

A NEW INQUILINE SILVERFISH GENUS (ZYGENTOMA: NICOLETIIDAE: ATELURINAE) FROM WESTERN AUSTRALIA

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Summary

Galenatelura deflexa gen. & sp. nov. is described from mounds of the termite *Coptotermes brunneus* Gay, from Western Australia.

Keywords: new genus, new species, termite

INTRODUCTION

The Australian inquiline silverfish fauna has been poorly collected and even more poorly studied (Smith 2007). Eight species of Atelurinae have been described from Australia, belonging to the genera *Australiatelura* Mendes, 1995, *Allatelura* Silvestri, 1947, *Ausallatelura* Smith, 2007 and *Pseudogastrotheus* Mendes, 2003 as well as the unplaced *Atelura similata* Silvestri 1908a. Wygodzinsky, 1963 included *A. similata* in *Atelurodes* Silvestri, 1916 based on the five pairs of urostylets. Mendes, 2003 however refutes this position, correctly noting that *A. similata* has different chaetotaxy and lacks the characteristic, closely spaced, medial vesicular structures on urosternite II. Given the strong association of these silverfish with ants or termites and the richness of this host fauna in Australia, it is likely that many more inquiline species and genera will be found.

This paper describes a new genus and species of silverfish from specimens collected over 50 years ago. They were found in the nest of the termite *Coptotermes brunneus* Gay (Isoptera: Rhinotermitidae) north of Galena (near Kalbarri) in Western Australia. This species of silverfish displays a number of apomorphic features and a marked sexual dimorphism.

MATERIALS AND METHODS

The following abbreviations are used in this paper: ACT: Australian Capital Territory, Australia; ANIC: Australian National Insect Collection, CSIRO, Canberra, ACT; IICT: Zoology Unit of the Instituto de Investigação Científica Tropical, Lisbon, Portugal; H+B: head and body length; WA: Western Australia.

Specimens in alcohol were measured using a graticule in the 10x ocular of an Olympus CHT microscope as follows: H+B: from anterior edge of head between antennae to base of apical macrochaetae on urotergite X in females or the posterior margin of urotergite IX in the males; head width: distance across head where it disappears under the prothorax; thorax: width between

widest points of metathorax, length along midline from back of head to posterior margin of metathoracic tergite; antennae: from base of scape to tip; cerci and medium dorsal appendages: from proximal end of first article to tip; palp articles: length between ends of each article or to the tip (excluding any papillae or sensillae), width across widest part of article; tibia: length along dorsal/anterior edge between joints, ignoring the overlap of the bifurcated spines.

Drawings were made using an Olympus CX31 biological microscope fitted with a U-DA drawing attachment.

Some slide material was prepared by transferring dissected parts through 100% ethanol, 100% acetone, Euparal essence then into Euparal on a slide. While effective, it was very labour intensive. Slide material was more recently prepared using Tendeiro solution, where specimens can be dissected in 100% ethanol and then transferred directly to the slide (see Pagès and Sarto I Monteys, 2005 for composition of Tendeiro solution); a far more practical method.

Specimens for scanning electron microscopy were critical point dried using an acetone/carbon dioxide system. The electron microscope used was a Philips 505, using a voltage of 10kV, a spot size of 20nm and a back-scattered electron detector.

SYSTEMATICS

Galenatelura gen. nov.

Type species: *Galenatelura deflexa* sp. nov.

Diagnosis: ♂. Medium sized (3.4 – 4.2 mm), limuloid, almost half as wide as long; body strongly convex dorsally (Figures 2, 3), thorax wider than abdomen, the latter tapering posteriorly. Scales multi-radiate with ends of the 16-22 rays extending well beyond the edge of the membrane (Figure 4). Scales lacking from head, ovipositor, subgenital plate and appendages (except some areas of coxa). Macrochaetae thin and simple, although a very few have a fine apical bifurcation.

Head: partially covered by large prothorax; exposed portion rounded, hypognathous, with isolated thin setae (Figure 5). Antennae short (Figure 6); less than half H+B; about 26 articles. Ultimate antennal article subdivided into two sub-units, with a small terminal process (Figure 7), remaining articles not sub divided, with numerous setae and trichobothria. Pedicel with a shallow fovea defined within a partial ring of setae and with numerous short setae within the depression (Figure 8).

Mouthparts: Labrum typical for family (Figure 9). Mandibles (Figure 10), incisor region with five well sclerotised teeth, molar region with six strong spines (Figure 11). Maxillae (Figure 12) with lacinia the same length as the galea; lacinia with simple pointed apex although somewhat chisel-like on tip rather than pointed, pectinate prostheca extending beyond tip of lacinia; galea lacking distinct apical conules but with a very small apical papilla (Figure 13). Maxillae palp stout, with a single feathered papilla distally (Figure 14). Labium typical for family (Figure 15); ultimate article subovate, six sensory papillae distally (Figure 28).

Thorax: large, about half H+B, tergites strongly curved around the body, extending well below sides of body enclosing the legs; with small setae along lateral edges but not along posterior edge; several long thin setae scattered over surface of nota, forming weak rows but well back from margin (Figures 2, 16). Prothorax large, about as long as meso- and metathorax together.

Legs: short, stout (Figure 17), easily confined within cavity defined by large thoracic and abdominal tergites; coxa large, broad and flat, with some scales; femur with one strong, deeply bifurcated macrochaeta (almost lyriform) sub-distally on anterior edge; tibia with distal row of stout, deeply bifurcated lyriform macrochaetae (Figure 18), pretarsus four-articles, basal division large and remaining articles small with little, if any, articulation between joints; two simple, curved, smooth lateral claws, small medial empodial claw and two prominent pulvillae (Figure 19).

Abdomen: urotergites with lateral portions extending well over sides, anterior five with distinct fold ventrolaterally, each terga folding back on itself to define cavity to enclose the legs (Figure 29); long, thin setae dorsally in weak transverse row well back from posterior margin and very close to point of overlap of previous urotergite (Figures 1, 2). Setae on lateral (ventral) margin and comb of strong macrochaetae on posterior ventral margins of urotergites (Figure 3). Urotergite X weakly sclerotised, morphologically dorsal surface strongly de-flexed, morphologically

ventral surface almost vertical; large 1+1 fields of heavily sclerotised sensory conules, two strong macrochaetae apically (Figures 20, 30).

Urosternites I-III with at least 1+1 fine setae, close together on II but wider spaced on I and III, urosternites IV-VI with 2+2 setae, medial pair larger, urosternites VII-VIII with 3+3 setae; urosternites VI possibly with very obscure vesicles (refer discussion and Figures 21, 31); pseudovesicles present on urosternite VII; small stylets, approximately equal in size and lacking terminal spine, present on urosternites VI-IX; posterior edge of urosternites VI, VII and VIII shown in Figures 21, 22, 23 respectively.

Cerci short, stout, held almost vertically in contact with modified urotergite X, widely expanded proximally, with approximately eight articles, basal four of which appear to be fused on inner surface, first article very large, almost half length of cerci, basal three articles medially with four rows of heavily sclerotised modified setae/sensory conules directly apposed to those fields of sensory conules on urotergite X, some long fine setae and trichobothria (Figures 24, 30, 32). Medium dorsal appendage deflexed, directed slightly forward, not greatly widened at base without special modifications (Figure 20). Penis large, opening longitudinally, parameres simple, with field of small setae distally (Figure 25).

♀. As for male except longer (H+B 5.0 mm) due mainly to longer abdomen (Figure 1). Marginal macrochaetae in posterior-lateral corners of posterior urotergites not much stronger than macrochaetae on dorsal area of urotergites and not developed into comb-like structures. Urotergite X small but visible from above, with shallow v-shaped emargination on posterior edge (Figure 26), strong macrochaetae on apices; lacking fields of sensory conules on ventral surface. Urostylets IX almost twice as thick and about one and a half times length of those on urosternites VI-VIII. Cerci lacking modified spines/sensory conules. Medium dorsal appendage short and broad at base, not deflexed but extending posteriorly. Ovipositor short, about eight articles, not protruding beyond posterior limits of urotergite IX (Figure 27), with thin setae only. Subgenital plate small, semi-circular, with numerous short setae but lacking scales.

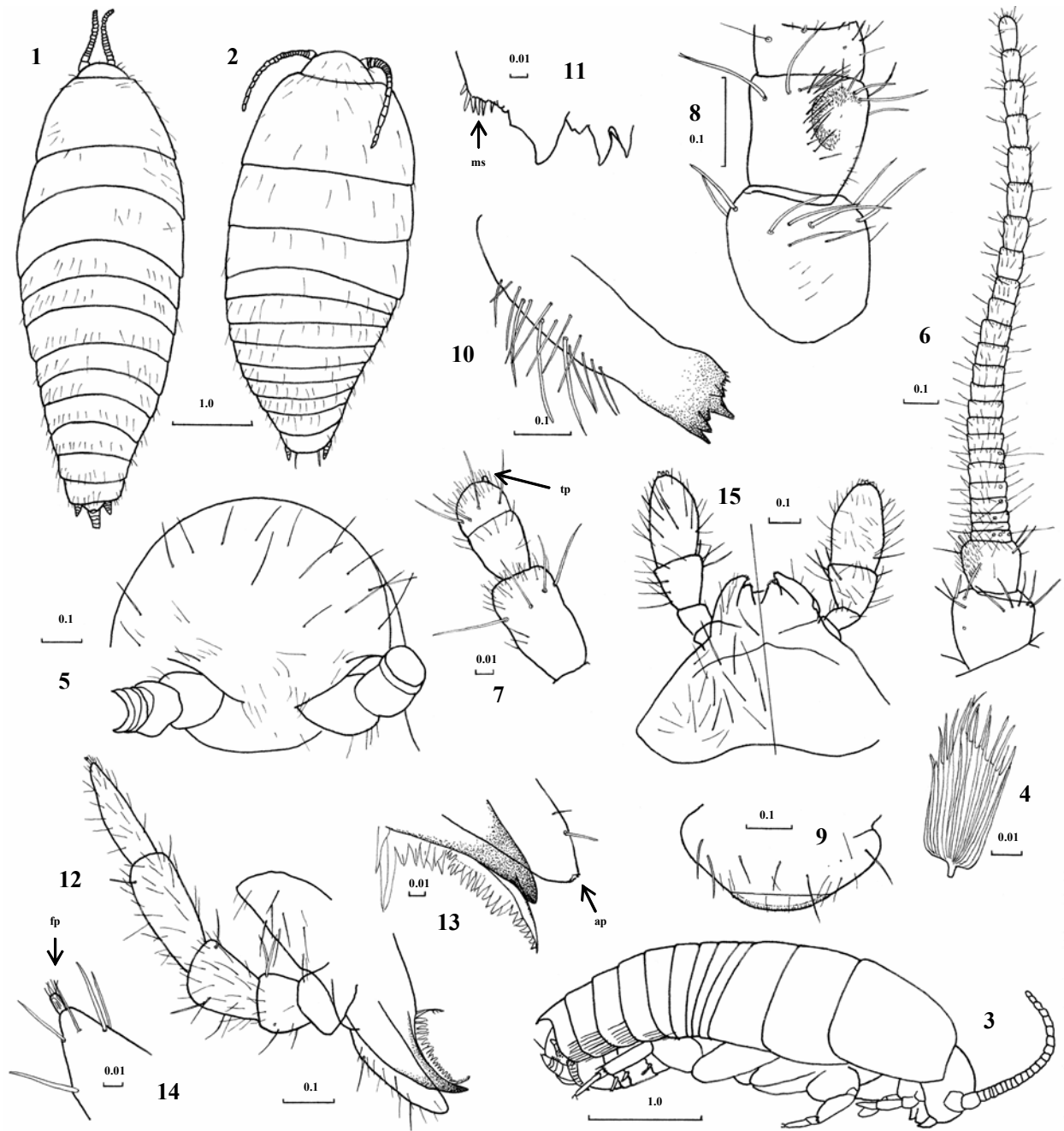
Etymology: The genus name derives from the area it was collected (Galena, WA) combined with *Atelura*, the type genus of the family.

***Galenatelura deflexa*, sp. nov.**

(Figures 1-33)

Holotype: ♂, 69 km NNW Galena, WA, with *Coptotermes brunneus* Gay; 23.x.1955, J.H. Calaby

Figures 1-15. *Galenatelura deflexa* sp. nov. (1 ♀, 2 - 15 ♂) 1. habitus, dorsal, 2. habitus, dorsal, 3. habitus, lateral, 4. scale, 5. head, anterior, 6. antenna, 7. enlargement of terminal articles of antenna, showing terminal process (tp), 8. scape and pedicel with fovea, 9. labrum, 10. mandible, 11. enlargement of same showing spines in molar region (ms), 12. maxilla, 13. enlargement of distal part of lacinia and galea of same showing apical papilla (ap), 14. enlargement of tip of maxillae palp showing distal feathered papilla (fp), 15. labium, left hand side from below, right from above. (scale bars in mm).



and F.J. Gay, (ANIC 10043)

Paratypes: 1 ♀, 6 ♂♂, same data as holotype (1 ♀, 5 ♂♂ 2 of these on four microscope slide preparations ANIC; 1 ♂ ICT)

Two further specimens 1 ♀, 1 ♂ same data as holotype, were examined by scanning electron microscopy and

are not designated as paratypes.

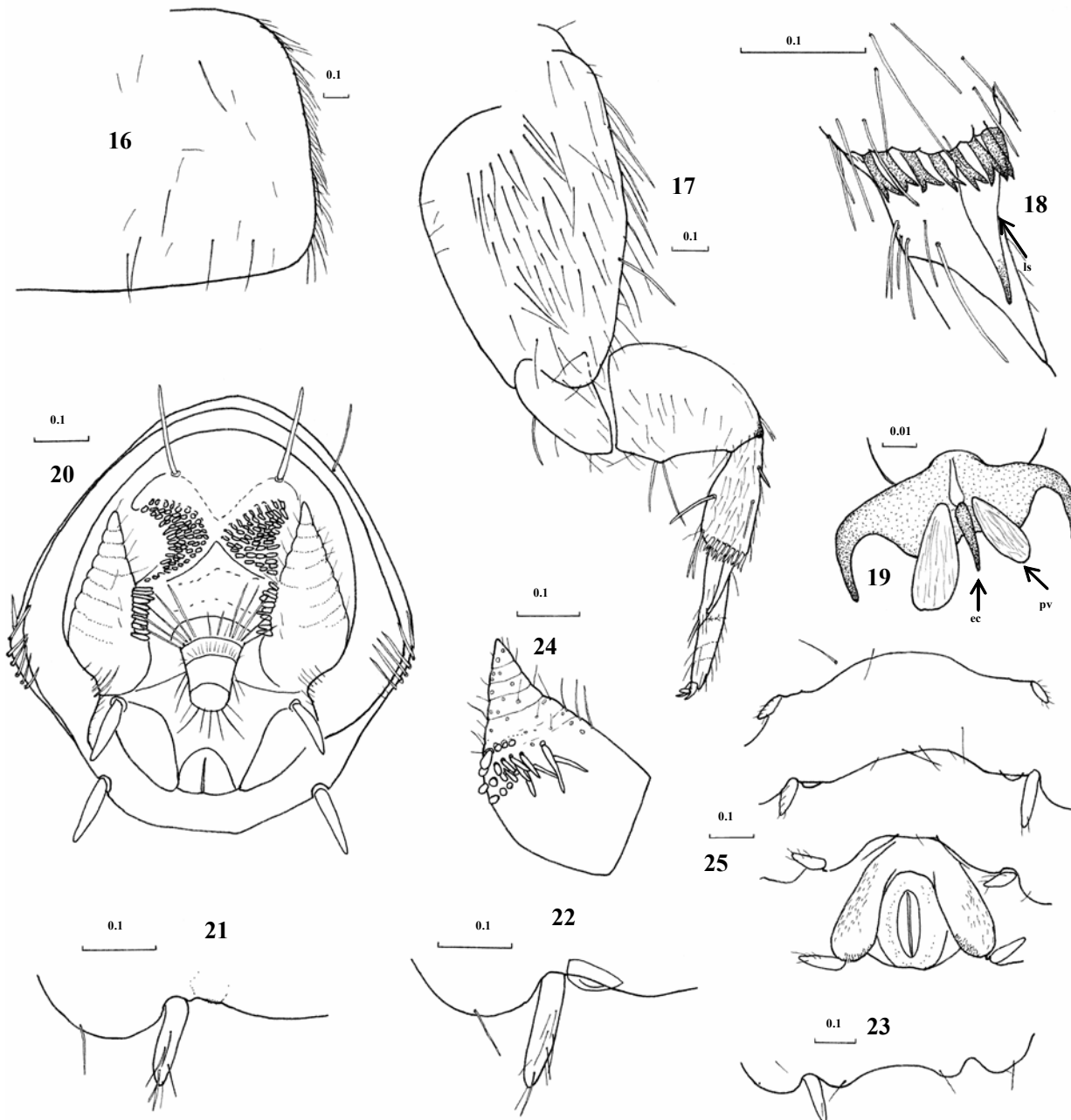
Description: H+B: 5.0 mm in largest specimen available (range of head widths 0.63 – 0.78 mm; range of H+B male 3.4 - 4.2 mm, female 5.0 mm; H+B of male 5 - 6 x head width, (female about 7x); antennae one third to one half H+B; cerci about one tenth H+B; median dorsal appendage slightly longer (about one eighth

H+B); legs of similar size e.g. metathoracic tibia only 15% longer than pro-thoracic tibia; ovipositor equal in length to about 1.2 x head width in single female measured; thorax slightly longer than wide and about half H+B in males; ultimate article of maxillae palp more than twice as long as wide and sub-conical in shape, sub-equal to penultimate article; but thinner and pointed; ultimate article of labial palp about twice as long as wide. Body rich gold colour in preserved specimens due to dense covering of scales which overlap

margins of sclerites; lacking hypodermal pigment.

Coxa with some long thin setae on margins and over ventral surface; trochanter reasonably large, about one quarter to one third length of total trochanter/femur unit; femur with two longer, stronger setae on distinct raised portion midway along posterior/ventral edge as well as single deeply bifurcated macrochaeta (almost lyriform) sub-distally on anterior edge; tibia about same length as femur (excluding trochanter) with four

Figures 16 - 25. *Galenatelura deflexa* sp. nov. ♂ 16. prothorax, right hand side, 17. prothoracic leg, 18. enlargement of distal end of tibia showing lyriform spines (ls), 19. pretarsus showing pulvillae (pv) and empodial claw (ec), 20. terminalia, posterior view, with deflexed urotergite X, 21. half of urosternite VI, 22. half of urosternite VII, 23. urosternite VIII, 24. cerci, 25. urosternites VI-IX, with penis and parameres. (scale bars in mm).



(or five) stout macrochaetae, one midway along anterior edge, remainder on posterior edge with one about one third length of tibia on corner of curve, sometimes one about midway and two more sub-distally, row of eight to twelve strong lyriform macrochaetae distally along ventral and lateral aspects, apical spur large but not quite reaching distal end of basal tarsal article (Figure 18).

Combs of macrochaetae on posterior, ventro-lateral margins of urotergites increasing in number posteriorly with maximum of about twelve macrochaetae on urotergite VII, and eight on urotergite VIII; those on urotergite IX much weaker, smaller and covering small area rather than being on margins (Figure 3).

Juvenile stages not described; all available specimens of a similar size and all appear mature.

Biology: Collected in mound nest of *C. brunneus*. The short legs, cerci and ovipositor are well protected by the overlapping tergites suggesting these insects defend themselves from the termites when necessary by retreating under tergites rather than relying on a turn of speed to evade their hosts.

Etymology: The species name refers to the deflexed nature of the tenth urotergite of the male.

DISCUSSION

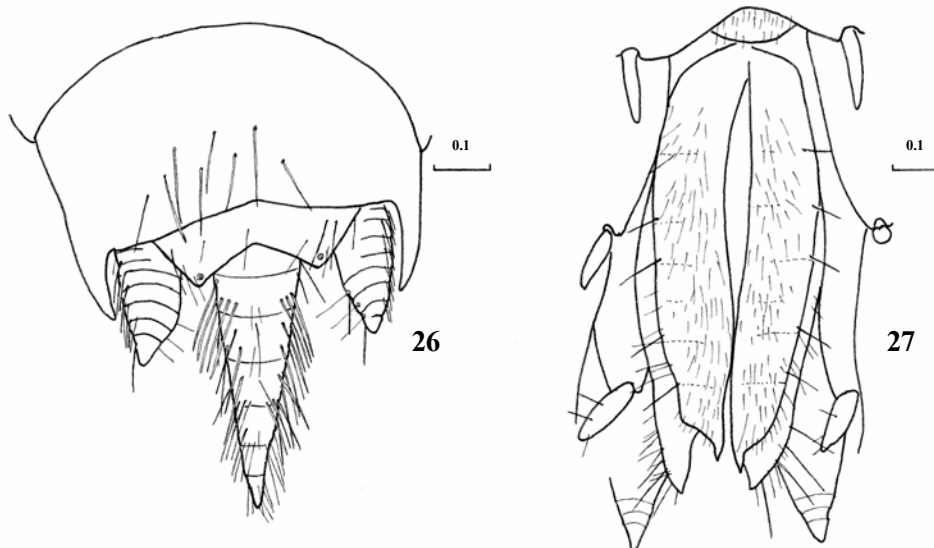
The presence or absence of vesicles on urosternite VI is somewhat ambiguous. Material in alcohol sometimes appeared to have a lighter bulge on the slightly recessed posterior margin of the sternite just inside the stylets and scales are absent from this small area where the vesicles would be expected. With slide

preparations, a small "double edge" to the sternite could be observed but it was not obvious that any vesicle was present and, under the electron microscope, the scales absorbed much of the electron energy creating strong contrast such that the underlying cuticle was in shadow and difficult to see (Figure 31). The collective observations are here interpreted as indicating the probable presence of weak vesicles however this needs to be confirmed with fresh material.

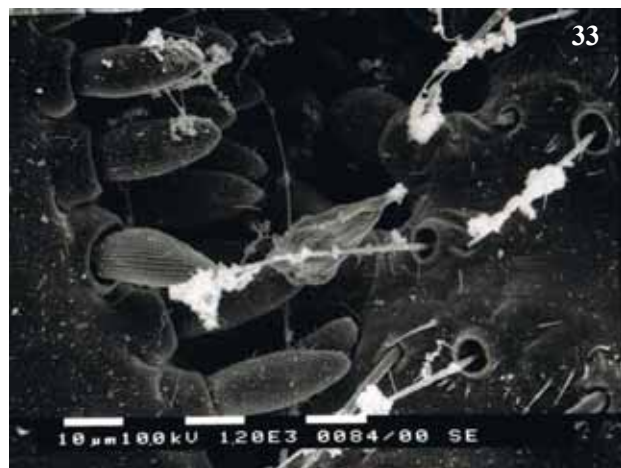
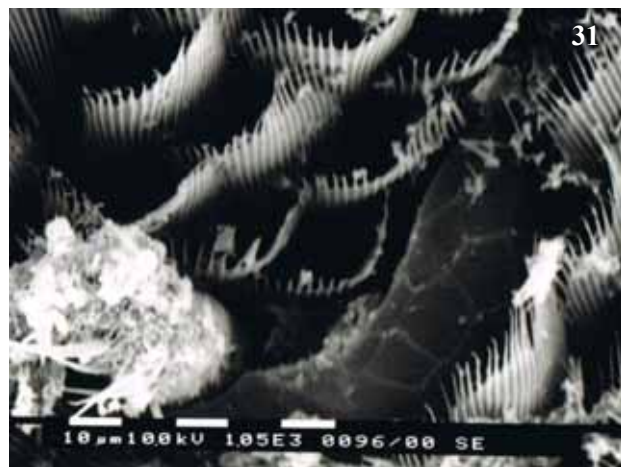
Galenatelura belongs within a grouping of genera suggested by Mendes (pers. comm.) that share several features including the lack of scales on the more or less exposed head capsule, the fovea and absence of a pedicellar apophysis on the male antennae, vesicles lacking from urosternite II, pseudovesicles on urosternite VII, vesicles on urosternite VI (when present) with a row of setae, a simple ovipositor with thin setae only, as well as the cerci and underside of urotergite X of the males with sclerotised pegs which do not occur on the median dorsal appendage. All described Australian genera as well as *Atelura similata* lie within this grouping.

Galenatelura shares several additional characteristics with *Allatelura* Silvestri i.e. the claws with pulvilli, the lack of scales on the head, rows of lyriform macrochaetae on the tibia, the number of stylets and the presence of heavily sclerotised sensory conules on both the ventral surfaces of urotergite X and the cerci, as well as the shape and arrangement of the penis and paramera. Both genera lack obvious vesicles with a row of setae on urosternite VI and are thus easily distinguished from the other Australian genera. *Galenatelura* differs markedly from *Allatelura*, however, in its rounded hypognathous head, the paucity of setae with bifurcated tips, the smaller urostylet IX of the male, the expanded and

Figures 26-27. *Galenatelura deflexa* sp. nov. ♀ 26. urotergites IX-X, dorsal, 27. ovipositor and subgenital plate, ventral. (scale bars in mm).



Figures 28-33. *Galenatelura deflexa* sp. nov. ♂ scanning electron micrographs 28. enlargement of papillae of labial palp, 29. habitus, ventral, 30. genital area, posterior, 31. urosterite VI, edge of sternite adjacent to stylet where vesicle should be located, 32. enlargement of cerci, 33. enlargement of sensory conules of urotergite X. (scale bars on plate).



fused basal articles of the cerci, the spined mandibular molar area, the forward pointing median dorsal appendage and the strongly deflexed urotergite X of the males, the sub-division of the ultimate antennal article only and the folded urotergites I-V forming a cavity

under the body and the smaller sub-genital plate. *Galenatelura* can be distinguished from other genera within Mendes' grouping as follows, the Afrotropical genus *Atopatelura* Silvestri, 1908b, *sensu* Mendes 1995, *Arabiatelura* Mendes, 1995 from the Red Sea basin

and the endemic *Australiatelura*, all have stylets on urosternites III-IX with those on III being sub-medial, as well as the obvious vesicles with setae on urosternite VI and a single obvious conule on the galea. *Rasthegotus* Mendes 2001 from the Democratic Republic of Congo, also has obvious vesicles with setae on urosternite VI and a single obvious conule on the galea but has stylets on urosternites VII-IX. The South African genus *Ecnomatelura* Wygodzinsky, 1961, 1970 has unusually laterally placed vesicles with setae on urosternite VI, stylets on urosternites VII-IX only and appears, from the illustrations, to have small spines in the molar area of the mandibles as well as at least one conule on the galea. The poorly described Chilean genus *Dodecastyla* Paclt, 1974 has stylets on urosternites IV-IX. The number of stylets is not however a good indicator of close relationships within the Atelurinae.

Galenatelura shares two superficial similarities with some quite unrelated South African genera. The deflexed urotergite X resembles that of the males of *Rulenatida apprima* Wygodzinsky, 1970 and urotergites folded to form a cavity is also found in *Natiruleda* Wygodzinsky, 1970. These genera differ, however in so many other ways (e.g. their highly modified stylets on urosternite IX, the modified paramera, the greatly widened base of the medium dorsal appendage, and apophyses on the pedicel, long series of eversible vesicles etc). This suggests that the deflexing of urotergite X, the modification of the cerci and the urotergal folds are parallel developments rather than indicating any relationship with *Galenatelura*.

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