichobothria and some macrochaetae, the most distal with strong macrochaetae, cilia and setae, possibly without trichobothria. — Median dorsal appendage (Fig. 97), first division short and glabrous, following three divisions each with single ring of setae and trichobothria, fifth and sixth divisions each with two rings, the most basal of scales only, the more distal of long setae trichobothria and cilia, seventh division with three rings of which the middle ring is scales only, the basal of setae and scales, the most distal of macrochaetae, stronger setae, cilia and trichobothria.

*Male:* Unknown.

*Juveniles:* K.261261 juv. ♀ of unrecorded head width. Ovipositor not developed, still with two pair of styli, inner processes not elongated (ca. 1.5 L/W), fewer combs on lateral nota, fewer macrochaetae per comb of abdomen, urotergite X not as long (L/W 0.40) and less acute (95°) but no other difference could be distinguished but the trapezoidal thoracic sterna with combs only in the posterior half of the prosternum. — K.261297 juvenile ♀ (HW 0.90) ovipositor just starting, inner processes of coxite IX beginning to elongate (L/W 2.0). — K.261326 juvenile ♀ (HW 0.83), ovipositor not developed, thoracic sternites with same comb arrangement but posterior margin not concave, perhaps even slightly convex but still wide.

**Habitat.** Although a total of 34 specimens have been collected during 15 collection events over four states,



**Figure 97.** *Acrotelsella auricoronata* sp. nov. holotype ♀ (97) base of cerci and medial filament. Scale bars = 0.1 mm.

surprisingly no males have yet been collected. Specimens have been collected from bark of a variety of trees including *Eucalyptus*, *Allocasuarina* and *Melaleuca* (paperbark).

**Etymology.** The species is named *auricoronata*, referring to the “crown” of golden scales on the frons.

### Remarks

The species appears to be close to *Acrotelsella escherichi* from Kangaroo Island (and reportedly Central Australia) which also has trapezoidal thoracic sternites. It differs from Womersley’s illustrated species by the reduced number of papillae in the labial palps (three versus 11), the absence of thicker spines on the apical articles of the ovipositor, the long processes of coxites IX which surpass the apex of the styli by about half the length of the stylus, and the shape of the internal process of coxites VIII which is broadly curved in the new species but somewhat rounded acute in *A. escherichi*.

The trapezoidal shape of the thoracic sternites may however be less phylogenetically relevant if the molecular data to hand is to be believed. This data seems to separate the *Acrotelsella sensu lato* species into two branches, one of which appears to have secondary type of ovipositor and the other with a simple primary type.

*Acrotelsella giubana* from Somalia and *A. procedens* Silvestri *sensu* Mendes, 1989 from Sri Lanka and Thailand, seem to be the closest species based on morphology as they both also have trapezoidal sternites and a primary type ovipositor. *Acrotelsella auricoronata* differs from *A. giubana* in having 25–30 divisions in the ovipositor versus 20–21, a less pointed urotergite X (56–69° versus 50°), longer posterior combs on the nota (3–5 versus 2 macrochaetae) and stronger bushes on the frons.

*Acrotelsella procedens* differs from both in having five labial papillae and a much smaller gap between the urosternal combs relative to the average length of their combs. Mendes (1989) comments that this species is quite variable. However, given the understanding now emerging with the Australian fauna, where molecular data is available to aid in species delimitation, it is quite likely that the three described populations of *A. procedens* probably represent distinct but related species.

*Acrotelsella thommoi* sp. nov.

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Figs 98–123

**Holotype** ♀ (HW 1.45) NEW SOUTH WALES: ca 55km northwest of Nyngan 31.14635°S 146.8123°E 251m asl, 7.iv.2011, Graeme Smith, in accumulated bark/termite dirt in fork at base of Eucalypt; also under bark at very base, AMS K.541636 (on two slides). **Paratypes** 1♂ (HW 1.50), same data as holotype, AMS K.541637 (on two slides); 1♂ (HW 1.43), same data as holotype, AMS K.377973) (in alcohol).

**Other material examined but not included in type series.** 1♂ (HW 1.29) VICTORIA: Hattah-Kulkyne N.P. 34.62633°S 142.37472°E 75m asl, 24.ix.2013, Graeme Smith, top of dune in loose strips of bark caught in fork of Eucalyptus, NMV gbs004035 (on two slides); 1♀ (HW 1.25) Hattah-Kulkyne N.P. 34.62636°S 142.37486°E 71m asl, 24.ix.2013, Graeme Smith, bark spray to loose strips of bark caught in fork of *Eucalyptus*, NMV gbs004036 (on two slides).

**Diagnosis.** This species can be distinguished from other described *Acrotelsella* with a primary type ovipositor and a rounded or slightly pointed subtriangular prothoracic sternum by a combination of several characters including the presence of three papillae in a straight line, by the presence of only a single macrochaeta mediad of the anterior trichobothrium on the meso- and metanota, by the quite rounded posterior margin of coxites VIII in the female (the curved region occupying  $\frac{2}{3}$ – $\frac{7}{8}$  of the margin versus less than half in other Australian species but possibly about the same as in *A. wygodzinskyi* Hazra, 1980 from India and *A.*

*giubana* from Somalia), by the larger number of divisions in the ovipositor (25–31 versus less than 25 in all other described species).

**Description**

**Appearance:** Medium to large silverfish, with narrow body, thorax slightly wider than the abdomen which only tapers slightly posteriorly. Scale pattern when live mottled grey, with light brown macrochaetae (Fig. 99); in alcohol mottled brown. Eyes dark chestnut, thorax and abdomen dorsally fairly evenly covered in brown scales.

**Body length:** H+B up to 11.3 mm, HW 2.4 mm; thorax: length 3.5 mm or 0.29–0.35 H+B; width 2.4 mm with the mesonotum being slightly wider than the pronotum and metanotum. Antennae when complete up to about H+B; terminal filaments maximum length seen of 0.87 H+B.

**Pigmentation:** Flagellum of antennae without annulations, light brown pigment evenly distributed; scape and pedicel without pigment. Head with slight pigment behind the eyes, ultimate article of maxillary palp with light pigment at each end, moderate brown pigment on other four articles, mostly along the sides and above (not below); labial palp with similar moderate pigment on articles 2–3, ultimate article with pigment only along proximal margins. Notae and thoracic sterna without obvious pigment. Coxae of legs with light pigment along the outer margin. Trochanter with slight pigment in distal corner adjacent to femur. Femora with small pigment region over posterior bulge extending

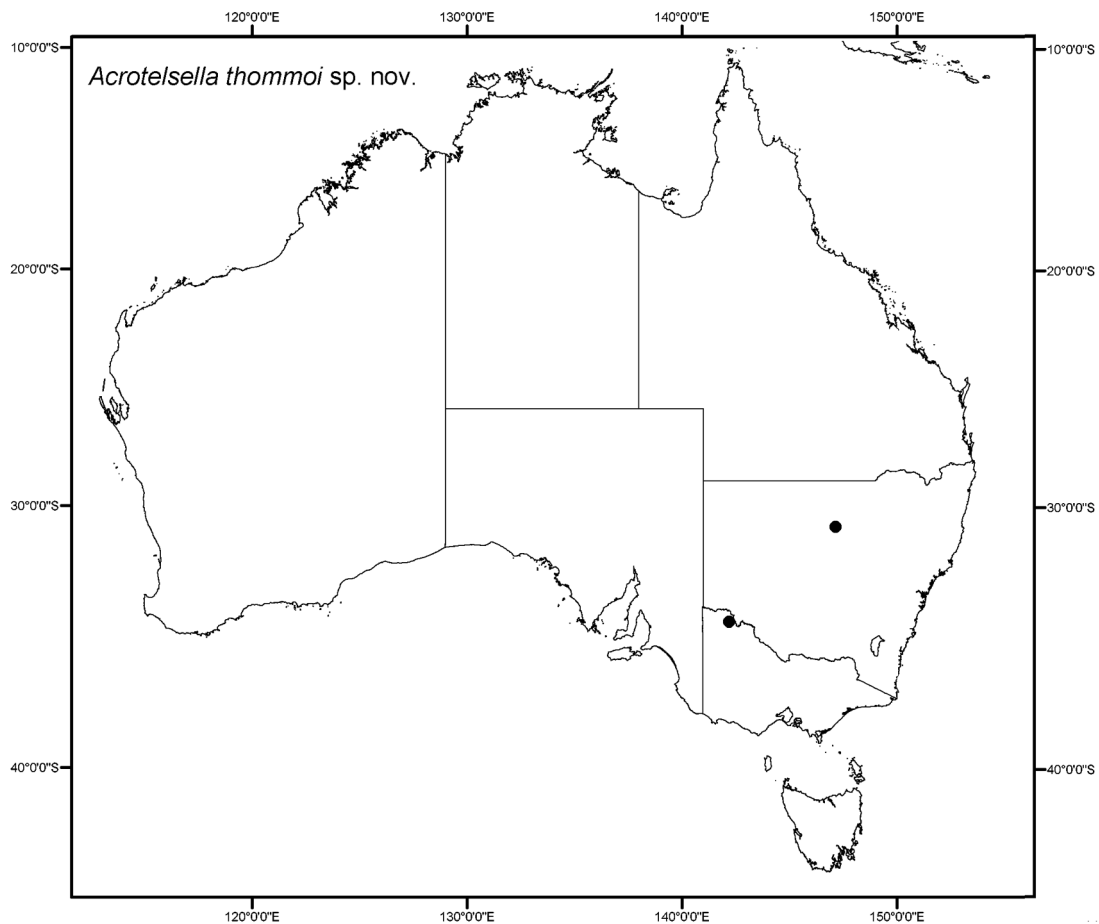


Figure 98. Known distribution of *Acrotelsella thommoi* sp. nov.





**Figure 99.** *Acrotelsella thommoi* sp. nov., Nyngan.

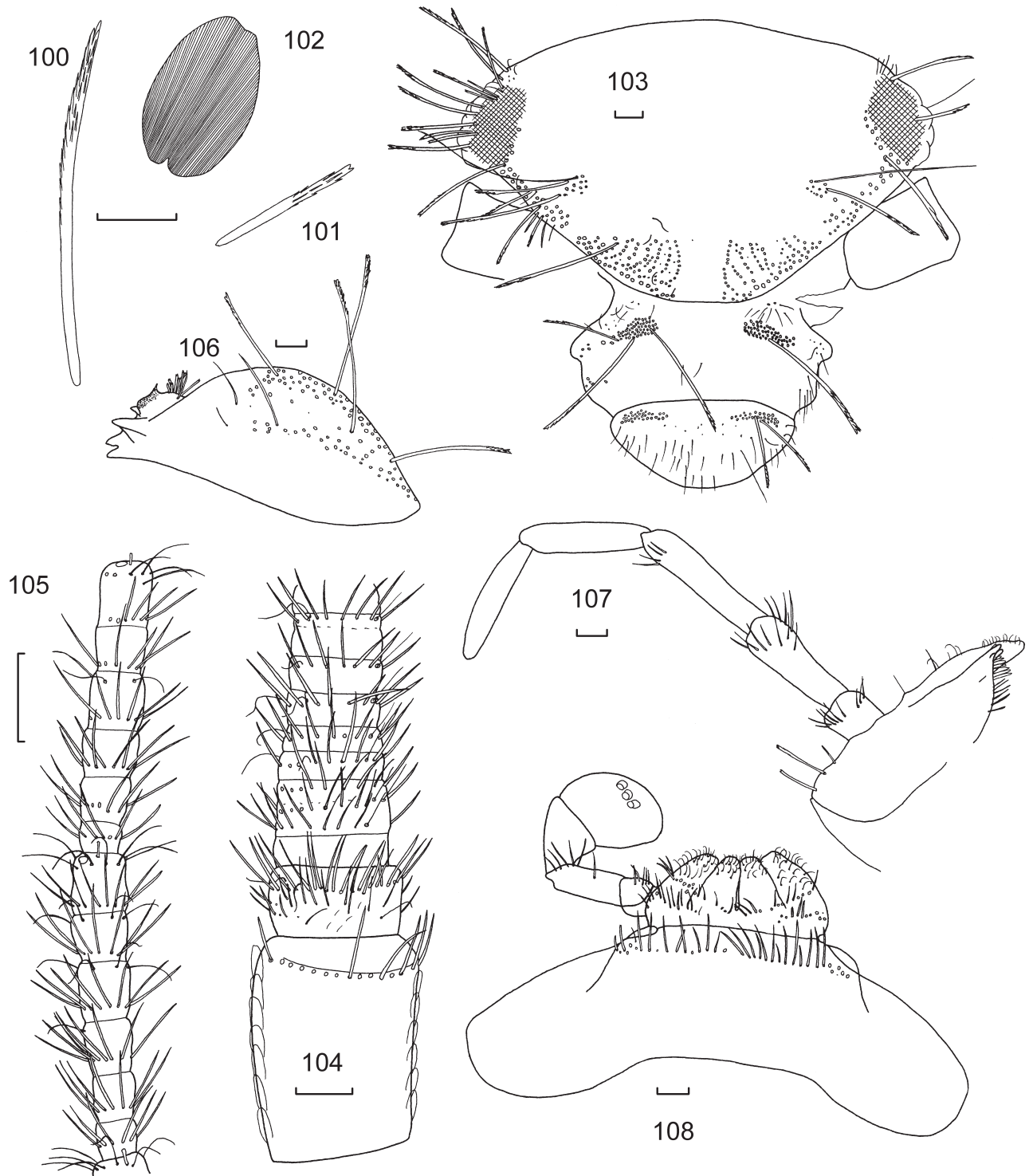
to the joint with the tibia as well as on the leading edge adjacent to the distal comb. Tibia dark along dorsal margin especially distally but at least some of this is due to scales. First tarsal article dark with pigment and scales, remaining articles without pigment. Abdominal segments without obvious pigment except for pigment on coxites IX adjacent to the styli. Ovipositor largely without pigment. Cerci and median filament with medium brown pigment overall, except for the distal most annulus of each division bearing the large macrochaetae which is light in colour, this lighter area can be less prominent in some individuals. Abdominal styli with light pigment.

**Macrochaetae:** Variable, the major macrochaetae of the combs with strong pectinations (Fig. 100) while those of the larger slightly submarginal macrochaetae have more delicate pectinations, less numerous apically (Fig. 101) or smooth, straw coloured.

**Scales:** Variable in shape, with numerous sub-parallel ribs that do not surpass the margin of the scale (Fig. 102), those dorsal are brown, those ventral hyaline. Scales found on top of head, on scape, on second and third articles of maxillary palp, on mentum of labium, all nota, all thoracic sterna, legs (except for trochanter and distal three articles of tarsi), all urotergites and urosternites, styli IX, medial filament and cerci.

**Head:** (Fig. 103) wider than long, with 1+1 bushes of macrochaetae aligned in subparallel rows on the anterolateral corners. Eyes dark brown in alcohol preserved material. There is a small gap in the row of macrochaetae along the margin above the antennal bases behind which is another row of macrochaetae two macrochaetae wide which extends to and above the eyes; the peri-antennal group is almost connected with the lateral rows. Clypeus with 1+1 very dense bushes of strongly pectinate macrochaetae as well as a few setae laterally. Labrum also with 1+1 dense bushes of pectinate macrochaetae as well as many simple setae, some longer than others. — Antennae fairly long, scape

(Fig. 104) quite long with scales over surface and a preapical ring of numerous setae; pedicel with preapical ring of strong simple setae and cilia as well as smaller setae on the dorsal face and some scattered over face; first annulus/interval of flagellum glabrous; next annulus in holotype apparently with three rings of simple setae each with a trichobothrium which probably represent annuli in the process of dividing; subsequent four intervals with single ring of setae and cilia and a short trichobothrium per annulus; following interval divided into two with the basal annulus glabrous and the next of setae, cilia and a trichobothrium. By one quarter the length of the antennae there are four annuli per interval and by mid antenna eight per interval. Distally it is difficult to decide how many annuli per interval as the trichobothria do not appear to be present. There is a repeating pattern of six annuli (Fig. 105) with the most distal annulus having at least one long basiconic sensilla type B and probably also a campaniform sensilla. — Mandibles (Fig. 106) typical for *Acrotelsella* with prominent molar and large incisor areas; a group of about nine strong apically bifurcated but simple setae distally adjacent to the pectinate molar area and a bush of extremely numerous and densely packed pectinate macrochaetae externally as well as scattered simple setae. — Maxilla (Fig. 107) with two thicker and one smaller, smooth or slightly pectinate macrochaeta externally proximal to the palp, the lacinia with four strong teeth, one set further back than the other three, followed by seven lamellate processes and a row of six smooth apically bifurcate setae, galea longer than the lacinia with just two somewhat stronger, smooth, simple or apically bifurcate setae externally in its basal half and several cilia distally; maxillary palp long and thin, apical article 3.6–6.1 times longer than wide and 0.93–1.07 times as long as the penultimate article which is almost as long as the third and longest article, the ultimate article apparently only with basiconic sensilla (type B); last two articles of palp with fine setae only, third article with scales and thin setae as well as a few slightly stronger setae

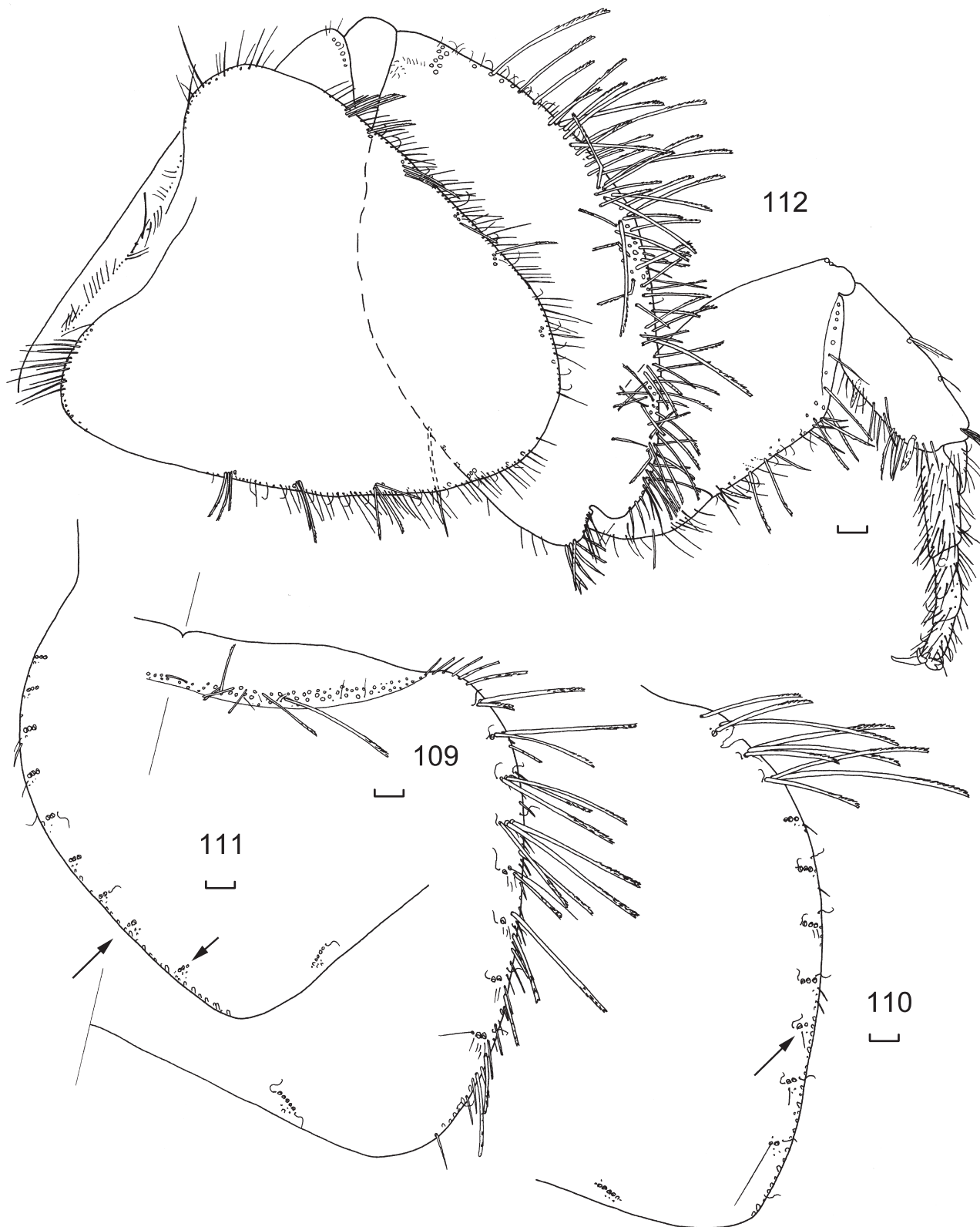


**Figures 100–108.** *Acrotelsella thommoi* sp. nov. holotype ♀ (100) long pectinate macrochaeta of clypeus; (101) finely pectinate marginal macrochaeta of pronotum; (102) darker dorsal scale of mesonotum; (103) head (cross-hatched area obscured by eye pigment); (104) antenna, scape, pedicel and basal intervals of flagellum; (105) idem, most distal surviving complete interval; (106) mandible; (107) maxilla; (108) labium. Scale bars = 0.1 mm.

subapically, first and second articles with subapical ring of slightly thicker setae, the ring incomplete on the basal article, second article also with scales. — Labium (Fig. 108) short and broad, postmentum with transverse row of simple and truncate apically bifurcate macrochaetae, prementum with transverse and oblique rows of short strong apically bifurcated setae, apically with curved setulae; labial palp with the second article with several strong setae; apical article

expanded medially, a little shorter than long (0.79–1.04) with row of three papillae of compact type arranged in a single row near the outer margin, with one or two rod-like basiconic sensillum (type B) near the outer margin, covered with numerous fine setae as well as longer fine setae.

*Thorax:* Pronotum (Fig. 109) with setal collar about three macrochaetae wide, with the macrochaetae in the medial region smaller and sparser than those laterally; lateral

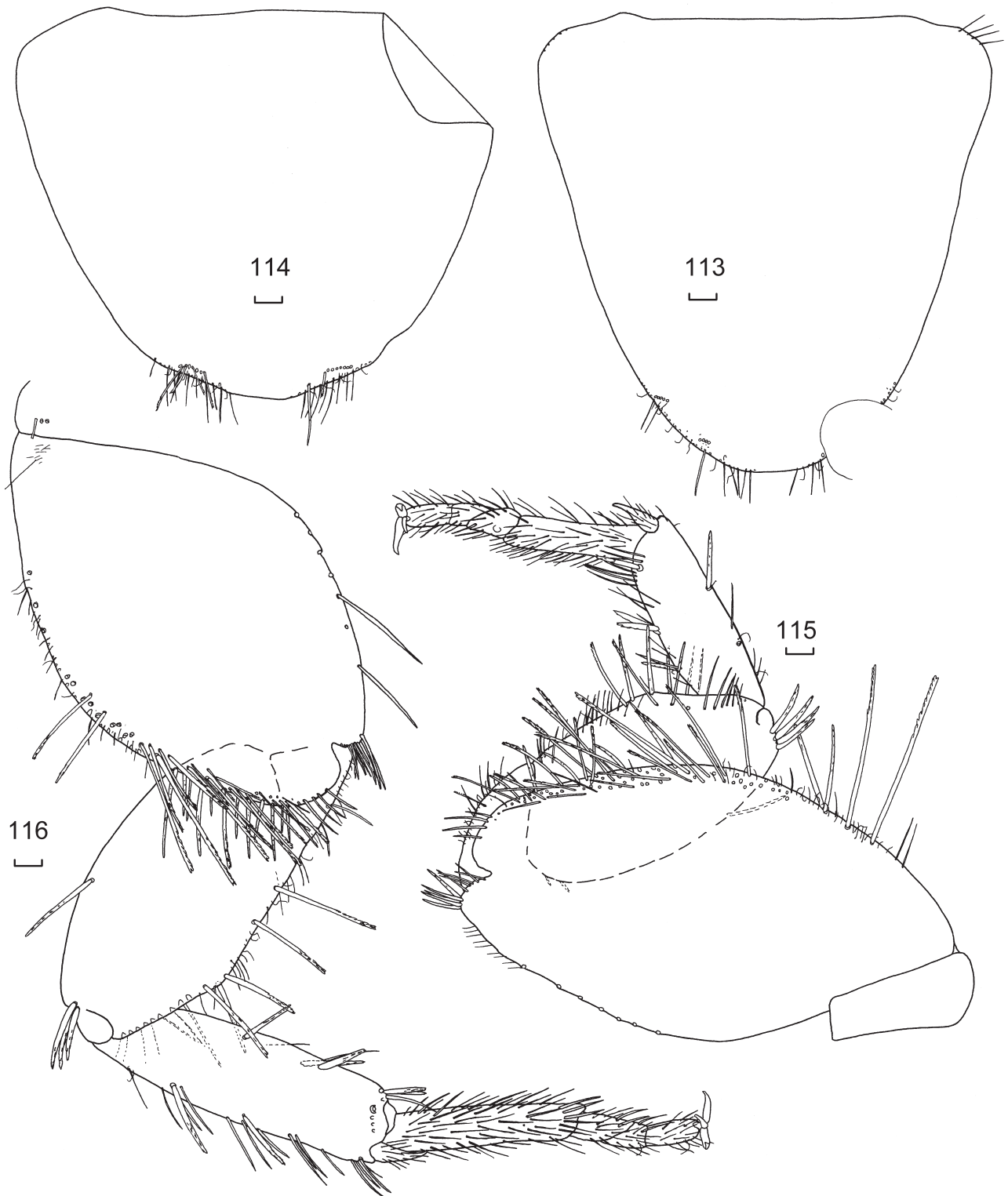


**Figures 109–112.** *Acrotelsella thommoi* sp. nov. holotype ♀ (109) pronotum, right side; (110) mesonotum, right side with anterior trichobothrial area indicated; (111) metanotum with trichobothria indicated; (112) presternum, prothoracic sternum and PI. Scale bars = 0.1 mm.

margins with a few smaller finely pectinate setae along the margin, as well as larger slightly submarginal macrochaetae also with subtle pectinations, usually located near to but not quite in line with the lateral combs, with 8–9 combs of one to three strongly pectinate macrochaetae along each margin. Two open trichobothrial areas; the anterior trichobothrial area about 0.34–0.39 of the distance along the margin, associated

with comb N-3, the trichobothrium being placed between the single macrochaeta of the comb and the margin; posterior trichobothrial area is located about 0.70–0.75 of the distance along the margin and is associated with the last comb which is composed of two macrochaetae with the short trichobothrium at the mediad end and a cilium at the laterad end, all combs associated with a several setulae. Posterior margin with 1+1

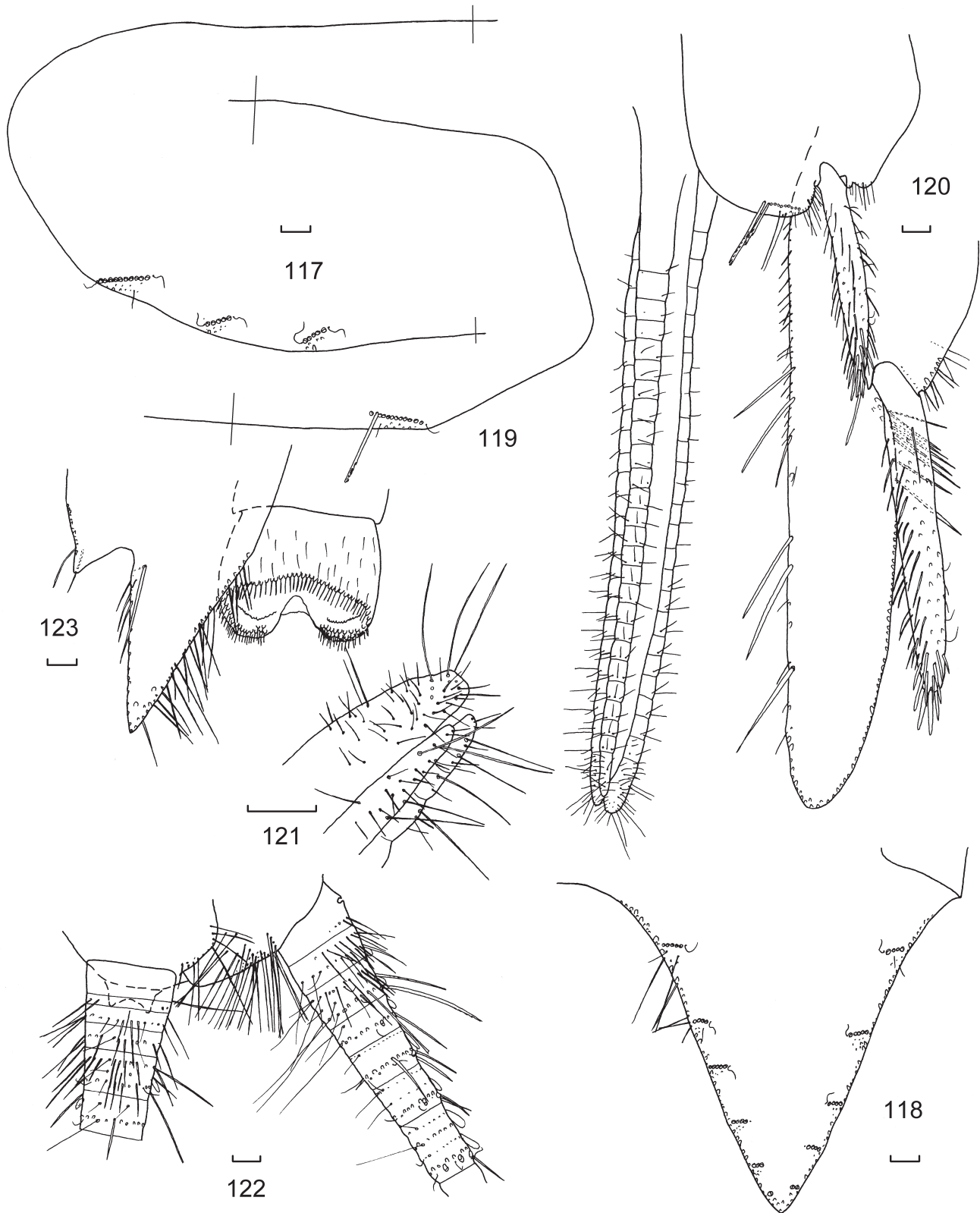




**Figures 113–116.** *Acrotelsella thommoi* sp. nov. holotype ♀ (113) mesothoracic sternum; (114) metathoracic sternum; (115) PII; (116) PIII. Scale bars = 0.1 mm.

combs of 4–8 insertion points, each associated with a few small setae between the comb and the margin and a cilium at each end; the outermost insertion on the comb is occupied by a long thin trichobothrium-like seta. The gap between the posterior combs 48–49% of the width of the pronotum. — Mesonotum (Fig. 110) with lateral chaetotaxy similar to pronotum but with 9–11 combs each of 1–4 macrochaetae, the anterior trichobothrial area located 0.60–0.65 along the

lateral margin associated with comb N-2 composed of one macrochaeta (rarely two) with the trichobothrium located between the macrochaeta and the margin, with several setulae posterior to the comb and a cilium at the mediad end. Posterior trichobothrial area slightly more posterior than that on the pronotum (0.82–0.84), the trichobothrium located mediad to the comb of usually just one macrochaeta although two occur on one side of gbs004036 and with a



**Figures 117–123.** *Acrotelsella thommoi* sp. nov. holotype ♀ unless otherwise indicated by specimen number (117) urotergite VII, left half; (118) urotergite X; (119) urostermite VII, left half; (120) left coxites VIII and IX with styli and ovipositor; (121) apex of gonapophyses; (122) base of cerci and medial filament; (123) right coxite IX of male and penis (K.541637). Scale bars = 0.1 mm.

few setulae posterior to the comb. Posterior margin with 1+1 combs of 4–8 macrochaetae insertions usually with a cilium at each end, the most lateral macrochaeta most likely a long, thin, trichobothrium-like seta, with a few setulae between the comb and the margin. — Metanotum

(Fig. 111) similar to mesonotum with 8–10 combs of 1–4 macrochaetae, the anterior trichobothrial area associated with comb N-1 of two macrochaetae about 0.72–0.73 along the margin, the posterior trichobothrial area associated with the most posterior comb (0.85–0.87 along margin) and the

posterior 1+1 combs each of 4–8 macrochaetae, the most lateral macrochaeta being long, thin and trichobothrium-like, with a few setulae between the comb and the margin.

Presternum very narrow, with transverse row of long almost smooth setae and setulae (Fig. 112). — Prothoracic sternum (Fig. 112) large, 0.93–1.07 times as long as wide at its base, parabolic, rounded apically, antero-lateral corners with many simple setae, those on the margins smaller than those just inside the margin, posterior  $\frac{1}{5}$  to  $\frac{2}{3}$  of lateral margins with fringe of long setae and some cilia as well as 4–7 combs each composed of 1–6 pectinate macrochaetae arranged in single straight or curved combs. — Mesosternum (Fig. 113) a little larger than prosternum (1.10–1.16 times as long) but similar in shape, about as long as wide at its base (L/W 1.00–1.02), with a few fine setae in the anterolateral corners, with long, thin simple marginal setae and cilia along the posterior quarter of the lateral margins and 2 + 2 combs distally, the more anterior composed of 5–6 strongly pectinate macrochaetae, the next of 4–5 macrochaetae with additional slightly submarginal 1+1 strong setae nearer to the posterior end; all combs with a few setulae distal to each comb. — Metasternum (Fig. 114) shorter and wider than the mesosternum (L/W 0.77–0.82) apically rounded or very slightly pointed, the margins may be slightly concave adjacent to the posterior combs, with marginal setae and cilia along distal margins adjacent to the combs as well as a few setulae between the combs and the margin; 1+1, 1+2 or 2+2 subdistal combs of 2–11 strongly pectinate macrochaetae.

Legs of average dimensions, neither long and slender nor short and stout, tibia L/W ratio of PI 2.5 (range 2.2–2.9), PII 2.9 (range 2.7–3.3), PIII 5.0 (range 3.3–6.0); tarsi L/W ratio PI 6.0 (range 5.4–7.2), PII 6.8 (range 5.8–8.0), PIII 8.6 (range 7.0–10.4). PI (Fig. 112) with a row of about six macrochaetae laterally on the precoxa. Coxa with scales and a group of about eight macrochaetae on the anterolateral corners followed by a field of pectinate macrochaetae along the external margin about three macrochaetae wide; inner margin with a five lightly pectinate macrochaetae and several smooth and pectinate setae of varying thickness distally over the articulation; distal end with distinct cleft, with a row of small setae along the mediad margin. Trochanter with one small pectinate macrochaeta and a few strong smooth setae. Femur posteriorly with several slender pectinate macrochaetae, in addition to some stronger tapered and carrot-shaped macrochaetae along the margin to the posterior bulge then a row of about eight setae along the margin to the articulation; anterior edge with two strong macrochaeta insertions near the articulation. Tibia of PI with about two stout, carrot-shaped, pectinate macrochaetae along the posterior margin as well as several longer, thinner, pectinate or smooth setae and a row of three shorter stout setae near the distal margin; anterior margin with two strong insertion points about  $\frac{1}{2}$  and  $\frac{3}{4}$  along the margin, each associated with one or two strong setae, as well several subdistal setae over the articulation; apex of tibia with the usual apical spur which is covered in numerous setae. Tarsi with four articles, the basal article of PI about half the total length of the tarsus, its join with the next article not particularly oblique, whereas the distal margin of the second article is quite oblique, the surface of all tarsal articles with very numerous simple setae. Pretarsus with two long curved lateral claws and a shorter curved medial claw. PII (Fig. 115) and PIII (Fig. 116) similar to PI except the macrochaetae laterally on the coxae are somewhat reduced

in the anterior half on PII and much reduced in the anterior half on PIII; the tibia of PIII has a long thin trichobothria-like seta about  $\frac{1}{4}$  the distance along the outer margin: legs progressively longer from PI to PIII and the relative length of the basal tarsal article is progressively longer, being about 60% of the total length of the tarsus of PIII.

*Abdomen:* Urotergite I with 1+1 lateral combs of 5–7 macrochaetae each associated with a cilium at each end and several setulae or slender setae between the comb and the margin, urotergites II–VII with 3+3 combs of 4–13 macrochaetae as in table 6 (Fig. 117), urotergite VIII with 2+2 combs (lacking the sublateral), urotergite IX glabrous; all combs with a cilium at each end and many small setae and setulae between the comb and the margin. — Urotergite X (Fig. 118) triangular (50–56° in both sexes) but with the apex slightly withdrawn from the apex of a triangle, wider at base than long (L/W 0.60–0.77) with many delicately pectinate smooth setae along entire margin both above and 4–5 combs on each side, the combs composed of 1–7 macrochaetae per comb usually with a cilium at the mediad end of each comb, as well as several setulae posterior to each comb.

Urosternite I and II glabrous, urosternites III–VII with 1+1 lateral combs of 8–17 pectinate macrochaetae (Fig. 119) each with a similar number of setulae between the comb and the margin as well as a cilium at the lateral end of every comb. The distance between the lateral combs 3.5–10.3 times the average width of these combs, the ratio being largest on urosternite III and decreasing posteriorly.

Genital region of ♀ as in Figure 120. Two pairs of styli, those on IX about one third longer than those on VIII, with some robust setae apically. Coxites VIII with long combs of 10–14 macrochaetae and a smaller number of thin but sometimes very long setae (almost as long as the macrochaetae) between the comb and the margin, the coxites with rounded inner corners, the straight section being only  $\frac{1}{8}$ – $\frac{1}{3}$  the width of the distal margin. Coxites IX with long rounded internal process, about 2.8–5.2 times longer than wide at its base (longer in larger specimens) and 7.2–11.4 times longer than the short pointed external process, the inner processes surpassing the apex of styli IX including macrochaetae, almost reaching to the end of the ovipositor; outer process with several setae externally, inner process with strong smooth macrochaetae along the margins, being very dense on the outer margin where many scales also exist. — Ovipositor of primary type with rows of fine setae on each article (Figs 120, 121), not very long

**Table 6.** Number of macrochaetae per bristle comb — *Acrotelsella thommoi* sp. nov.

segment	urotergite			urosternite
	lateral	sublateral	submedial	
I	5–7	—	—	—
II	5–8	4–7	4–7	—
III	6–11	5–6	5–7	8–12
IV	8–11	5–7	4–7	10–15
V	8–13	5–7	5–7	10–15
VI	8–13	5–7	5–7	11–16
VII	8–13	5–7	5–8	12–17
VIII	8–13	—	5–8	10–14
IX	—	—	—	—



(up to 1.5 HW, range 1.42–1.95), reaching to the apex of the long internal processes of coxites IX, both pairs of gonapophyses consisting of long basal division followed by smaller divisions that do not differ greatly in their length along the ovipositor, 25–31 divisions in total.

Cerci (Fig. 122) with first division almost glabrous, with just a couple of minute setae near the lateral margin, following four divisions wider than long with two or three rings of setae, macrochaetae and trichobothria, the middle, later also most basal ring with some small scales, divisions then progressively longer with four annuli per division each with a ring of setae, trichobothria, macrochaetae restricted to the most distal ring, scales present in the most basal and the penultimate rings.—Median dorsal appendage (Fig. 122) first division glabrous, second division very short with only a couple of small setae laterally on each side, third division with one full ring, following two divisions with a single ring of setae and trichobothria, subsequent divisions with two or more rings of setae and trichobothria with scales present on basal and middle rings. Most distal divisions in more or less intact terminal filaments with 16 annuli per division. Epiproct and paraproct quite darkly sclerotized or pigmented.

Coxite VIII in ♂ entire with 1+1 combs of 11–15 macrochaetae as well as many thin marginal setae and setulae between the comb and the margin. Coxites IX in ♂ separated (Fig. 123) each side with a long smooth macrochaeta (about  $\frac{2}{3}$  the length of the internal process) mediad to the base of the stylus. The internal process very acute apically, about 2.9–4.8 times longer than the external process and 1.3–1.5 times as long as broad at its base. External and internal margins of internal process and external margin of outer process with many finely pectinate setae and macrochaetae. Outer process small triangular with several stout finely pectinate setae along the outer margin. Penis typical with numerous glandular setae apically, each set on a protuberance. Parameres absent.

**Habitat.** This species has been collected in accumulated bark and/or termite dirt in fork at base of Eucalypt, as well as under bark at very base of Eucalypt.

**Etymology.** This species is named for a good friend, Greg Thompson (“Thommo”), a quiet adventurer, who sadly is no longer with us (22 January 1954–22 October 2021).

### Remarks

There are several species in a group that have simple ovipositors and, while we have found distinct morphological differences to separate the three species described in this work, it is quite difficult to be certain of the position of other species described because of their inadequate descriptions. *Acrotelsella splendens* (Nicholls and Richardson, 1926) appears to differ from the three species described in this work by the extremely truncate posterior margin to coxites VIII with less than one quarter of the margin being occupied by the medio-posterior curve. It is also illustrated as having a long series of papillae on the labial palp whereas the species described here do not have more than five papillae. However, Mendes (1989) redescribed the species based on material from Indonesia and Thailand without seeing the type material. Only five papillae are illustrated on the ultimate article of the labial palp and Mendes does not illustrate the posterior margin of coxites VIII in the female. The variability of the shape of urotergite X between the Thai and Indonesian

specimens is much greater than we have found within species in this current study. While the material described by Mendes may be closely related to the Australian species, we believe that their correct identity needs further investigation. We have not included the characters described by Mendes in our evaluation of the species described here.

*Acrotelsella producta* also appears in this group but the inner processes of coxites IX are illustrated, at least in one of his illustrations, as being much longer than any other species, reaching beyond the apex of the stylus IX by the length of the stylus, however it is not illustrated as being so long in a second illustration in the tables. No other described species extends more than half the length of stylus IX, however *Acrotelsella producta* does need to be redescribed, checking the length of the processes as well as providing details on many characters, over-looked at that time but now considered relevant. Womersley (1939) interpretation of the various specimens before him and his interpretation of the published descriptions of other *Acrotelsella* species is probably not very helpful and should be re-examined in the light of new knowledge and technical advances.

*Acrotelsella pacifica* may also fit into this group of species. It differs from all other species in the group by having 8–14 labial palp papillae however the original description of Marquesas Island material lacks many details and Mendes (1989) supplementary description is based on material from Indonesia and the Philippines without reference to the types and also lacks some details that we now think useful.

## *Acrotelsella tanni* sp. nov.

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### Figs 124–156

**Holotype** ♀ (HW 1.73) NEW SOUTH WALES: Mungo National Park 33.491°S 143.101°E 26.viii.2017, J. Tann, bark spray, AMS K.377775 (on two slides). **Paratypes** 1♀ (HW 1.54) same data as holotype, AMS K.377776 (in alcohol); ♂ (HW 1.40) same data as holotype, K.377777 (on two slides); 10 specimens (HW not recorded) same data as holotype, K.377778 (in alcohol); 78 specimens, mostly subadult and juvenile (HW not recorded), same data as holotype, AMS K.377779 (in alcohol); 1♂ (HW 1.43) Mungo National Park, Mungo National Park, Garnpang House 33.490°S 143.101°E, 31.viii.2017, J. Tann, bark spray, AMS K.377780 (on two slides); 1♂ (HW 1.55) same data as previous, AMS K.377781 (in alcohol); 27 specimens (HW not recorded) same data as previous, AMS K.377782 (in alcohol); 1♀ (HW 1.60) Mungo National Park 33.355°S 143.139°E, 31.viii.2017, J. Tann, bark spray, AMS K.377784 (on two slides); 1♂ 1♀ (HW not recorded), same data as previous, AMS K.377785 (in alcohol); 1♂ (HW 1.50) Mungo National Park, Leaghur Tank 33.618°S 143.034°E, viii.2017, J. Tann, bark spray, AMS K.377788 (on two slides); six specimens (HW not recorded) same data as previous, AMS K.377789 (in alcohol); 1♂ (HW 1.28) Mungo National Park, SS1 33.632°S 143.031°E, 28.viii.2017, J. Tann, bark spray, AMS K.377790 (in alcohol).

**Additional material examined but not included in type series.** 1 juvenile ♀ (HW 0.75) NEW SOUTH WALES: Jerilderie 35.34730°S 145.60062°E 104m asl, 5.xi.2014, Graeme Smith, leaf litter, AMS K.377977 (in alcohol); six juvenile specimens (HW not recorded) same data as previous, AMS K.377978 (in alcohol); 1 subadult ♂ (HW 0.81) Jerilderie, 35.34721°S 145.60028°E 107m asl, 5.xi.2014, Graeme Smith, bark spray to old Eucalypt, AMS K.541638 (on slide); 1♂ (HW 1.13) ca. 40km east of Hay 34.50587°S 145.23440°E 97m asl, 22.ix.2013, Graeme Smith, bark spray to River Red Gum, AMS K.261259 (on two slides); 1♂ (HW 1.18) same data as previous, AMS K.377975 (in alcohol); 2♂♂ 1♀ 2 juvenile ♀♀ specimens (HW not recorded) same data as previous, AMS K.377976 (in alcohol).

**Diagnosis.** This species can be distinguished from other described *Acrotelsella* with a simple ovipositor by a

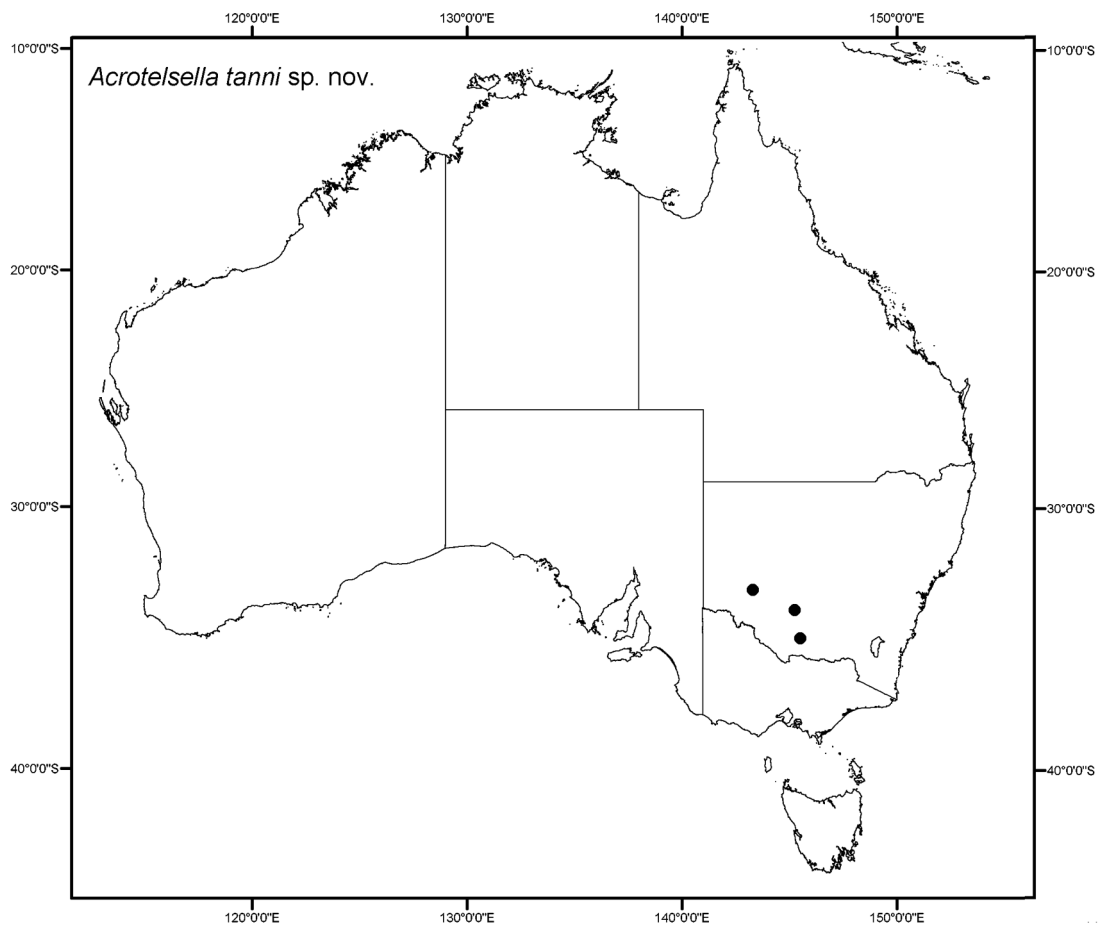


Figure 124. Known distribution of *Acrotelsella tanni* sp. nov.

combination of characters including, the number of papillae on the apical article of the labial palp (five), the presence of two macrochaetae mediad of the anterior trichobothrium and three laterad of the posterior trichobothrium of the pronotum (at least in mature specimens) versus only one and two respectively, the parabolic shape of the thoracic sternites with 5–8 combs along about  $\frac{2}{3}$  of the margin of the prosternum each of which is more or less in a single line (versus complex overlapping lines in *A. parlevar*), (2–3)+(2–3) in the mesosternum and (1–2)+(1–2) on the metasternum and the sexual dichotomy of the angle of the quite pointed urotergite X ( $40^\circ$  in females and  $50\text{--}58^\circ$  in the males).

### Description

*Appearance:* Medium to large silverfish, with narrow body, thorax not much wider than the abdomen which only tapers slightly posteriorly. Scale pattern when live see Figure 125, in alcohol mottled brown.

*Body length:* H+B up to 10.8 mm, HW 1.73 mm; thorax: length 3.5 mm or  $0.27\text{--}0.33$  H+B; width 2.73 mm with the mesonotum being slightly wider than the pronotum and metanotum, the metanotum being slightly shorter than the pro- and mesonota. Antennae incomplete, maximum preserved length 9.6 mm or  $>0.9$  H+B; terminal filaments all broken, maximum length of terminal filaments 7.9 mm or  $>0.79$  H+B.

*Pigmentation:* Flagellum of antennae without annulations, light brown pigment evenly distributed; pedicel with patch

of pigment on anterior face, scape without pigment. Frons with pigment around the eyes and among the macrochaetae anterior to the eyes, labrum and clypeus without pigment, mandibles and maxillae without pigment among bushes of macrochaetae, ultimate article of maxillary palp with very slight pigment except basally, penultimate article with some pigment evenly distributed, third article with slightly more pigment, second article with a little pigment above; labial palp without pigment. Nota and thoracic sterna without obvious pigment. Coxae of legs without pigment. Trochanter with faint pigment along posterior margin especially distally. Femora with slight pigment along posterior bulge and distally on the outer margin. Tibia with light pigment over much of outer face, more so distally. First tarsal article with a little blotchy pigment above, remaining articles without pigment. Abdominal segments without obvious pigment except for light pigment on coxites IX. Ovipositor largely without pigment except for a light scattering of pigment distally. Cerci and median filament with moderate brown pigment overall, except lighter around the distal most annulus of each division bearing the large macrochaetae, this lighter area can be less prominent in some individuals. Abdominal styli with light pigment. Some males (e.g., K.377777 and K.377780) with more pigment, especially noticeable in posterior abdominal sternites and edges of tergites.

*Macrochaetae:* Variable, pectinate (Fig. 126) or smooth, straw coloured.

*Scales:* Variable in shape, with numerous sub-parallel ribs that do not surpass the margin of the scale (Fig. 127), those





**Figure 125.** *Acrotelsella tanni* sp. nov., Hay

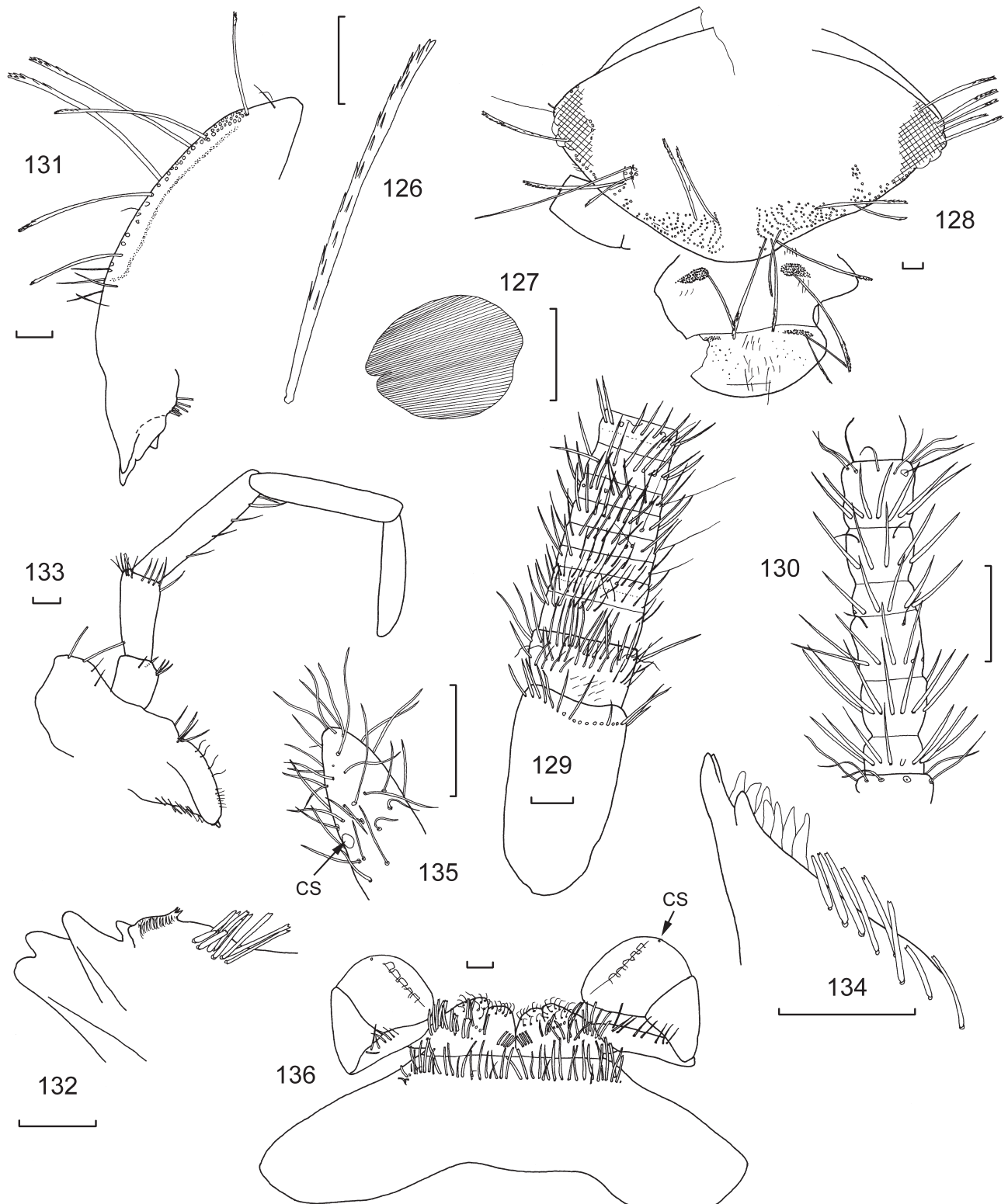
dorsal brown, those ventral hyaline. Scales found on top of head, on scape, on second and third articles of maxillary palp, on mentum of labium, all nota, all thoracic sterna, legs (except for trochanter and last three articles of tarsi), all urotergites and urosternites, styli and terminal filaments.

**Head:** (Fig. 128) wider than long, with 1+1 not very dense bushes of macrochaetae aligned in subparallel rows on the antero-lateral corners. Eyes dark brown in alcohol preserved material. There is a small gap in the row of macrochaetae along the margin above the antennal bases behind which is another row of macrochaetae 2–3 wide which extends to and above the eyes; the peri-antennal group is almost connected with the lateral rows. Clypeus with 1+1 very dense bushes of strongly pectinate macrochaetae as well as a few curved setae laterally. Labrum also with 1+1 dense bushes of pectinate macrochaetae as well as many simple setae, some longer than others. — Antennae fairly long, scape (Fig. 129) quite long with scales over surface and a preapical ring of numerous setae; pedicel with preapical ring of strong simple setae and cilia as well as smaller setae in a ring about half way along the face and an incomplete ring in the distal third as well as some small scattered setae over face; first annulus/interval of flagellum with an incomplete subapical ring of simple setae and about two trichobothria; next annulus with two rings of simple setae each with about two trichobothria which probably represents an annuli in the process of dividing; subsequent intervals with single ring of setae and cilia across the middle of the annulus and two short trichobothria per annulus. Intervals of flagellum subdivided into two from the

ninth interval and further into three then four from the 13th interval. Distally it is difficult to decide how many annuli per interval (Fig. 130), trichobothria are seen every 11th of 12 annuli but circular sensilla are seen on the eighth and on other specimens there appears to be two circular sensilla on adjacent annuli around the middle of the interval, the more distal being larger than the more proximal with the most distal annulus bearing a proximal ring of setae and a subapical ring of cilia and a trichobothrium. — Mandibles (Figs 131, 132) typical for *Acrotelsella* with prominent molar and large incisor areas; a group of about nine strong apically bifurcated but simple setae distally adjacent to the pectinate molar area and a bush of extremely numerous and densely packed pectinate macrochaetae externally as well as scattered simple setae. — Maxilla (Fig. 133) with two thicker, smooth or slightly pectinate macrochaetae externally proximal to the palp, the lacinia with three strong teeth, one set further back than the other two, followed by about seven lamellate processes and a row of 4–9 smooth setae, those nearest the lamellate processes shorter and conical in shape, galea longer than the lacinia with 4–6 strong, smooth, simple or apically bifurcate setae externally in its basal half and several cilia distally (Fig. 134); maxillary palp very long and thin, apical article 6.1–7.4 times longer than wide and 0.86–1.07 times as long as the penultimate article which is 0.87 times as long as the third and longest article, the ultimate article with a circular sensillum subapically appearing like a “sensillum of Silvestri” (*sensu* Mendes, 1986a) with a protruding lobe or sometimes could not be seen; last two articles of palp with fine setae only, third article with one slightly stronger seta subapically, first and second articles with subapical ring of slightly thicker setae, the ring incomplete on the basal article. — Labium (Fig. 136) very short and broad, postmentum with transverse row of simple and truncate, apically bifurcate macrochaetae, prementum with transverse and oblique rows of short strong apically bifurcated setae, apically with long curved setulae; labial palp short, the second article quite slender with several strong setae; apical article expanded medially, a little shorter than long (0.77–1.04) with row of five papillae of compact type arranged in a single row near the outer margin, with a single (?) circular walled basiconic sensillum and at least one rod-like basiconic sensillum (type B) on the outer margin, covered with numerous fine setae as well as longer fine setae.

**Thorax:** Pronotum (Fig. 137) with dense setal collar about three macrochaetae wide, with very slight gap medially, some macrochaetae very long and strongly pectinate in outer quarter, others shorter with subtle pectinations; lateral margins with a few setae along the margin, those still present with very subtle pectinations or even appearing completely smooth (especially posteriorly), with 7–8 combs of 1–3 strongly pectinate macrochaetae along each margin. Two open trichobothrial areas; the anterior trichobothrial area (Fig. 138) about 0.28–0.37 of the distance along the margin, associated with comb N-3, the trichobothrium being placed between the comb of 1–2 macrochaetae and the margin; posterior trichobothrial area is located about 0.70–0.75 of the distance along the margin and is associated with the last comb which is composed of three macrochaetae with the short trichobothrium at the mediad end and a cilium at the laterad end, all combs associated with a several setulae. Posterior margin with 1+1 combs of 3–8 insertion points associated with a few small setae between the comb and the

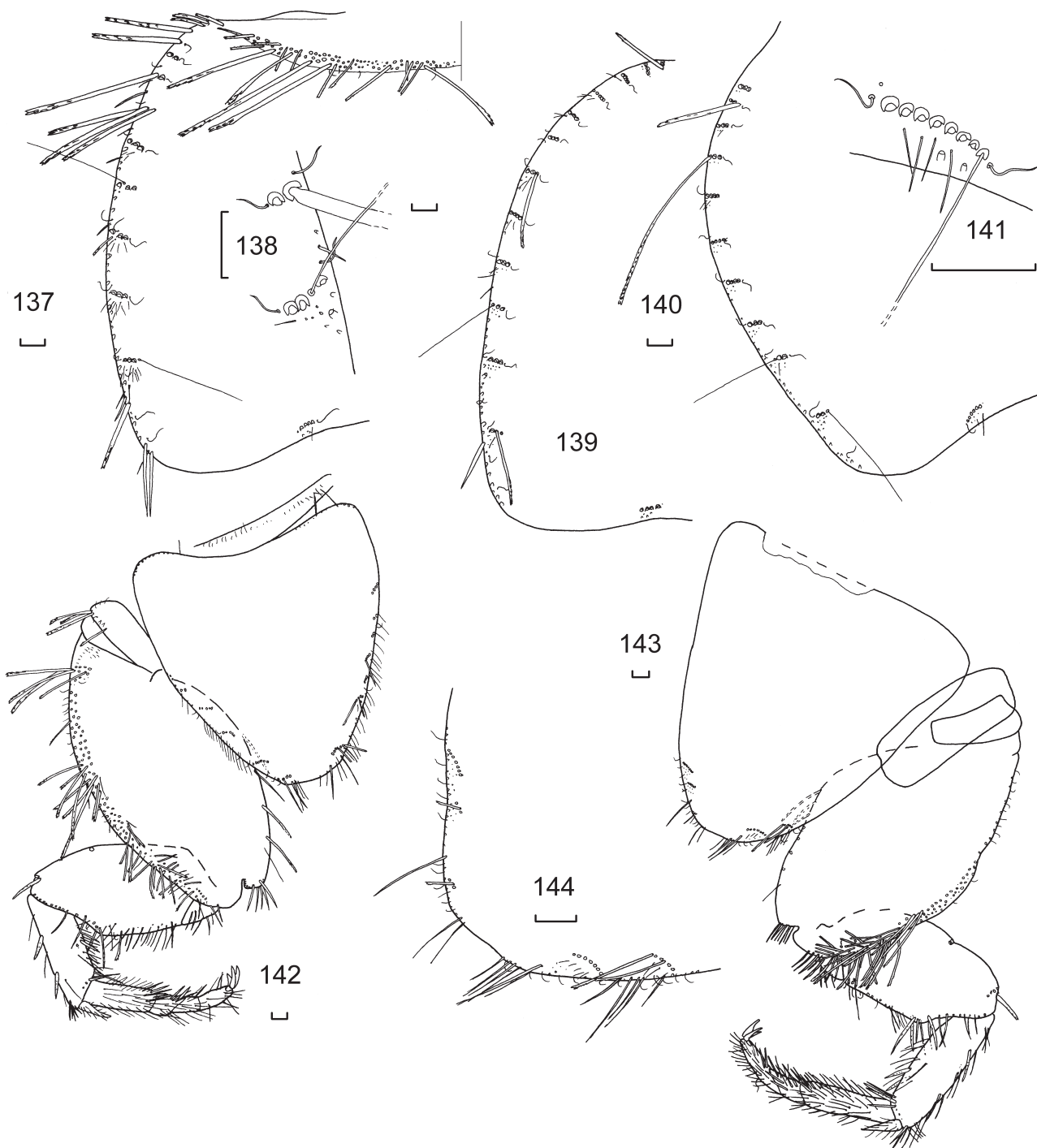




**Figures 126–136.** *Acrotelsella tanni* sp. nov. holotype ♀ (126) long pectinate macrochaeta of head; (127) darker dorsal scale of mesonotum; (128) head (cross-hatched area obscured by eye pigment); (129) antenna, scape, pedicel and basal intervals of flagellum; (130) idem, most distal surviving complete interval; (131) mandible; (132) idem, molar and incisor region; (133) maxilla; (134) idem, lacinia and galea; (135) idem, apex of ultimate article of palp; (136) labium. *cs* = circular sensillum. Scale bars = 0.1 mm.

margin and a cilium at each end; on K.377780 and K.377777, the outermost insertion on the comb is occupied by a long thin trichobothria-like seta (about as long as  $\frac{2}{3}$  the length of the nota), presumably this is the case in all other specimens where the combs have been lost (also the case with K.377788 on the metanotum). Distance between the posterior combs

41–49% of the width of the pronotum. — Mesonotum (Fig. 139) with lateral chaetotaxy similar to pronotum but with 9–12 combs each of 2–5 macrochaetae (rarely 1, in a juvenile specimen), the anterior trichobothrial area located 0.56–0.61 along the lateral margin associated with comb N-2 composed of 2–3 macrochaetae with the trichobothrium located

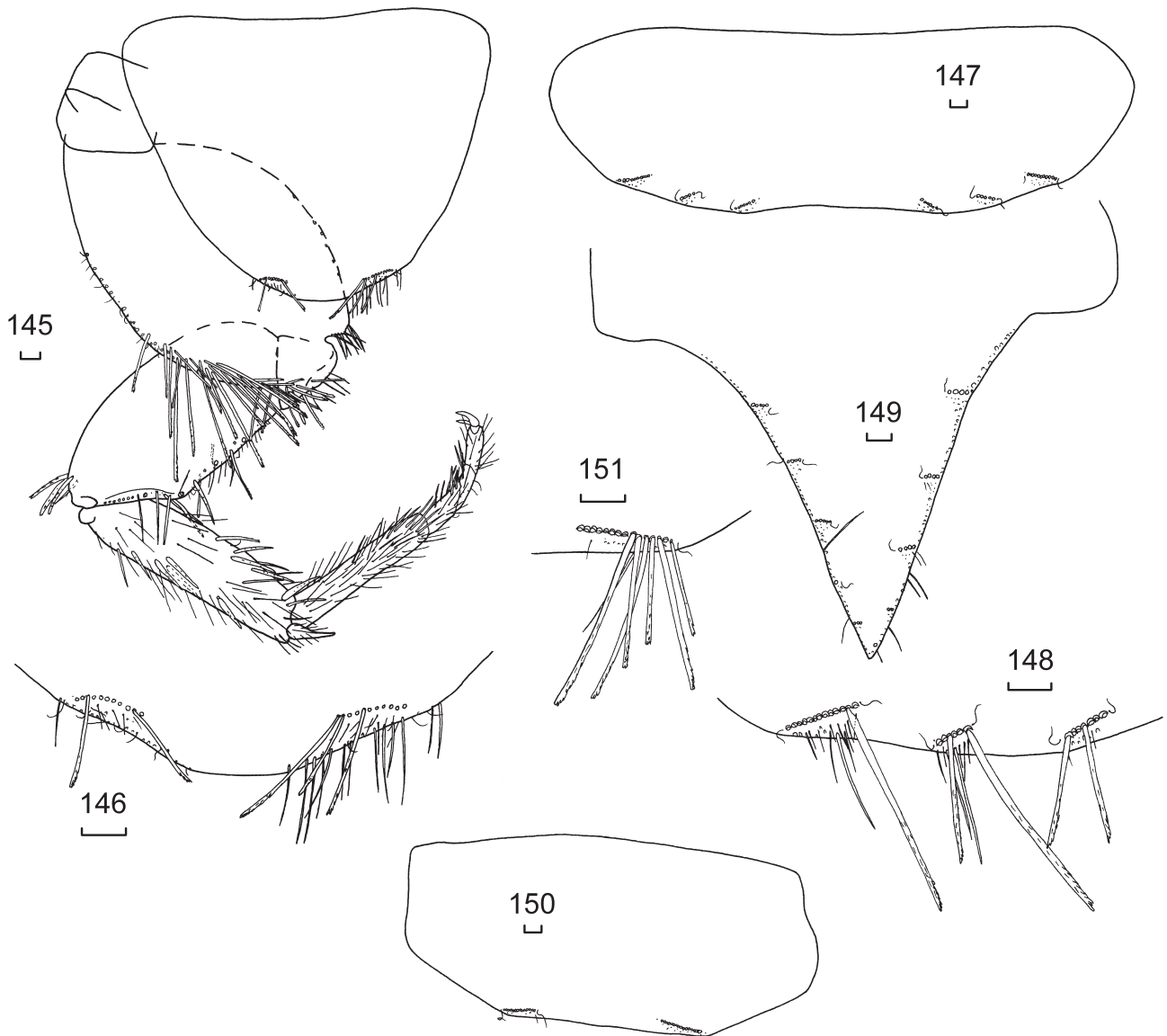


**Figures 137–144.** *Acrotelsella tanni* sp. nov. holotype ♀ unless otherwise indicated by specimen number (137) pronotum; (138) idem, right anterior trichobothrial area; (139) mesonotum; (140) metanotum; (141) idem, right posterior comb (K.377788); (142) presternum, prothoracic sternum; (143) mesothoracic sternum; (144) combs of mesosternum. Scale bars = 0.1 mm.

between the macrochaetae and the margin, with several setulae posterior to the comb and a cilium at the mediad end. Posterior trichobothrial area slightly more posterior than that on the pronotum (0.81–0.83), the trichobothrium located mediad to the comb of 2–3 macrochaetae and with several setulae posterior to the comb. Posterior margin with 1+1 combs of 4–9 insertions usually with a cilium at the mediad end, the most lateral macrochaeta most likely a long, thin, trichobothrium-like seta, with a few setulae between the comb and the margin. — Metanotum (Fig. 140) similar to mesonotum with 8–10 combs of 2–4 macrochaetae (rarely

1–3), the anterior trichobothrial area associated with comb N-1 of two macrochaetae about 0.70–0.72 along the margin, the posterior trichobothrial area associated with the most posterior comb and the posterior 1+1 combs each of 6–8 insertions the most lateral macrochaeta being a long, thin, trichobothrium-like, with a few setulae between the comb and the margin (Fig. 141).

Presternum very narrow, with transverse row of cilia and setulae (Fig. 142). — Prothoracic sternum (Fig. 142) large, almost as long as the coxa, 0.98–1.05 times as long as wide at its base, parabolic, rounded/sometimes slightly flattened



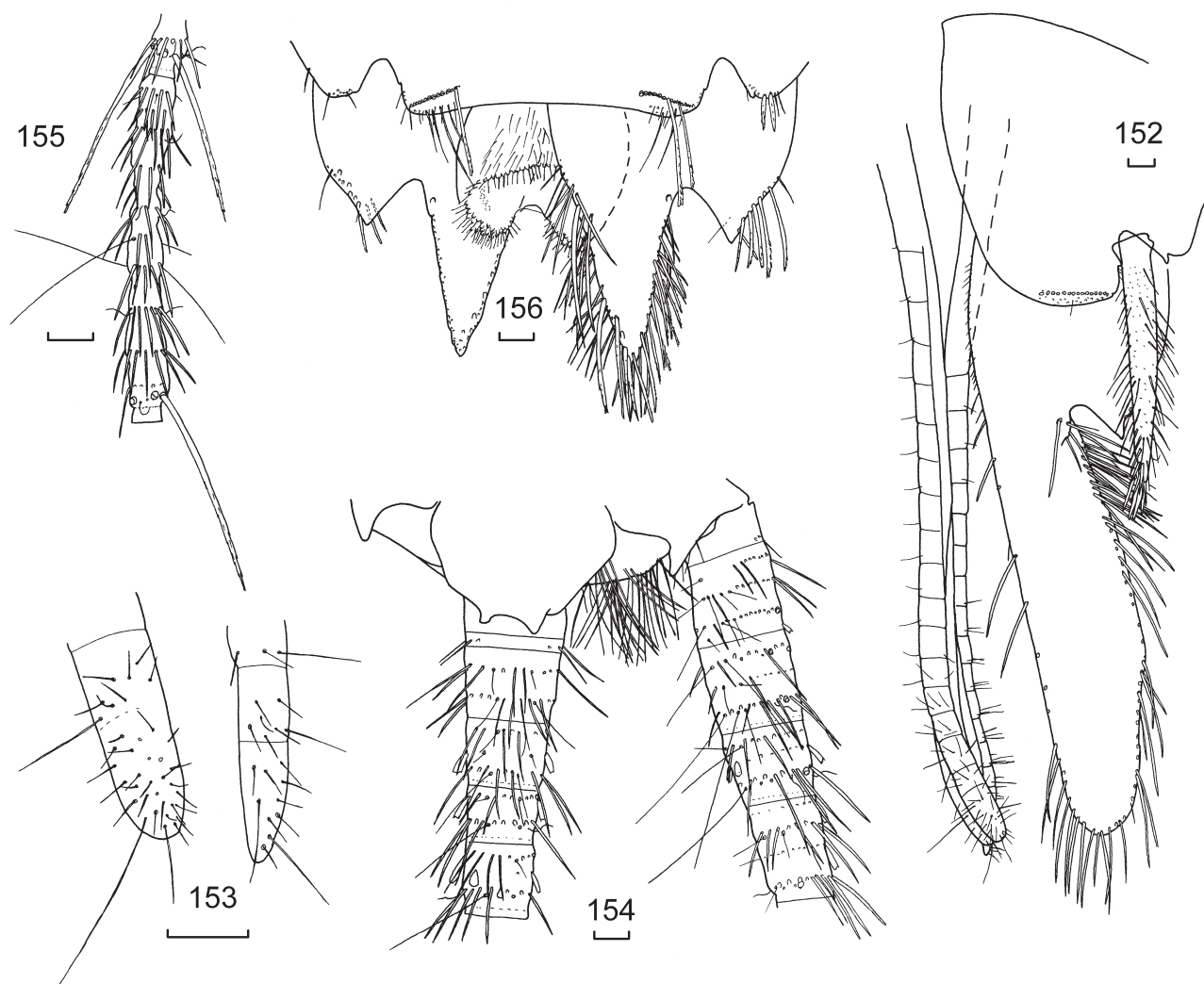
**Figures 145–151.** *Acrotelsella tanni* sp. nov. holotype ♀ (145) metathoracic sternum and PIII; (146) combs of metasternum; (147) urotergite VII; (148) idem, right combs; (149) urotergite X; (150) urostermite VII; (151) left comb of urostermite IV. Scale bars = 0.1 mm.

apically, antero-lateral corners with about 20 simple small setae, posterior two thirds of lateral margins with fringe of setae and some cilia as well as 5–8 combs each composed of 2–11 pectinate macrochaetae arranged in curved combs in a single line, although an occasional macrochaeta can be found slightly off-set from the rest. — Mesosternum (Figs 143, 144) a little larger than prosternum (1.1–1.2 times as long) but similar in shape, about as long as wide at its base (L/W 0.90–1.02), with or without fine setae in the anterolateral corners, with long, thin simple marginal setae and cilia along the posterior quarter of the lateral margins and 2+2 or 2+3 combs distally, the more anterior composed of 6–11 strongly pectinate macrochaetae, the next of 2–7 macrochaetae and the most distal of 1–3 pectinate or smooth macrochaetae, the more anterior combs with several setulae spread over the region distal to each comb. — Metasternum (Figs 145, 146) shorter and wider than the mesosternum (L/W 0.75–0.81) apically rounded, the margins may be slightly concave adjacent to the posterior combs, with marginal setae and cilia along distal margins adjacent to the combs as well as several setulae between the combs and the margin; 1+1, 1+2 or 2+2

subdistal combs of 6–14 strongly pectinate macrochaetae.

Legs of average dimensions, neither long and slender nor short and stout, tibia L/W ratio of PI 2.8 (range 2.5–3.1), PII 3.3 (range 3.0–3.5), PIII 4.0 (range 3.5–4.5); tarsi L/W ratio PI 6.5 (range 5.9–7.0), PII 7.1 (range 6.7–7.2), PIII 8.9 (range 8.1–9.6). PI (Fig. 142) with a row of about seven macrochaetae laterally on the precoxal. Coxa with scales and a group of about ten macrochaetae on the anterolateral corners followed by a field of pectinate macrochaetae along the external margin about three macrochaetae wide; inner margin with a four lightly pectinate macrochaetae and several smooth and pectinate setae of varying thickness distally over the articulation; distal end with distinct cleft, with a row of small setae insertions along the mediad margin. Trochanter with a few strong smooth setae. Femur posteriorly with three slender pectinate macrochaetae, in addition to many robust smooth setae along the margin to the posterior bulge then a row of about 12 setae along the margin to the articulation; anterior edge with one strong macrochaeta about  $\frac{2}{3}$  along the margin and at least three pectinate macrochaetae over the articulation. Tibia of PI with three stout, carrot-shaped,





**Figures 152–156.** *Acrotelsella tanni* sp. nov. holotype ♀ unless otherwise indicated by specimen number (152) left coxites VIII and IX with ovipositor; (153) apex of gonapophyses; (154) base of cerci and medial filament; (155) cercus, most distal surviving divisions; (156) urosternite VIII, coxites IX and penis of male (K.377777). Scale bars = 0.1 mm.

pectinate macrochaetae along the posterior margin as well as several longer, thinner, pectinate or smooth setae and a row of shorter stout setae near the distal margin; anterior margin with two pectinate macrochaetae as well several subdistal setae over the articulation, dorsal surface with a subdistal row of setae; apex of tibia with the usual apical spur which is covered in numerous setae. Tarsi with four articles, the basal article of PI about half the total length of the tarsus, its join with the next article not particularly oblique, whereas the distal margin of the second article is more oblique, the surface of all tarsal articles with very numerous simple setae. Pretarsus with two long curved lateral claws and a shorter curved medial claw. PII (Fig. 143) and PIII (Fig. 145) similar to PI except the macrochaetae laterally on the coxae are much reduced in the anterior half; the tibia of PIII appears to have more pectinate carrot-shaped macrochaetae than the other legs, tibia of PIII with a long trichobothria-like seta about  $\frac{1}{4}$  the distance along the outer margin; legs progressively longer from PI to PIII and the relative length of the basal tarsal article is progressively longer, being about 60% of the total length of the tarsus of PIII.

**Abdomen:** Urotergite I with 1+1 lateral combs of 4–7 macrochaetae each associated with a cilium at each end and

several setulae between the comb and the margin, usually but not always more numerous than the macrochaetae, urotergites II–VII with 3+3 combs of 4–13 macrochaetae as in Table 7 (Fig. 148), the smallest mounted specimen having the least, urotergite VIII with 2+2 combs (lacking the sublateral), urotergite IX glabrous, rarely with a small marginal seta in the infralateral position (e.g., K.377780); all combs with a cilium at each end and usually but not always more setulae than macrochaetae between the comb and the margin. — Urotergite X (Fig. 149) acutely triangular ( $40^\circ$  in females,  $50$ – $58^\circ$  in males), slightly wider at base than long (L/W 0.61–0.87) with many smooth setae along entire margin both above and 4–5 combs on each side, the combs composed of 1–7 macrochaetae per comb usually with a cilium at the mediad end of each comb, as well as several setulae posterior to each comb.

Urosternite I and II glabrous, urosternites III–VII with 1+1 lateral combs of 9–18 pectinate macrochaetae (Figs 150, 151) each with a similar number of setulae between the comb and the margin as well as a cilium at the lateral end of every comb; the smallest mounted specimen always at the lower end of the range. The distance between the lateral combs

**Table 7.** Number of macrochaetae per bristle comb—*Acrotelsella tanni* sp. nov.

segment	urotergite			urosternite
	lateral	sublateral	submedial	
I	4–7	—	—	—
II	4–8	3–7	4–8	—
III	5–10	3–7	3–8	5–15
IV	5–12	3–7	3–9	6–18
V	5–13	3–7	3–9	7–18
VI	5–13	3–6	3–9	7–17
VII	5–13	3–7	3–9	6–18
VIII	5–13	—	4–9	5–16
IX	—	—	—	—

2.7–8.4 times the average width of these combs, the ratio being largest on urosternite III and decreasing posteriorly; the ratios are largest on smaller specimens because the number of setae in the combs is less than in mature specimens.

Genital region of ♀ as in Figure 152. Two pairs of styli, those on IX about one third longer than those on VIII, with some robust setae apically, stylus lost or deformed in holotype. Coxites VIII with long combs of 5–16 macrochaetae (deformed on right side of holotype with only six insertions) and a similar number of setulae between the comb and the margin, the coxites with rounded inner corners. Coxites IX with long rounded internal process, about 3.9–4.8 times longer than wide at its base and 8.3–11.9 times longer than the short pointed external process, the inner processes just surpassing the apex of styli IX including macrochaetae, reaching to about the end of the ovipositor; outer process with several strong setae externally, inner process with strong smooth macrochaetae along the margins, being very dense on the outer margin where many scales also exist. — Ovipositor (Figs 152, 153) not very long (1.45–1.60 HW), reaching to the apex of the long internal processes of coxites IX, both pairs of gonapophyses consisting of long basal division followed by smaller divisions that do not differ greatly in their length along the ovipositor, 19–21 divisions in total; of primary type with rows of fine setae on each article.

Cerci (Figs 154, 155) first division almost glabrous, with just a couple of minute setae near the lateral margin; following four basal divisions about as long as wide with three or four rings of setae, macrochaetae and trichobothria, the middle and also most basal ring with some small scales; divisions then progressively longer with four annuli per division each with one or two rings of setae and macrochaetae, trichobothria absent from the two rings of the most distal annuli and very small in the basal annulus; scales present up until the 13th division, at least on some specimens, in the penultimate ring of each division; most distal surviving division with about eight ill-defined annuli with a total of 12 rings of chaetotaxy, the most basal with two very small trichobothria, the sixth and seventh with long trichobothria, larger pectinate macrochaetae restricted to the most distal ring. — Median dorsal appendage (Fig. 154) first division glabrous; second division very short with only a couple of small setae laterally on each side; following three divisions with 2–3 rings of setae and trichobothria, scales present on basal and middle rings, scales present some basal divisions. Epiproct and paraprocts very darkly sclerotized.

Urosternite VIII in ♂ entire (Fig. 156) with 1+1 combs of 13–14 macrochaetae as well as 2–5 thin marginal setae and several setulae. Coxites IX in ♂ separated each side with a long macrochaeta (about 2/3 the length of the internal process) mediad to the base of the stylus. The internal process very acute apically about 3.1–4.0 times longer than the external process and 1.2–1.6 times as long as broad at its base. External and internal margins of internal process and external margin of outer process with many moderately strong setae and macrochaetae. Outer process small triangular with several stout pectinate setae along the outer margin. Penis typical with numerous glandular setae apically, each set on a protuberance. Parameres absent.

**Habitat.** This species was mostly collected by spraying the bark of trees, usually the bottom 1.5 m. At Jerilderie, the species was collected from leaf litter.

**Etymology.** The species is named for the collector John Tann, formerly of the Australian Museum.

### Remarks

The molecular data places this species close to *A. thommoi* sp. nov. and *A. parlevar*. It is easily distinguished from both of these by the presence of five papillae on the ultimate article of the labial palp versus three in the other two species. Due to the poor descriptions of other species such as *A. silvestri* Womersley from Kangaroo Island and *A. sinensis* Silvestri from China, which also have five papillae and simple ovipositors, it is difficult to make conclusive comments. *Acrotelsella silvestri* appears to have more combs of fewer macrochaetae on the metathoracic sternum (2+3 of 3–6 versus 1+2 of 6–14 macrochaetae) and *A. sinensis* appears to have fewer lateral combs on the nota (6–8 versus 8–11) however these species need to be redescribed in more detail to complete the character set used here and to understand the intraspecific variability.

## *Acrotelsella parlevar* Smith, 2016

*Acrotelsella parlevar* Smith, 2016: 66

Figs 157–159

**Material examined.** Holotype ♀ (HW 1.55) TASMANIA: Travellers Rest, near Launceston 41.49103°S 147.07778°E, 17–23.iv.2015, W. & L. Clarkson, pitfall trap, dry sclerophyll forest, AMS K.261103 & K.261104 (on two slides); 1 ♀ (HW 1.24) NEW SOUTH WALES: ca 15km south of Balranald 34.76606°S 143.53946°E 71m asl, 23.ix.2013, Graeme Smith, mallee leaf litter, AMS K.541625 (on two slides); 1 juvenile ♀ (HW not recorded) same data as previous, AMS K.261322 (on two slides); 1 ♂ (HW 1.15) same data as previous, AMS K.261323 (on two slides); 1 ♂ (HW 1.19) same data as previous, AMS K.541626 (on two slides); 1 juvenile (HW 0.70) same data as previous, AMS K.377959 (in alcohol); 1 ♂ (HW 1.10) ca 135km west of Cobar 31.51686°S 144.48158°E 95m asl, 21.v.2012, Graeme Smith, wind blown leaf litter on red soil, AMS K.541639 (on two slides); 2 ♂, 1 ♀ 1 juvenile ♀ (HW, 1.13, 1.10, 1.18, 0.88 respectively) same data as previous, AMS K.377972 (in alcohol); 1 ♀ (HW 1.30) east of Cobar 31.52264°S 146.07185°E 264m asl, 22.v.2012, Graeme Smith, wind blown leaf litter on red soil, mostly Eucalyptus, AMS K.541629 (on two slides); 2 ♀♀ 4 ♂♂ 1 juvenile ♀ (HW not recorded), same data as previous, AMS K.377962 (in alcohol); 1 juvenile ♀ (HW 0.68) Nangar N.P. near campground 33.41933°S 148.49969°E 470m asl, 7.vii.2016, Graeme Smith, bark spray to cypress pine, AMS K.377961 (in alcohol); 1 juvenile ♂ (HW 0.88) VICTORIA: Hattah-Kulkyne N.P. dune near Lake Mournpell campsite 34.70198°S 142.33780°E 57m asl, 24.ix.2013, Graeme Smith, leaf litter on sand under small bush (small leaves—wattle? Hakea?) with *Acrotelsella mallee* sp. nov., AMS K.377960 (in alcohol); 1 ♀ (HW 1.25) VIC: Sturt

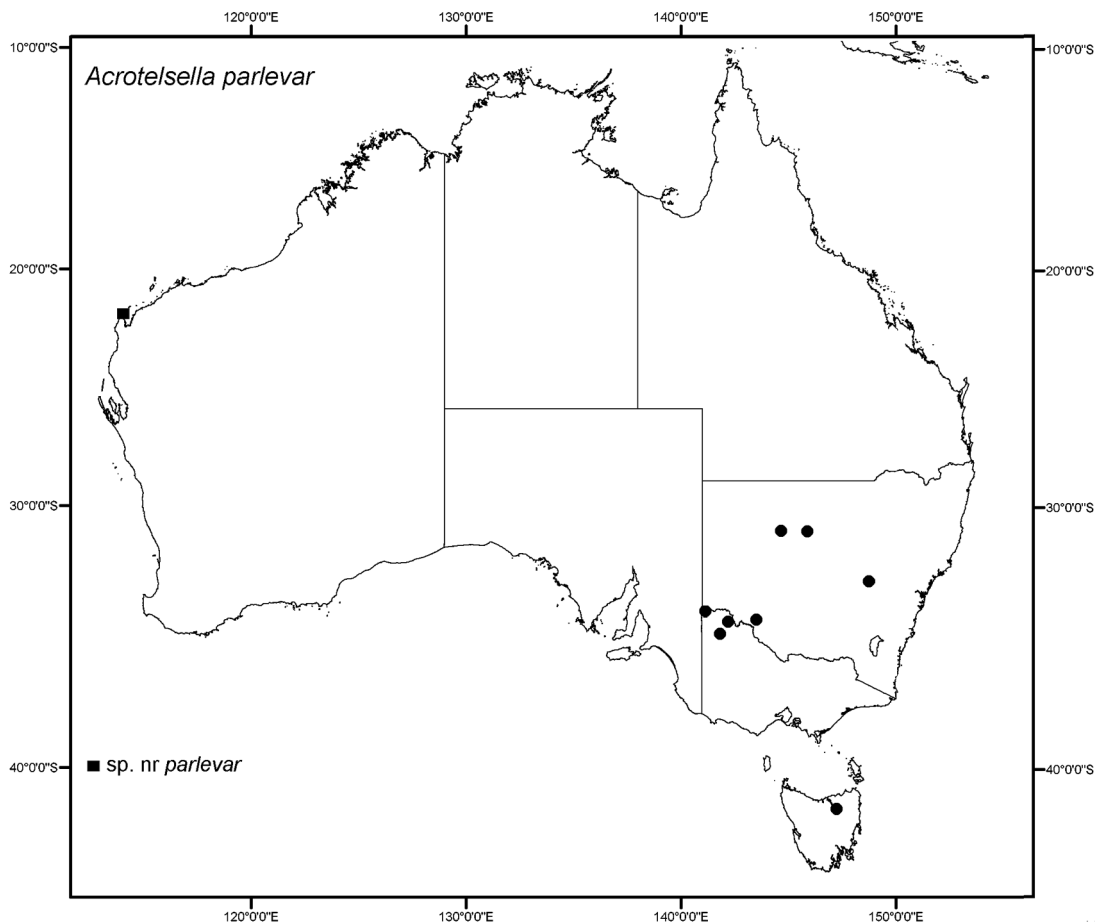


Figure 157. Known distribution of *Acrotelsella parlevar* and a closely related taxon.

Highway, rest stop near South Australia border 34.27503°S 140.96759°E 37m asl, 7.v.2012, Graeme Smith, leaf litter mallee scrub, AMS K.541627 (on two slides); 1♂ (HW 1.15) same data as previous, AMS K.377969 (in alcohol); 1♂ (HW 1.25) same data as previous, AMS K.377970 (in alcohol); 1♂ (HW 1.11) same data as previous, AMS K.377971 (in alcohol); 1♂ (HW estimated 1.15) Murray-Sunset N.P. Pioneer track 35.03489°S 141.73909°E 59m asl, 26.ix.2013, Graeme Smith, under dead spinifex in mallee, AMS K.541628 (on two slides); 1♂ (HW 1.13) Murray-Sunset N.P. Pioneer track 35.03444°S 141.73926°E 52m asl, 26.ix.2013, Graeme Smith, *Eucalyptus* leaf litter on top of ridge (collected with *Acrotelsella mallee* sp. nov.), AMS K.541631 (on two slides); 1♀ (HW 1.13) VIC: ca 1km south of Walpeup 35.14308°S 142.03095°E 84m asl, 26.ix.2013, Graeme Smith, shallow litter, *Acacia?*, NMV gbs004056 (on two slides); 1♂ (HW 1.11) Wyperfeld N.P., Desert track car park 35.60408°S 141.99718°E 78m asl, 28.ix.2013, Graeme Smith, leaf litter under pea or *Acacia* bush?, NMV gbs004063 (on two slides).

**Other material whose relationship with *A. parlevar* requires further investigation.** 1♂ (HW 1.38) WESTERN AUSTRALIA: North West Cape, near Wabiri, inland side of road 21.834°S 114.079°E 10m asl, 28.ix.2008, Graeme Smith, under or within cracks of limestone rocks on red soil, WAM E113405 (in alcohol); 1♂ (HW 1.15) same data as previous, WAM E113406 (on two slides).

#### Supplementary description and description of male

Description as in Smith, 2016 with the following changes/additions and changes to measurement range based on ten dissected sexually mature specimens from nine mainland localities. The larger size of the Tasmanian specimen may

account for the larger number of macrochaetae reported in combs. All additional specimens were considerably smaller than the Tasmanian holotype.

**Diagnosis.** This species can easily be distinguished from other described *Acrotelsella* by the presence of only three papillae on the last article of the labial palp, the shape of the thoracic sterna and the arrangement of the sternal combs in over-lapping irregular rows and the simple ovipositor of the female.

**Appearance:** Scale pattern when live as in figure 158 with thin band of white scales along of the nota, dorsal surface including head with mottled grey scales, dorsal surface of legs light in colour. Antennae evenly light brown terminal filaments with inconspicuous darker and lighter annulations.

**Body length:** terminal filaments all broken but some at least 0.6 H+B.

**Scales:** Scales also confirmed to be present on third article of maxillary palp, found on top of head, on scape but not pedicel, present on terminal filaments.

**Head:** The small gap in the row of macrochaetae along the margin above the antennal bases is not always present; the distal annuli arranged in chains of 12 not six annuli, bearing rod-like basiconic sensilla type B and possibly type C. — Maxillary palp very long and thin, apical article 4–6 times longer than wide and about the same length as the penultimate article, apical article of labial palp expanded somewhat medially, the length to width ratio quite variable (0.8–1.7) however this may reflect the difficulties of





**Figure 158.** *Acrotelsella parlevar* sp. nov. Walpeup

measurement of material in alcohol; once slide mounted the shape of the ultimate article seems much more consistent.

**Thorax:** The described “very slight gap in the setal collar” is not consistently present, the chaetotaxy is weak in the medial region but a distinct gap was not usually present, the macrochaetae of the collar are pectinate and can be quite long; lateral margins with short, tapered and slightly pectinate setae along the margin (all lost except one which is short and slightly pectinate), these marginal setae almost absent from the anterior part of the margin, becoming more frequent posteriorly, with 7–8 combs of 1–3 macrochaetae along each margin. Two open trichobothrial areas; the posterior trichobothrial area is located about 0.70–0.77 along the margin and is associated with the last comb (N), this comb composed of 2–3 macrochaetae with the short trichobothrium at the mediad end and a cilium at the laterad end, the anterior trichobothrial area is located 0.33–0.41 and associated with comb N-3 (except in K.261323 here the N-1 comb appears to be missing from both sides), the comb composed of only a single macrochaeta with the trichobothrium between the macrochaeta and the margin and a cilium at the mediad side of the macrochaeta (in one specimen (K.541627) a second macrochaeta is present on both anterior trichobothrial areas (left and right sides) and on another (K.261323) a second

macrochaeta is present only on one side); all combs associated with a few setulae. Posterior margin with 1+1 combs of eight macrochaetae in the Tasmanian specimen but only 4–7 insertion points on the mainland material, the outermost insertion point is almost certainly a long, thin trichobothrium-like seta (definitely present in NMV gbs004063); the gap between the posterior combs 44–52% the maximum width of the pronotum. — Mesonotum with trichobothrial areas located 0.49–0.62 and 0.78–0.87 along the margins with 8–11 combs of 2–4 macrochaetae, the metanotum with trichobothrial areas located 0.63–0.74 and 0.82–0.87 along the margins with 8–10 combs of 2–4 macrochaetae, in one specimen (K.541625) a third trichobothrium is present on one side.

Prothoracic sternum 0.91–1.08 times as long as wide at its base, somewhat pointed apically rather than round, antero-lateral corners with fields of 20–40 small simple setae, posterior three quarters of lateral margins with fringe of setae and some cilia as well as 4–8 eight small groups of 1–13 macrochaetae almost always arranged in 2–3 irregular overlapping rows. — Mesosternum a little larger than prosternum and slightly less acute apically (L/W 0.91–1.09) with (2–4)+(2–4) groups or combs distally of 1–16 pectinate macrochaetae in overlapping irregular rows. — Metasternum wider and shorter (L/W 0.76–0.91) with 1+1 (rarely 1+2)

**Table 8.** Number of macrochaetae per bristle comb—mature *Acrotelsella parlevar*.

segment	urotergite			urosternite
	lateral	sublateral	submedial	
I	6–9	—	—	—
II	5–9	4–7	6–10	—
III	7–10	4–7	5–10	11–18
IV	7–11	5–8	6–11	12–21
V	8–11	5–8	6–11	11–20
VI	9–13	4–7	7–10	12–21
VII	8–13	4–8	6–11	13–20
VIII	9–13	—	7–11	11–18
IX	—	—	—	—

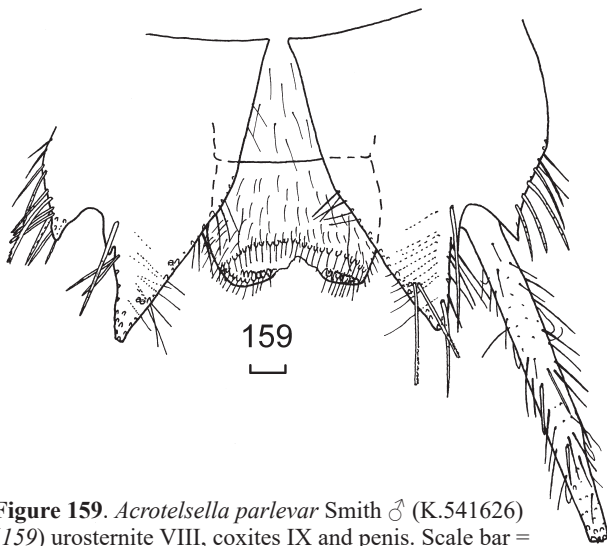
groups of 2–19 pectinate macrochaetae arranged in 2–4 overlapping rows plus 1+1 single submarginal macrochaetae more distally.

Tibia L/W ratio of legs PI 2.3–3.1, PII 2.9–3.2, PIII 3.4–4.4; tarsi L/W ratio PI 5.9–8.0, PII 6.2–10.1, PIII 8.1–11.7.

**Abdomen:** Urotergite X acutely triangular (47–53° in females, 54–60° in males), wider at base than long (L/W 0.63–0.85) with (4–5)+(4–5) combs of 1–7 macrochaetae per comb; the number of macrochaetae per comb as in Table 8.

Urosternites III–VII with 1+1 lateral combs of 11–21 pectinate macrochaetae; the distance between the lateral combs 2.4–5.8 times the average width of these combs, the ratio being largest on urosternite III and decreasing posteriorly.

Coxites VIII with almost right-angled inner angle (86–106°) with curve occupying  $\frac{1}{3}$ – $\frac{1}{2}$  of posterior margin. Coxite IX with long rounded internal process about 2.4–4.2 times longer than wide at its base and almost 4.5–8.9 times longer than the short pointed external process; with a long subtly pectinate macrochaeta mediad to the base of each stylus. — Ovipositor not very long (1.7–1.9 HW), about 16–20 articles in total.



**Figure 159.** *Acrotelsella parlevar* Smith ♂ (K.541626) (159) urosternite VIII, coxites IX and penis. Scale bar = 0.1 mm.

**Male.** Similar to female except coxites VIII entire (Fig. 159) with 1+1 combs of macrochaetae. Coxites IX in ♂ separated each side with a long subtly pectinate macrochaeta mediad to the base of each stylus, reaching almost to the apex of the internal process). External and internal margins of internal process with some moderately strong setae macrochaetae; ventral surface of process with many long thin setae inserted parallel to the external margin. In half of the slide mounted specimens examined (K.261323, K.541626 and K.541631 all of which were males) one or two short transverse combs of 1–3 pectinate macrochaetae are present (Fig. 159) but absent from the remainder including all females. Outer process small triangular with several stout pectinate setae along the outer margin. Penis typical with numerous glandular setae apically, each set on a protuberance. Parameres absent.

**Habitat.** This species is found in dry leaf litter, often that accumulating under bushes.

### Remarks

This species is most closely related to *A. thommoi* sp. nov. and *A. tanni* sp. nov. It can easily be distinguished from either of these species by the combs on the thoracic sterna. The macrochaetae in these combs on *A. parlevar* are generally irregularly arranged, almost looking like narrow bushes of macrochaetae in extreme examples whereas these combs on the other two species are arranged in lines, sometimes a little curved and sometimes with one or two macrochaetae off-set a little from the line but never in highly irregular groups. *Acrotelsella parlevar* can further be distinguished from *A. tanni* sp. nov. which has five papillae on the ultimate article of the labial palp (versus three in the other two species) and from *A. thommoi* sp. nov. which has more distinct regions of pigment (versus overall lightly pigmented in *A. parlevar*) and by the number of macrochaetae associated with the anterior trichobothrial area on the metanotum (always two macrochaetae in *A. parlevar* and *A. tanni* sp. nov. but usually only one macrochaeta in *A. thommoi* (one example was seen with two macrochaetae but only on one side). Females of *A. parlevar* also have less round posterior margin on coxites VIII and fewer divisions in the ovipositor (15–20 versus 25–29).

Other species known to have only three papillae on the labial palp include *Acrotelsella giubana* from Somalia and *Acrotelsella suqutrensis* from Yemen which differ from the Australian species in many ways such as the chaetotaxy of the frons and the combs or shape of the thoracic sterna.

The range of this species is now known to extend over 1000 km north of its type locality in Tasmania and it seems to be fairly common within the drier parts of NSW and Victoria (see map, figure 157). We also have specimens from North-West Cape in Western Australia that may belong to this species or else are very close to it. We did not obtain good sequence data (50% COI) but this data places the specimens with *A. parlevar*. Morphologically they also fit well with *A. parlevar*, having the same irregular combs on the thoracic sterna and three labial palp papillae but differ slightly in that the posterior corner of urotergite X is somewhat rounded where it is very pointed in all other specimens examined and there is a single comb on just one side of urosternite II, the latter character probably being anomalous.



## Discussion

The molecular data support three clades within the Australian *Acrotelsella* species examined here, however the genera *Hemitelsella* and *Qantelsella* lie within one of these clades. The females of this clade, represented here by *A. mallee* sp. nov. and *A. albicaudata* sp. nov., have secondary ovipositors, bearing modified spines. COI places both species in a clade with *Hemitelsella* and more distant from the other five described *Acrotelsella* species for which we have molecular data (*A. auricoronata* sp. nov., *A. tanni* sp. nov., *A. thommoi* sp. nov., *A. parlevar* and *A. erniei* Smith, 2015) all of which have primary type ovipositors. 28S on the other hand, places the two species closer to the remaining *Acrotelsella* species than to *Hemitelsella*.

The second group contains only *A. auricoronata* which has trapezoidal thoracic sternites. The only other described Australian species with similar sternites (*A. escherichi* Womersley, 1939) is quite different in having a secondary type ovipositor whereas *A. auricoronata* has a simple ovipositor.

The third group (*A. parlevar*, *A. thommoi* sp. nov., *A. erniei* and *A. tanni* sp. nov.) are more slender species all with primary type ovipositors.

*Acrotelsella* is clearly a very successful (abundant and widespread) genus within Australia and it will be necessary to extend this work to include many more species and collection localities before it will be possible to generate a useful key to the genus in Australia.

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## References

- Adel, T. 1984. Sensilleninventar und sensillenmuster auf den Antennen von *Thermobia domestica* und *Lepisma saccharina* (Insecta: Zygentoma). *Braunschweiger Naturkundliche Schriften* 2: 191–217.
- Bush Blitz Species Discovery Programme. 2019. *Mungo National Park New South Wales 2017. A Bush Blitz survey report, Commonwealth of Australia 2019*. 32 pp. [Accessed 22 Oct 2020]  
<https://bushblitz.org.au/wp-content/uploads/2019/02/Report-Mungo-National-Park.pdf>
- Escherich, K. 1905. Das System der Lepismatiden. *Zoologica (Stuttgart)* 43: 1–164.  
<https://doi.org/10.5962/bhl.title.7909>
- Kalyaanamoorthy, S., B. Q. Minh, T. K. F. Wong, A. von Haeseler, and L. S. Jermiin. 2017. ModelFinder: Fast Model Selection for Accurate Phylogenetic Estimates. *Nature Methods* 14: 587–589.  
<https://doi.org/10.1038/nmeth.4285>

- Kumar, S., G. Stecher, M. Li, C. Knyaz, and K. Tamura. 2018. MEGA X: Molecular Evolutionary Genetics Analysis across computing platforms. *Molecular Biology and Evolution* 35: 1547–1549.  
<https://doi.org/10.1093/molbev/msy096>
- Mendes, L. F. 1986a. Sur quelques caractéristiques morphologiques des Lepismatidae (Zygentoma: Insecta). II. Les sensilles spécialisées de l'antennae. In *2nd International Seminar on Apterygota, Siena, Italy*. ed. R. Dallai, pp. 217–228. Siena: University of Siena.
- Mendes, L. F. 1986b. Sur quelques caractéristiques morphologiques des Lepismatidae (Zygentoma: Insecta). III. Les aires trichobothriales. In *2nd International Seminar on Apterygota, Siena, Italy*. ed. R. Dallai, pp. 229–236. Siena: University of Siena.
- Mendes, L. F. 1989. Nouvelles données sur les Lepismatidae (Zygentoma) de l'Asie Orientale et de l'Indonésie. *Garcia de Orta, Séries Zoologia, Lisboa* 14(2): 79–92.
- Miller, M. A., W. Pfeiffer, and T. Schwartz. 2010. Creating the CIPRES Science Gateway for inference of large phylogenetic trees. *Proceedings of the Gateway Computing Environments Workshop (GCE)*, New Orleans, USA. pp 1–8.  
<https://doi.org/10.1109/GCE.2010.5676129>
- Molero-Baltanás, R., M. Gaju-Ricart, C. Bach de Roca, and L. F. Mendes. 2010. On *Ctenolepisma ciliata* and a new related species, *Ctenolepisma armeniaca* n. sp. (Zygentoma, Lepismatidae). *Deutsche Entomologische Zeitschrift* 57(2): 243–252.  
<https://doi.org/10.1002/mmnd.201000021>
- Nguyen, L.-T., H. A. Schmidt, A. von Haeseler, and B. Q. Minh. 2015. IQ-TREE: A fast and effective stochastic algorithm for estimating maximum likelihood phylogenies. *Molecular Biology and Evolution* 32: 268–274.  
<https://doi.org/10.1093/molbev/msu300>
- Ronquist, F., M. Teslenko, P. van der Mark, et al. 2012. MrBayes 3.2: efficient Bayesian phylogenetic inference and model choice across a large model space. *Systematic Biology* 61(3): 539–542.  
<https://doi.org/10.1093/sysbio/sys029>
- Silvestri, F. 1904. Thysanura. *Fauna hawaiiensis* 3(1): 293–297.
- Silvestri, F. 1908. Thysanura. In *Die Fauna Südwest-Australiens. Ergebnisse der Hamburger südwestaustralischen Forschungsreise 1905*. ed. W. Michaelsen and R. Hartmeyer, vol. 2. pp. 47–68. Jena: Gustav Fischer.
- Silvestri, F. 1935. Marquesan Thysanura. *Bulletin of the Bernice Pauahi Bishop Museum* 114: 305–312.
- Smith, G. B. 2013. A new species of *Heterolepisma* from Barrow Island (Zygentoma: Lepismatidae). *Records of the Western Australian Museum Supplement* 83: 229–240.  
<https://doi.org/10.18195/issn.0313-122x.83.2013.229-240>
- Smith, G. B. 2017. The Australian silverfish fauna (Order Zygentoma)—abundant, diverse, ancient and largely ignored. *General & Applied Entomology* 45: 9–58.  
<https://www.entocnsw.org.au/wp-content/uploads/2021/06/Smith-2017a-The-Australian-silverfish-fauna.pdf>
- Smith, G. B., A. Mitchell, and R. Molero-Baltanás. 2021. Molecular and morphological studies identify a new genus within the Heterolepismatinae (Zygentoma: Lepismatidae). *Zootaxa* 5030: 1–118.  
<https://doi.org/10.11646/zootaxa.5030.1.1>
- Stach, J. 1932. III. Die Apterygoten aus den Galapagos-Inseln. *Meddelelser fra det Zoologiske Museum Oslo* 29: 331–346, tabs II–IV.
- Womersley, H. 1939. *Primitive insects of South Australia. Silverfish, springtails and their allies*. Adelaide: Frank Trigg, Government Printer, 322 pp.