

A new Australian species of *Acrotelsella* (Zygentoma: Lepismatidae); could it be an endangered short range endemic?

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Abstract

A new and comparatively attractive species of silverfish from the genus *Acrotelsella* is described from specimens collected near the summit of a mountain in central Australia. It is unusual in displaying medial combs on some urosternites. Questions are posed as to whether it is a species with a very restricted range that may be endangered by global warming, or simply a reflection of the poor state of knowledge of the Australian silverfish fauna.

Keywords Thysanura | taxonomy | new species | global warming

1. Introduction

Escherich (1905) erected the genus *Acrotelsa* for all species of Lepismatidae with an acutely triangular urotergite X. He nominated the circumtropical species *Lepisma collaris* Fabricius, 1793 as the type species and described three new species including *Acrotelsa producta* Escherich, 1905, which was the first silverfish species to be described from Australia. Silvestri (1935) split *Acrotelsa* into three genera without explanation, nominating *Acrotelsa producta* as the type species of his new genus *Acrotelsella*. He seems to have been unaware of Stach (1932), who also split *Acrotelsa* into two subgenera, with *Acrotelsa (Stylifera)* containing only the neotropical species *A. galapagoensis* (Banks, 1901) from the Galapagos Islands and *A. gigantea* Escherich, 1905 from the Antilles. Wygodzinsky (1959) raised *Stylifera* to the level of genus and suggested that *Acrotelsella* Silvestri, 1935 should be considered

a synonym of *Stylifera* until further evidence was available. This suggestion was followed by Paclt (1967), who placed *Acrotelsella* as a subgenus within *Stylifera* in his catalogue of the Lepismatidae. Mendes (1982), in his unpublished review of the Lepismatidae, considered *Acrotelsella* to be a genus independent of *Stylifera*, the same position being accepted by Irish (1988) in his revision of the genus *Stylifera* and that which is followed here.

Eighteen species (or subspecies) of *Acrotelsella* have been described to date. Seven of these species were collected in the drier regions of Australia, the rest in Southeast Asia, China, Somalia, Yemen, Kenya, Colombia, the Seychelles, Hawaii and French Polynesia.

This paper describes a new, quite different and comparatively attractive species (Fig. 1) collected under rocks about 200 metres below the summit of Mt Sonder (or *Rwetyepme* - its aboriginal name), 1380 m in altitude, located in the centre of Australia (Figs 2, 3).

2. Materials and methods

Type specimens were collected within a few metres of each other. Locality co-ordinates for specimens were obtained using a hand held Garmin eTrex®10 GPS with a claimed accuracy usually under five metres. All specimens were initially stored in 75–80% ethanol.

Methods for measurement and dissection are the same as described in Smith (2013). The female holotype and one male paratype (dissected and mounted on two slides each) are deposited with the Northern Territory Museum of Arts and Sciences, Darwin, Australia and two paratypes in alcohol are with the Australian Museum, Sydney, Australia.

All climate data was taken from the Australian Bureau of Meteorology website on 24 June 2014 (<http://www.bom.gov.au/climate/data/>).

Roman numerals are used to indicate abdominal segment number. In addition the following abbreviations are used: asl: above sea level (in metres); HW: head width (in millimetres); H+B: head and body length (in millimetres); L/W: length to width (ratio); PI, PII, PIII: legs of prothorax, mesothorax and metathorax, respectively. The term macrochaetae refers to the larger stronger bristles (generally pectinate in this species); setae refers to smaller thinner bristles (always simple); setulae to the very small, usually straight setae associated with the combs and cilia to the curly thin hairs, often associated with the combs, setal collar or notal margins.

3. Systematics

Family **Lepismatidae** Latreille, 1802

Subfamily **Ctenolepismatinae** Mendes, 1991

Acrotelsella Silvestri, 1935: 307.

Acrotelsa Escherich, 1905 (pro parte): 105.

Acrotelsa (*Acrotelsa*) Stach, 1932: 333.

Acrotelsella Silvestri, 1935: 307.

Stylifera Wygodzinsky, 1959: 39.

Stylifera (*Acrotelsella*) Paclt, 1967: 54.

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

***Acrotelsella erniei* n. sp.** (Figs 1, 4–50)

Material examined. Australia, Northern Territory: West MacDonnell National Park, Mount Sonder track near summit 23°34.711'S 132°34.100' E, 1194 m asl, 10.vii.2009, Graeme Smith. holotype ♀ (HW 1.10) (NTM I009249) on two slides; paratypes ♂ (HW 1.25) (NTM I009250) on two slides, ♂ (HW 1.01) (K377609) in alcohol, ♀ (HW 0.99) (K377610) in alcohol. All specimens with same collection data as holotype.



Figure 1. *Acrotelsella erniei* n.sp

Diagnosis. Its colour and scale pattern when alive and the presence of medial combs on some of the urosternites distinguishes this species from all other described species of *Acrotelsella*, as well as the many other undescribed Australian species seen by the author.

Description. Appearance in life mottled grey with distinct lighter posterior margins to all tergites, legs almost white, antennae and terminal filaments light brown (Fig. 1).

Body length up to 8.3 mm (♀), 9.3 (♂); maximum head width 1.25 mm; thorax: length up to 2.8 mm (or 0.30–0.32 times H+B); width up to 1.80 mm with no great difference between the pro-, meso- and metanota, although the mesonotum is the widest; antennae incomplete in all specimens, maximum preserved length of antenna 5.5 mm (or 0.5–0.62 H+B); maximum length of intact cercus 3.95 mm (or 0.48 H+B); median dorsal appendage broken in all specimens, maximum preserved length 2.65 mm or 0.32 H+B. Body neither elongate nor broad (Fig. 4) with

thorax only slightly wider than abdominal segment I, the following abdominal segments about the same width until the fourth or fifth from, where it narrows moderately towards the posterior end; the large coxae quite visible at the sides of the body. Pigment generally absent, except for the antennae and terminal filaments which are evenly light brown.

Scales (Fig. 5) unevenly rounded, ovoid, distally truncate or even somewhat irregular with notches in the distal margin, with numerous light brown parallel ribs that do not extend beyond the margin. Scales on appendages, ventral surface and along margins of tergites with grey or hyaline ribs (in alcohol). Macrochaetae hyaline and mostly pectinate (Fig. 6).

Head (Fig. 7) wider than long with scales dorsally. Macrochaetae prominent in two bushes on the antero-lateral corners, each consisting of about seven curved rows; slightly posterior to the antennal base, these bushes almost join with the marginal rows about two to three

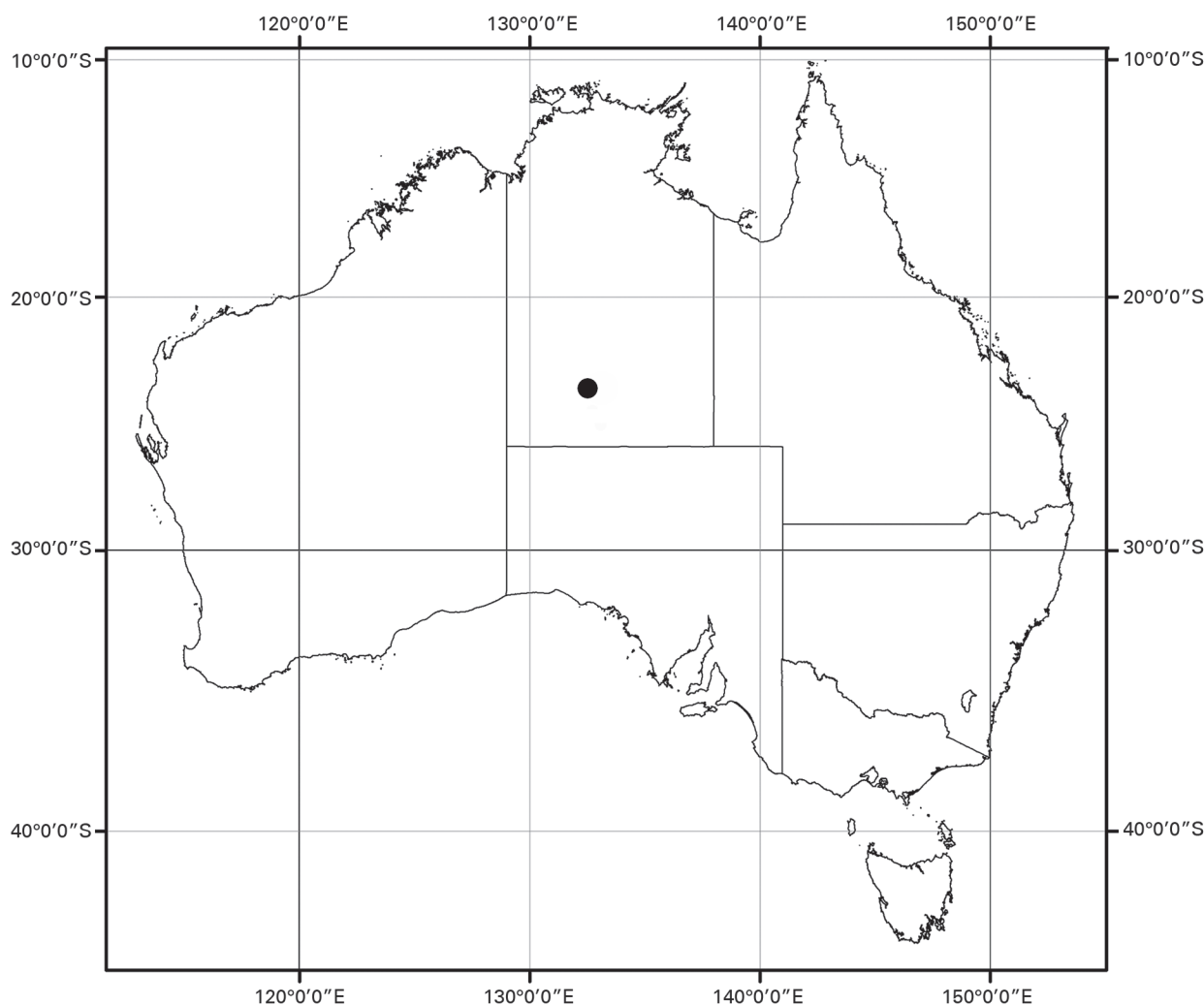


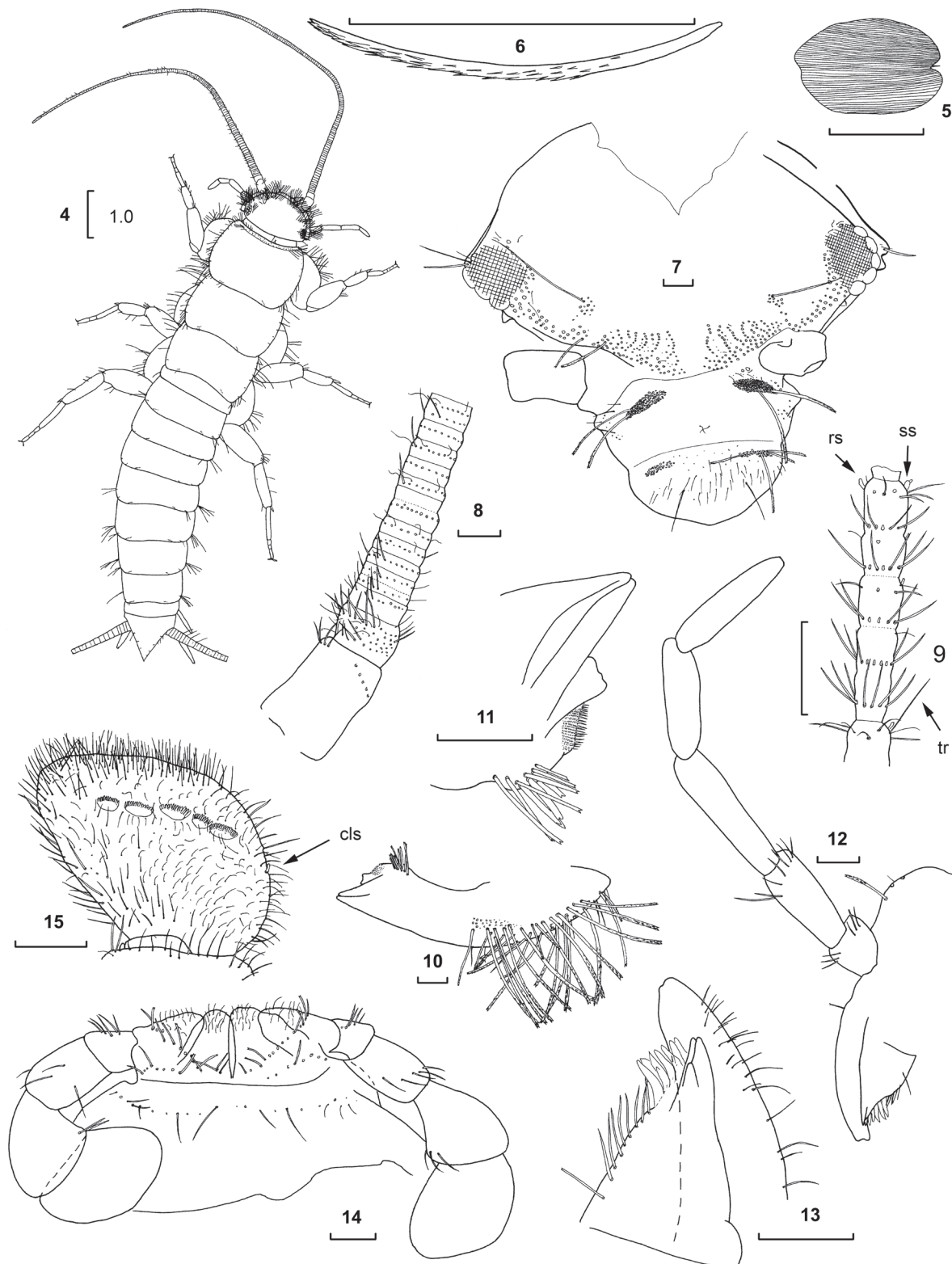
Figure 2. Collection locality, Mt. Sonder.

macrochaetae wide running along the sides of the head to the level of the eyes and then running above the eyes. On each side of the head, there is also a small group of macrochaetae posterior to the antennal base which includes a long thin seta. Eyes dark brown. Clypeus with 1+1 bushes consisting of tightly grouped macrochaetae as well as some small setae posterolaterally. Labrum also with 1+1 bushes of tightly grouped macrochaetae as well as many simple setae and two longer thin setae. Antennae incomplete in all specimens but fairly long, reaching a little under two thirds H+B. Scape (Fig. 8) quite long with short robust simple setae apically and hyaline scales. Pedicel covered with numerous finer setae and some cilia; subsequent articles with single rosette of setae transversely across the middle of the article and two short trichobothria per article (hidden behind flagellum in illustration), which decrease in frequency to every fourth subarticle distally as well as some additional apical cilia. More apical articles (Fig. 9) with both rod-like and sausage-shaped basiconic sensilla near the apex of each article; the more distal subarticles of each article with trichobothria, which progressively become very short (eventually not much longer than the fine subapical setae). Mandibles (Figs 10, 11) typical for genus with

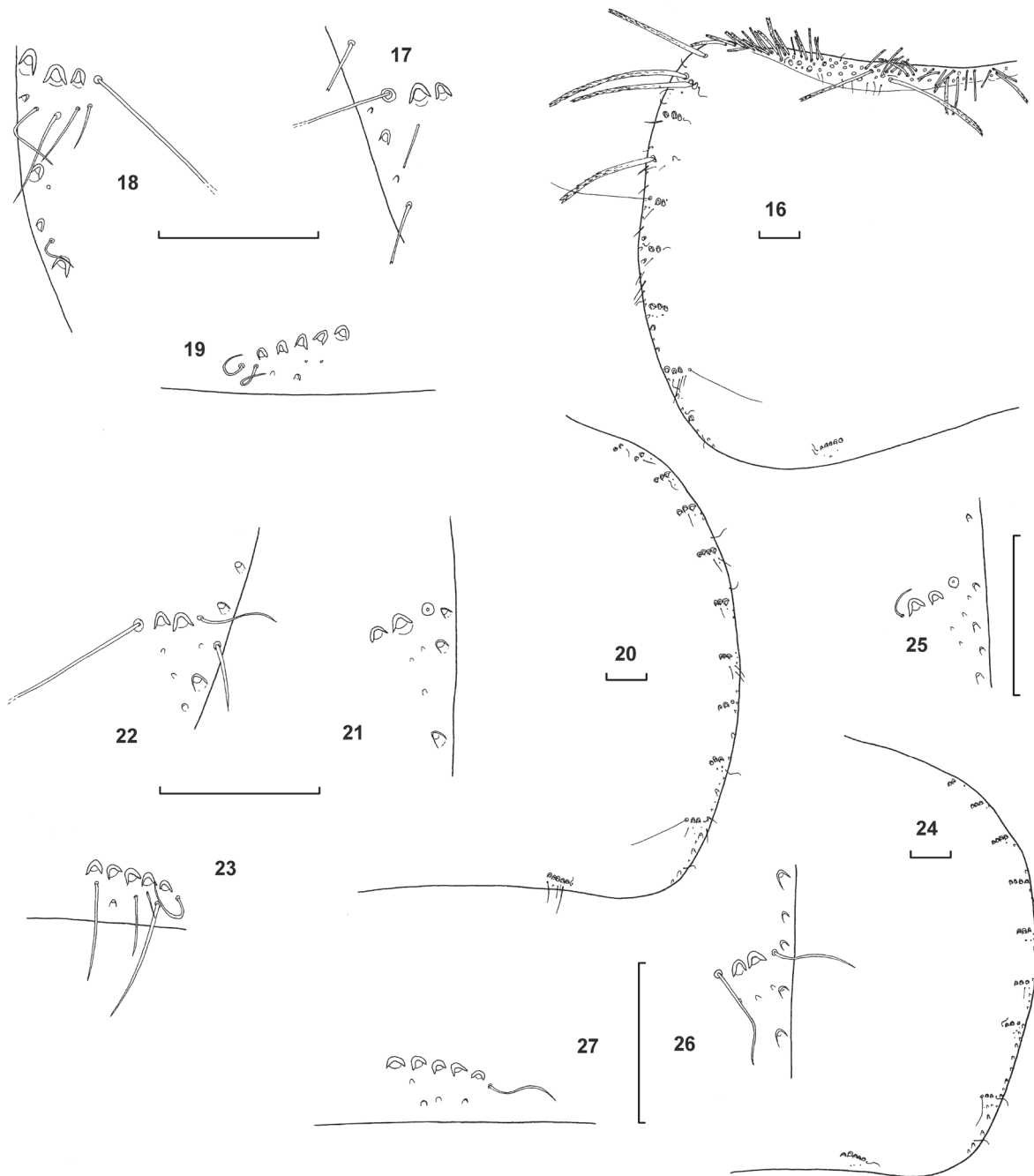
well-developed molar and incisor areas; a group of about nine strong apically bifurcated but otherwise simple setae distally adjacent to the pectinate molar area and a bush of setae and macrochaetae externally. Maxilla (Figs 12, 13) with three pectinate macrochaetae externally proximal to the palp, the lacinia with three strong teeth, one shorter than the rest, followed by six or seven lamellate processes and a row of seven or eight apically bifurcate setae. Apical article of maxillary palp 2.6–3.6 times longer than wide and 1.0–1.3 times longer than penultimate article; the ultimate article in both sexes without any obvious papillae or specialised sensillae. Last three articles of palp with fine setae; basal and second articles with subapical coronae of slightly thicker setae. Hyaline scales present on second and probably third article of palp, probably absent from basal, fourth and fifth articles. Labium (Fig. 14) short and broad with rows of short strong apically bifurcated setae on the prementum. Postmentum with a transverse row of apically bifurcate setae, which are shorter and stronger at the lateral margins. Glossae and paraglossae quite broad with short curved setulae. Labial palp short; apical article suboval expanded slightly medially (Fig. 15), wider than or as wide as long (L/W 0.7–1.0), with five papillae of compact type arranged in



Figure 3. Type locality and habitat, collected from underside of rocks 200 m below summit.



Figures 4–15. *Acrotelsella erniei* n. sp., female holotype unless otherwise indicated by specimen number. (4) Habitus (NTM I009250); (5) scale from urotergite; (6) macrochaeta from clypeus; (7) head, cross-hatched areas not clear due to dark staining from eye pigments; (8) antenna, scape, pedicel and basal articles of flagellum; (9) idem, most distal surviving article showing rod-like basiconic sensilla (rs), trichothria (tr) and sausage-shaped basiconic sensilla (ss) with apex of rod-like sensilla behind it; (10) mandible (NTM I009250); (11) idem, enlargement of distal end; (12) maxilla; (13) idem, enlargement of lacinia and galea; (14) labium, only larger setae shown on palps; (15) idem, enlargement of distal article of labial palp with five papillae and a curved, club-like basiconic sensilla (cls) (NTM I009250). Scale bar = 0.1 mm unless otherwise indicated.



Figures 16–27. *Acrotelsella erniei* n. sp., female holotype. (16) Pronotum, left half; (17) idem, anterior trichobothrial area; (18) idem, posterior trichobothrial area; (19) idem, posterior combs; (20) mesonotum, right side; (21) idem, anterior trichobothrial area; (22) idem, posterior trichobothrial area; (23) idem, posterior comb; (24) metanotum, right side; (25) idem, anterior trichobothrial area; (26) idem, posterior trichobothrial area; (27) idem, posterior comb. Scale bar = 0.1 mm.

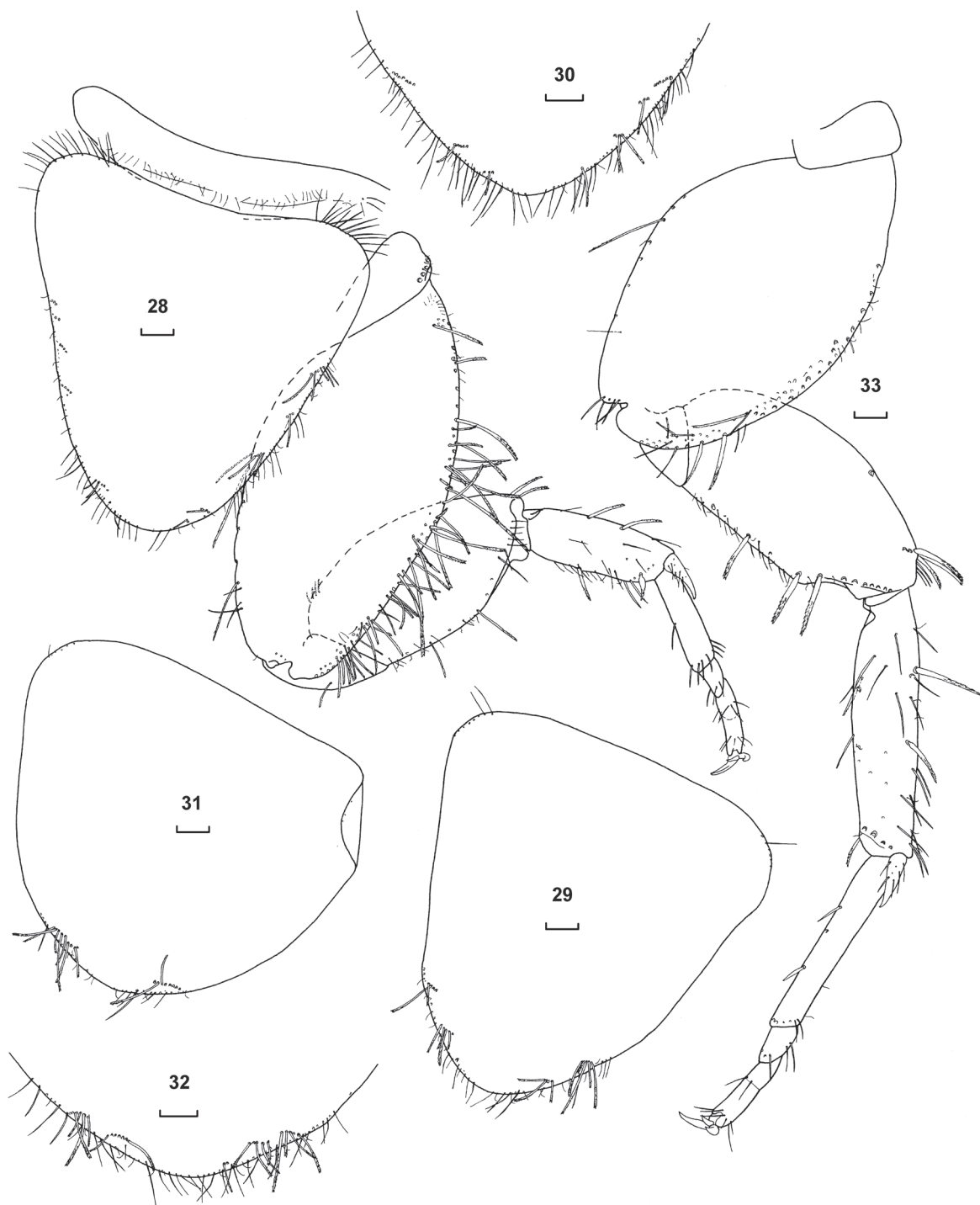
a single row and a curved club-like sensilla on the outer margin; covered with numerous fine short setae as well as longer fine setae on along the distal end. Scales appear to be absent on all articles of the labial palp.

Pronotum (Fig. 16) with wide setal collar of shorter and longer pectinate macrochaetae not arranged in distinct rows but about two to four macrochaetae wide, as well as some cilia and setulae. Laterally with a few setae as well as some setulae and cilia scattered along the margins. A strong pectinate macrochaeta located near the anterior corner is followed by seven to eight combs of two to three strong pectinate macrochaetae evenly spaced along the anterior three quarters of the sides of the notum; some combs with one to three setulae posterior to the comb. Two open trichobothrial areas; the anterior area (Fig. 17) is slightly forward of the midpoint and associated with the fifth comb with the trichobothrium located between the comb of two macrochaetae and the margin. Posterior trichobothrial area (Fig. 18) around three quarters of the distance along the margin and associated with the last comb; its trichobothrium located at the mediad end of the comb of macrochaetae. Both areas have a few setulae as well as one or two cilia usually at the ends of the comb. Posterior margin with 1+1 combs of five to seven macrochaetae (Fig. 19) with one or two cilia at one or either end of the comb; some setae and setulae between the comb and the margin. Mesonotum (Fig. 20) with lateral chaetotaxy similar to pronotum with ten combs of one to four pectinate macrochaetae. The anterior trichobothrial area (Fig. 21) is located about halfway along the lateral margin with two macrochaetae and a trichobothrium located between the comb and the margin and a few setulae posterior to the comb. Posterior trichobothrial area (Fig. 22) similar to that on pronotum but slightly more posterior. Posterior margin (Fig. 23) with 1+1 combs of five to six macrochaetae with a cilia at one or both ends and some fine setae and/or setulae between the comb and the margin. Metanotum (Figs 24–27) similar to mesonotum, but with only eight or nine combs of two to four macrochaetae and the anterior trichobothrial area is slightly posterior to the midpoint of the margin. The 1+1 posterior combs with five to seven macrochaetae as well as some fine setae and/or setulae between the comb and the margin.

Presternum narrow, with transverse row of very small setae (Fig. 28). All thoracic sterna with hyaline scales. Prothoracic sternum (Fig. 28) large, about as long as wide at its base, rounded apically. Antero-lateral corners with fringe of fine simple setae. Posterior two thirds of lateral margins also with fine simple setae and some cilia as well as five to eight short combs of one to six feathered macrochaetae on each side as illustrated. Mesosternum (Fig. 29) slightly longer than broad with marginal setae and cilia in distal quarter as well as three or four combs

of pectinate macrochaetae on each side in the posterior third. The most proximal combs with four to seven macrochaetae, the most distal with only one to three macrochaetae and the middle comb between these of three to five macrochaetae. In the larger male paratype, there is an additional comb of three macrochaetae between the middle and proximal combs on one side only (Fig. 30). Metasternum (Fig. 31) apically rounded, about 1.2 times wider than long with marginal setae and cilia along distal quarter of lateral margins with 1+1 longer subapical simple macrochaetae and one to three combs of pectinate macrochaetae on each side. Holotype with 1+2 combs, the two combs on one side not very far apart, and the distance between the combs about $2\frac{1}{2}$ times the length of the single comb; male paratype (NTM I009250) with 2+3 combs, the third and most distal comb consisting of only two pectinate macrochaetae associated with the longer subapical simple seta (Fig. 32).

Legs widely spaced, tibia L/W ratio of legs PI 2.2–3.1, PII 2.5–2.9, PIII 3.2–4.4; tarsi L/W PI 5.4–7.4, PII 7.0–9.1, PIII 8.7–11.0. PI (Fig. 28) with transverse comb of four to six macrochaetae laterally on small article between prothoracic presternum and coxa. Coxa with some scales and a small group (about six) macrochaetae on anterolateral corners followed by many strong macrochaetae in two or three rows along the external margin; distal two thirds of inner margin with some finer macrochaetae and about five stronger pectinate setae distally over the articulation (lost from the leg illustrated). Trochanter lacking scales. Femur and tibia with scales on outer margin. Femur ventrally with several strong pectinate macrochaetae and dorsally with three smaller pectinate macrochaetae subdistally, one long macrochaeta about two thirds of the way along the length of the femur mediad to the outer margin reaching almost to the end of the femur, in addition to several fine setae scattered over the mediad third of the ventral surface. Tibia of PI with a short stout pectinate macrochaeta half way along the ventral margin and another more robust macrochaeta subdistally as well as some stout setae near the latter. Tibia of PII with a short stout pectinate macrochaeta about one third the distance along the ventral margin and a pair of similar stout macrochaetae about half way along the margin (not very close together) and a third somewhat stouter pectinate macrochaeta subdistally on the ventral face with some strong setae between the latter two; on both PI and PII are two stout pectinate macrochaetae about one and two thirds the way along the outer margin as well as some longer setae especially distally. Tibia of P III (Fig. 33) with similar ventral chaetotaxy to PII and also with two macrochaetae near the dorsal margin, however the more proximal one is quite long (about 1.2 times as long as the width of the tibia) and stands more erect than the



Figures 28–33. *Acrotelsella erniei* n. sp., female holotype unless otherwise indicated by specimen number. (28) Presternum, prothoracic sternum and PI, showing only more robust setae and macrochaetae of leg; (29) mesosternum; (30) idem, enlargement of apex of paratype (NTM I009250); (31) metasternum; (32) idem, enlargement of apex of paratype (NTM I009250); (33) metathoracic leg, more robust setae and macrochaetae only. Scale bar = 0.1 mm.

rest. Tarsus with four articles; the basal article on PI only slightly longer than the length of the other three together, the second article being quite short. Tarsus of PII and PIII longer with the longer basal article almost two thirds the length of the whole tarsus in PIII. Basal article of tarsus (at least on PIII) also with a few hyaline scales in addition to setae; other articles appear to be without scales. Pretarsus with two long curved lateral claws and a shorter curved more delicate medial claw.

Urotergite I with 1+1 combs of five to six macrochaetae, each associated with one to three marginal setae and some setulae as well as a cilia at each end of the comb. Urotergites II–VII (Fig. 34) with 3+3 combs of macrochaetae, as in Tab. 1, each associated with one to four marginal setae and a few cilia. The lateral and often the sublateral combs with cilia at both ends of the comb, the submedial usually with only one cilia at the laterad end of the comb (Figs 35–38). Urotergite VIII with 2+2 combs, lacking the sublateral comb; urotergite IX glabrous. Urotergite X sharply triangular, similar in both sexes, wider than long (L/W at base about 0.7) with many setae along entire margin. Urotergite X of holotype with 3+4 combs of two to five macrochaetae per comb as in Figure 39; slightly larger male paratype with 5+5 combs of one to seven macrochaetae as in Figure 40.

Urosternite I glabrous; urosternite II with a medial comb of four macrochaetae (seven in NTM I009250) plus four marginal setae (Figs 41, 42). Urosternites III–VI in ♀ holotype and subadult ♀ paratype (K377610), III–V in ♂ paratype (NTM I009250) and III–IV in ♂ paratype (K377609) with medial combs of two to seven macrochaetae, each often associated with up to four long thin marginal setae and one or two small setulae between the margins and the comb. Urosternites III–VIII with 1+1 lateral combs of nine to sixteen pectinate macrochaetae (Fig 43, 44), each associated with three to five thin marginal setae (sometimes almost as long as the macrochaetae), one to four small setulae between the comb and the margin and a small cilia at the laterad end of each comb. Distance between the lateral combs

2.8–6.7 times the length of these combs, the ratio being largest on urosternite IV and decreasing posteriorly. Coxites of segment VIII in ♀ with a few fine setae on margin laterad of the stylet insertion and a comb of 12 pectinate macrochaetae mediad of the stylet insertion, each associated with a few fine marginal setae and some setulae. Two pairs of slender stylets; all stylets with a bunch of larger macrochaetae apically (lost in all specimens and only insertions visible) as well as numerous fine setae and some cilia (Fig. 45). Stylets IX about 1½ times the length of those on VIII and almost reaching to the end of the internal process (excluding apical macrochaetae).

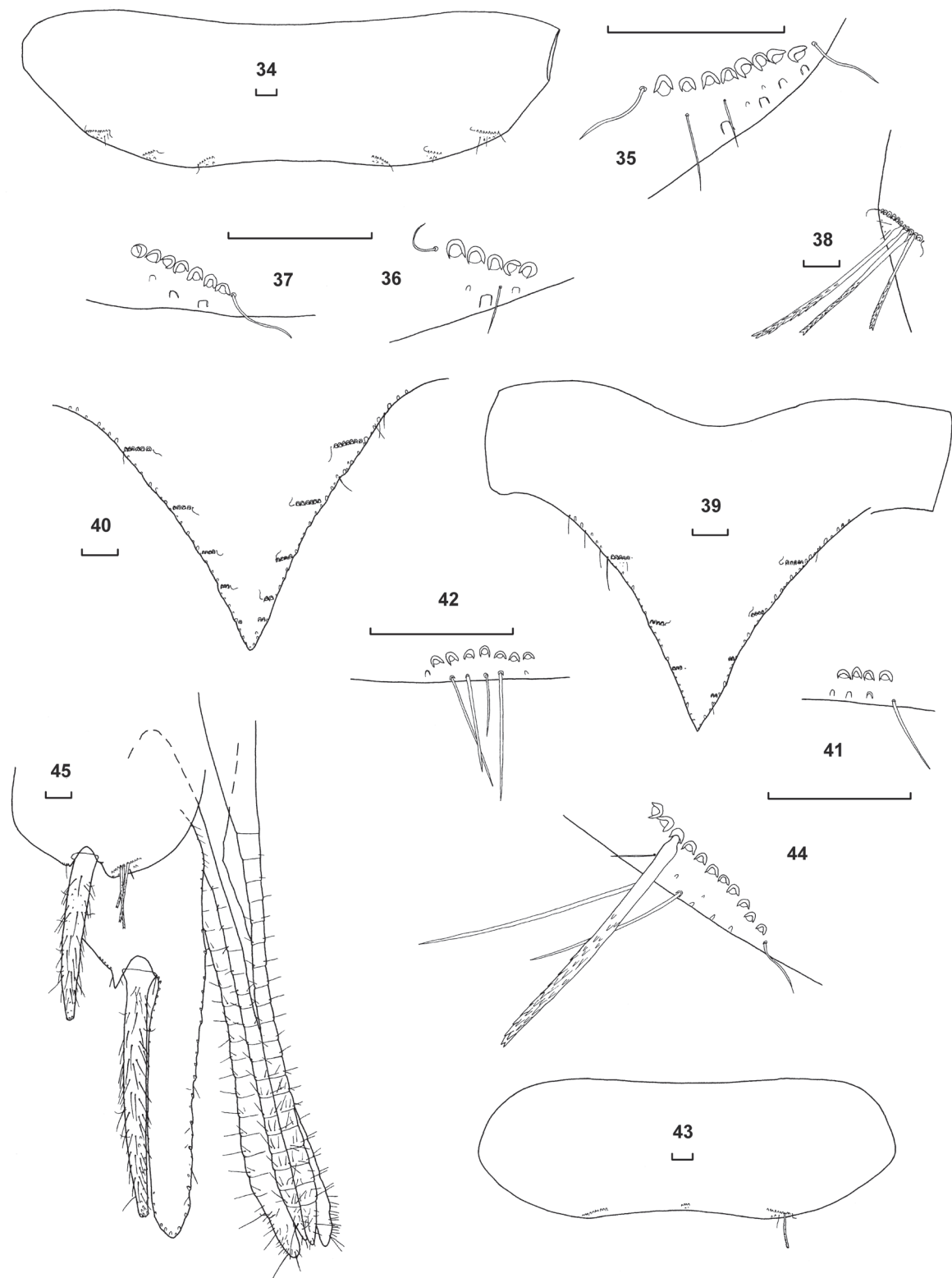
Genital region of ♀ as in Figure 45. The internal process of coxite IX long, almost as long as the ovipositor, more than four times longer than wide at its base and more than eight times longer than the external process. Apex of internal process rounded with macrochaetae along much of the margins. Ovipositor of primary type, not very long (up to 1.9 HW), only just surpassing the apex of the internal process of coxite IX, composed of about 22 articles. Distal area of gonapophyses VIII and IX as in Figure 46 with only long and short fine setae and setulae.

Coxite VIII in ♂ entire (Fig. 47) with 1+1 combs of 13 macrochaetae as well as two to four marginal setae and about seven setulae. Coxites IX in ♂ separated as in Figure 48, each side with a long macrochaeta (almost as long as the internal process) mediad to the base of the stylet. The internal process very acute apically, about three times longer than the external process and 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 moderately strong setae. Outer process small acute triangular with several setae along the outer margin. Penis typical with numerous glandular setae apically, each set on a protuberance. Parameres absent.

Cerci (Figs 49, 50) with four basal articles shorter than wide then progressively longer with setae, macrochaetae and trichobothria. Hyaline scales present at least on outer face of more basal articles of cerci. Most distal surviving

Table 1. Number of macrochaetae per bristle comb.

Segment	Urotergite			Urosternite	
	Lateral	Sublateral	Submedial	Lateral	Medial
I	5–6	-	-	-	-
II	5–7	5–6	5–8	-	4–7
III	5–8	5–6	5–8	11–13	3–6
IV	9	4–7	6–8	10–12	4–6
V	7–10	4–6	5–9	11–14	0–2?
VI	8–12	5–6	6–7	11–13	0–4
VII	7–11	5–6	7–8	9–16	0
VIII	8–11	-	7–8	12–14	-
IX	-	-	-	1♂, 0♀	-



Figures 34–45. *Acrotelsella erniei* n. sp., female holotype unless otherwise indicated by specimen number. (34) Urotergite VI?; (35) idem, lateral comb; (36) idem, sublateral comb; (37) idem, submedial comb; (38) lateral comb of urotergite VII of paratype (NTM I009250) showing some of the pectinate macrochaetae; (39) urotergite X; (40) urotergite X of male (NTM I009250); (41) medial comb of urosternite II; (42) medial comb of urosternite II (NTM I009250); (43) urosternite IV?; (44) urosternite V?, detail of left comb; (45) genital region of female with the right halves of urosternites VIII and IX. Scale bar = 0.1 mm.

articles very long and thin as in Figure 50, with large macrochaetae only at distal end of each article with setae and curled thin hairs at regular intervals as well as two? trichobothria. Median dorsal appendage with some very short basal articles, which soon become progressively longer with more numerous strong macrochaetae, especially at the ends of each long article.

Subadult stages. No completely juvenile specimens were collected. The smaller subadult ♀ (K377610 HW 0.99) had stylets VIII and IX and an ovipositor that was about the same length as the internal processes which did not quite reach the end of stylets IX.

Habitat. Two hundred metres below the summit on underside of grey rocks which were partly buried in soil (Fig. 3).

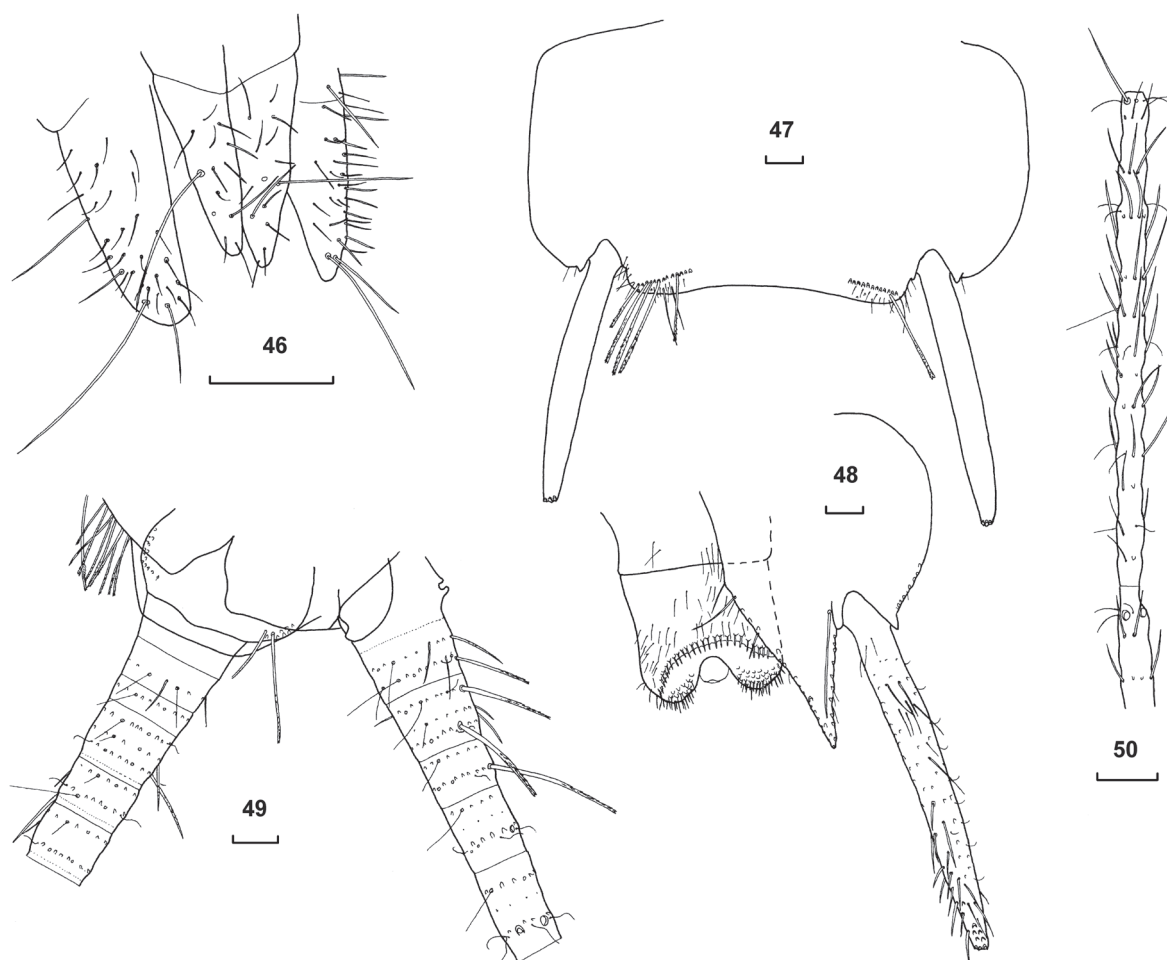
Derivation of name. The species is named in memory of a good friend who recently passed away. David 'Ernie' Unwin (17.07.1956–2.04.2014) shared many excursions into the Australian bush with me. He had a passion

and a talent for the photography of fungi and as a keen 'geocacher' was a source of advice with regards to the complexities of locality co-ordinates.

4. Discussion

4.1. Morphology

Published descriptions of most *Acrotelsella* species are currently inadequate to differentiate between species. This is further complicated by the apparent variability within a species due to age and moulting phase or just due to variability often within a single population (or even from the left side of an individual to its right side). Nevertheless there appears to be a wealth of morphological characters that will be useful for a revision of the genus. For example, some species have very long



Figures 46–50. *Acrotelsella erniei* n. sp., female holotype unless otherwise indicated by specimen number. (46) Apical articles of gonapophyses; (47) urosternite VIII and stylets VIII of ♂ (NTM 1009250); (48) urosternite IX, left half with penis (NTM 1009250); (49) base of median and lateral cerci; (50) most distal surviving article of lateral cercus. Scale bar = 0.1 mm.

lateral notal combs while others, like *A. erniei*, have short combs. At least one species (from Barrow Island) displays transverse combs on the inner processes of urosternite IX and these also show quite different levels of elongation. Irish (pers. comm.) found some Australian species to have only three papillae on the last article of the labial palps (since confirmed for several species by the author), five in a single line is quite common, with others having a long line of up to 12 (see Irish, 1987 for discussions on the variability of papillae number in the well-known and widely distributed *Ctenolepisma longicaudata* Escherich, 1905). Some species have an obvious long thin seta (trichobothria?) on the legs, others appear to lack this seta. Many species have ovipositors of the secondary type with a series of modified spines on the apical articles of the gonapophyses, while others such as *A. erniei* do not. There is also a great degree of diversity visible in the type and probably distribution of scales. Given the large number of *Acrotelsella* species the author has collected or seen within collections, much work will be required before a coherent morphological phylogeny emerges.

Of all the described *Acrotelsella* material and that seen by the author, *A. erniei* is the only species so far seen to have medial combs on the urosternites. These are fairly delicate and somewhat inconsistent in their occurrence, suggesting that they are not a very stable character. The presence of medial combs in other Lepismatidae has been used to erect robust subgeneric arrangements [e.g. *Ctenolepisma* (*Sceletolepisma*) Wygodzinsky, 1955 (sensu Irish, 1987)] and this may prove the case with *Acrotelsella erniei*, however, such a decision would be better made in conjunction with a comprehensive review of the genus.

4.2. Zoogeography

The genus *Acrotelsella* is fairly widely distributed, now with 19 described species or subspecies (which the author suspects will eventually be raised to species). Eight of these are described from Australia. Shortly after Escherich's description of *A. producta*, Silvestri (1908) described *Acrotelsella devriesiana* and *A. perspinata* (as a subspecies of *devriesiana*) from south-western Australia. Nicholls & Richardson (1926) later described *A. westralis* (also as a subspecies of *A. devriesiana*) and a further species, *A. splendens*, both also from Western Australia. Mendes (1989) has redescribed the latter species from material collected in Indonesia and Thailand; however, given the diversity of *Acrotelsella* species now being found in Australia, his redescription should probably be re-examined with reference to the

original type specimens, which are held by the Western Australian Museum. Womersley (1939) described a further two species (*Acrotelsella escherichi* from South Australia and the Northern Territory and *A. silvestri* from South Australia), while considering part of Escherich's *A. producta* material, as well as the two varieties of *A. producta* described from Seychelles (Silvestri, 1935) as synonyms of *A. splendens*. These early descriptions, while appropriate for their time, are no longer adequate. Given the far greater diversity of morphospecies now known, it will eventually be necessary to redescribe all the above listed species taking into consideration the much broader range of characters now considered significant at the species level.

The remaining species include five from the eastern Ethiopian Region (Kenya, Madagascar, the Seychelles, Somalia and Yemen), five from the Oriental Region (China, Indonesia, the Philippines, Sri Lanka, Thailand, Vietnam), one from the Neotropical Region (Colombia) and three from the Pacific islands (Hawaii and the Marquesas). With the large number of Australian species now known to exist, it is possible that Australia is the centre of radiation for the genus. This could however reflect the general lack of knowledge of the Zygentoma with only Europe, northern and southern Africa being well prospected. The multiple examples of *Acrotelsella* populations on isolated islands of volcanic origin suggests that it is reasonably proficient at crossing large ocean distances, possibly under the bark of floating trees or in other 'rafts' of flood debris. The limited biological data that exist for the Lepismatidae (e.g. Lindsay, 1940) show that at least some species are long-lived (up to seven years in *Ctenolepisma longicaudata* Escherich, 1905) and have the ability to absorb moisture from the atmosphere through their anus (Noble-Nesbitt, 1970 for *Thermobia domestica* (Packard, 1873)). These abilities, as well as their omnivorous diet would be beneficial in surviving a long sea voyage.

4.3. Ecology

The author has mostly found specimens of *Acrotelsella* in the drier hotter parts of Australia, in dry leaf litter, under rocks and from the bark of trees. However, a few specimens have been collected from under bark in tropical vine forests at the northern end of the Cape York Peninsula where annual rainfall is between 1200 and 2300 mm, but nearly all of this falls in the summer months of December to May (data for Heathlands National Park), resulting in a very dry climate at times.

Is *Acrotelsella erniei* n. sp. an endangered short range endemic species?

Acrotelsella erniei was collected in one of the driest parts of the continent. Weather data for Papunya (80 km northeast of Mt Sonder, 608 m asl) show an annual rainfall of 301 mm per annum, falling mostly in the hotter summer months with a total annual evaporation rate of 3000 mm per year. The mean maximum temperature is 38°C in the hottest month (January) with a highest daily maximum of 44.8°C and a mean annual minimum of 6.3°C in July. Using a lapse rate of 6.4°C per 1000 m elevation, the temperature where *Acrotelsella erniei* was collected would be cooler with a mean maximum of 34.3°C and a highest maximum of 40.7°C in January and a mean minimum in July of 2.6°C. The summit of Mount Sonder could be expected to be 1.28°C cooler than at the altitude from where these silverfish were collected. If this species is limited to this higher altitude by a requirement for cooler temperatures, then it may indeed be threatened by global warming. Current data suggests that temperatures in Australia are increasing by 0.02–0.03°C per year. It would require only another 50–80 years until the temperatures even at the top of the mountain exceeded that where *A. erniei* was collected in 2009.

Such postulation is, however, very tenuous. The knowledge of Australian silverfish is extremely limited and collection efforts spasmodic at best. Moderate collection effort over several days around the West MacDonnell Ranges did not find this species at any other location, but it is a huge and complex area. There are also several other isolated peaks in the region that were not sampled (e.g. Mt Razorback 1274 m asl and Mt Zeil 1531 m asl, 15 and 27 km to the northwest respectively), either of which could offer similar cooler conditions near their summits suitable to *A. erniei*, but which may well have genetically isolated and quite different silverfish.

It is therefore not possible to say whether this species is endangered. Without more effort to investigate the Australian fauna, we may never know the answer to this question.

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6. References

- Escherich, K. (1905): Das System der Lepismatiden. – *Zoologica (Stuttgart)* **43**: 1–164.
- Irish, J. (1987): Revision of the genus *Ctenolepisma* Escherich (Thysanura: Lepismatidae) in southern Africa. – *Cimbebasia (A)* **7**: 147–207.
- Irish, J. (1988): Revision of *Stylifera* Stach and its bearing on African south west arid biogeography (Thysanura: Lepismatidae). – *Annales de la Société Entomologique de France* **24**: 59–67.
- Lindsay, E. (1940): The biology of the silverfish, *Ctenolepisma longicaudata* Esch. with particular reference to its feeding habits. – *Proceedings of the Royal Society of Victoria* **52**: 35–83.
- Mendes, L. F. (1982): Dados sobre a sistemática evolutiva e a zoogeografia dos Lepismatidae (Zygentoma); Revisão das espécies do género *Lepisma* s. latum. Vol. 2. – Thesis, Universidade de Lisboa - Faculdade de Ciências (unpublished). Lisbon: 270 pp.
- 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**: 79–92.
- Nicholls, G. E. & Richardson, K. C. (1926): A description of two new species of *Acrotelsa*. – *Journal of the Royal Society of Western Australia* **12**: 133–142.
- Noble-Nesbitt, J. (1970): Water balance in the firebrat, *Thermobia domestica* (Packard). The site of uptake of water from the atmosphere. – *Journal of Experimental Biology* **52**: 193–200.
- Paclt, J. (1967): Thysanura. Fam. Lepidotrichidae, Maindroniidae, Lepismatidae. – *Genera Insectorum* **218e**: 1–86.
- Silvestri, F. (1908): Thysanura. –In: Michaelsen, W. & R. Hartmeyer (eds): Die Fauna Südwest-Australiens. Ergebnisse der Hamburger südwestaustralischen Forschungsreise 1905, Vol. 2. – Gustav Fischer, Jena: 47–68.
- 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.
- 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. – Frank Trigg, Government Printer, Adelaide: 322 pp.
- Wygodzinsky, P. (1959): Thysanura and Machilida of the Lesser Antilles and northern South America. – *Studies on the fauna of Curaçao and other Caribbean Islands* **36**: 28–49.

