

**CERORIBATULA GEN. NOV., FAVORIBATULA GEN. NOV. AND FAVORIBATULINAE SF. NOV.
(ACARIDA: CRYPTOSTIGMATA: ORIBATULIDAE) FROM SOUTH AUSTRALIAN SOILS**

D. C. LEE & C. M. BIRCHBY

LEE, D. C. & BIRCHBY, C. M., 1991. *Ceroribatula* gen. nov., *Favoribatula* gen. nov. and *Favoribatulinae* sf. nov. (Acarida: Cryptostigmata: Oribatulidae) from South Australian soils. *Rec. S. Aust. Mus.* 24 (2): 71-89.

Ceroribatula gen. nov. (including two species-complexes) and *Favoribatula* gen. nov. are established, with seven new species as follows: *Ceroribatula incrustata*-complex, *C. incrustata* (type-species), *C. bitygata*, *C. monozygata*, *C. trirostrata*; *C. megafuramina*-complex, *C. megafuramina*; *Favoribatula brevisetosa* (type-species), *F. mesosetosa*. They are grouped in the *Favoribatulinae*, a new subfamily in the Oribatulidae, with four other genera. The new species are from plant litter, moss or soil at the four drier (arid, semi-arid, mallee-broombush, mallee-heath) sites of the nine florally diverse South Australian sites sampled. Four species carry a conspicuous cerotegument, which in *C. incrustata* forms patches of thick wax. The leg chaetotaxy of the Oripodoidea is briefly discussed and the absence of setae on femora I and II is given taxonomic significance. There is a key to adults of Australian species of *Favoribatulinae*.

D. C. Lee and C. M. Birchby, South Australian Museum, North Terrace, Adelaide, South Australia 5000. Manuscript received 1 November 1989.

This is a further part of an ongoing study of sarcoptiform mites in South Australian soils, sampled from nine florally diverse sites, and for which an introduction to the relevant work on the advanced oribatid mites (Planofissurae) has been published (Lee 1987). The mites considered here have been referred to as 'seven species of *Oribatula*-like mites' in the publication describing *Decoribatula* Lee & Birchby, 1989. They are grouped here in two new genera. With *Brassiella* Balogh, 1970, *Decoribatula*, *Reticuloplia* Balogh & Mahunka, 1966 and *Romanobates* Feider, Vasiliu & Călugăr, 1970, they make up the *Favoribatulinae*, a new subfamily within the Oribatulidae Thor, 1929.

The *Favoribatulinae* has a deficient chaetotaxy on femora I and II, which is unusual amongst the Oripodoidea. This has had some consideration with the description of *Decoribatula* Lee & Birchby, 1989, but is further commented on here. Also the sejugal apodeme notation and the terms used to describe sculpturing of the integument are briefly reconsidered.

The notum is illustrated for all seven species, but the idiosterna are so similar for some pairs of species that they are only illustrated for four species. The only complete set of legs illustrated is for *Ceroribatula incrustata* (Fig. 4), where, because of the variations in leg chaetotaxy, the setae are drawn on femora I and II. Some legs are illustrated for a further four species, mainly to represent the variations in chaetotaxy on femora I and II, but also the relative sizes of the tarsi and pretarsal claws.

Measurements are in micrometres (μm). The mites examined were all collected by one of us (D.C.L.) and are mainly deposited in the South Australian Museum (SAMA), but also in the Natural History Museum, London (BMNH), the Field Museum of Natural History, Chicago (FMNH) and the New Zealand Arthropod Collection, DSIR, Auckland (NZAC).

NOTATION AND LEG CHAETOTAXY

The modifications in morphological notation presented in papers on *Setobates* (Lee & Pajak 1988) and *Scheloribates* (Lee & Pajak in press) are followed here, but elaborations are made in defining apodemes and describing the integumental sculpturing, whilst the relevant leg chaetotaxy is discussed.

Three types of apodemes are associated with the sejugal somal division: *dorsosejugal apodeme* (= dorsophragmatic apophysis of Norton 1983); *pleurosejugal apodeme* (= bothridial apodeme of Lee 1987, which merges dorsally with the integument near the bothridium of sensory seta α_2); *ventrosejugal apodeme* (= sejugal apodeme of the podosternum). Also, two further thickenings in the podosternal integument, other than apodemes I, II and III associated with the coxites, are apparent in the largest species (*C. trirostrata*, Fig. 9), *midsternal apodeme* dorsal to seta IIIA, and the *postpodal apodeme* abaxial to seta IV2 (not homologous with

apodeme IV, which is absent in the mites considered here).

It is characteristic of Fovoribatulinae that the integument is sculptured and incrustated with a substantial and sometimes conspicuous cerotegument. The sculpturing often consists of many small pits, each in the centre of a shallow depression. The depression may be circular or, if bounded by reticulate ridges, hexagonal. The reticulate ridges probably consist partly of the cerotegument (the superficial layer of the integument developed by exudation through pores in the cuticle), since they are conspicuous and more raised around the patches of thick wax on *Ceroribatula incrustata* (Fig. 3). The thick wax is columnar, white and strongly refractile, the hexagonal columns growing out at right angles to the integument surface, both in this species and *Reticuloppia reticulata* Balogh & Mahunka, 1966. On the other hand, the wax may form a thinner layer, uniformly covering the integument, and sometimes containing small, refractile wax granules making it either generally dirty white in colour as on *Ceroribatula bitygata* or forming white patches as on *Ceroribatula tirostrata* and *Fovoribatula mesosetosa*. The microsculpturing varies, the different states merging into a continuum, but they are categorized as follows: *foveate*, pitted; *reticulate-foveate*, pitted, with each pit in a hexagonal space delineated by reticulate ridges; *reticulate*, reticulate lines or ridges without pits; *alveolate*, depressions that may be separated by indistinct reticulation.

The chaetotaxy of five setae on both femora I and II is the same for most members of the Oribodoidea. Using only the four major files of setae on a leg segment (see Lee 1981, fig. 19), this chaetotaxy is represented by the number of setae that are *anterior*, *dorsal/ventral*, *posterior* and is given as follows: I - 0,2/2,1; II - 0,2/2,1. Exceptionally some setae are absent, either just the posterior seta as in Symbionibatidae Aoki, 1966 and a few genera of Oripodidae Jacot, 1925, or always the distoventral seta (v2) on femur II and some other ventral or posterior setae on femora I and II, as in Lamellareidae Balogh, 1972, Crassoribatulinae Balogh & Balogh, 1984, and the genera grouped here in the Fovoribatulinae sf. nov. The absence of such setae, at least within the latter two subfamilies of Oribatulidae, is considered primitive because they are also absent in the Licneremacoidea, regarded as the most primitive group within the Poropota and a sister group to the Oripodoidea. But it should be noted that the Galumpoidea, regarded as the most derived superfamily within the Poropota, always lacks seta v2 on femur II.

The relevant femoral chaetotaxy in the Oribatulidae has a number of forms when it is deficient as in the Fovoribatulinae and

Crassoribatulinae. These are listed, with the most deficient first, as follows:

I - 0,2/1,0; II - 0,2/1,0 some *Ceroribatula*

I - 0,2/2,0; II - 0,2/1,0 some *Ceroribatula* and *Reticuloppia*

I - 0,2/1,1; II - 0,2/0,1 *Brassiella*

I - 0,2/1,1; II - 0,2/1,1 *Fovoribatula* and *Decoribatula*

I - 0,2/2,1; II - 0,2/1,1 *Romanobates* and *Crassoribatula*.

The chaetotaxy of *Brassiella* and *Crassoribatula* is not given in the literature, but is newly recorded here after examining the holotypes of *Brassiella penicillifer* Hammer, 1973 and *Crassoribatula maculosa* Hammer, 1967. Not all variations are reflected in the above presentation of chaetotaxy, for example, in *Fovoribatula* the ventral seta on femur I is distoventral (v2 - see Fig. 13), whilst in *Decoribatula* it is proximoventral (v1 - see Lee & Birchby 1989, fig. 2). Also illustrations sometimes suggest a different setal position because of the orientation of leg segments, as for femur I of *Ceroribatula monozygata* (Fig. 5), where v1 appears to be in position p1. Such possibilities for confusion are greater when the greatest number of setae are absent compared with the usual complement for the Oripodoidea, since the seta present may be located in an intermediate position between its usual place and the expected position of the absent seta. In previous papers on the Planofissurae by one of us (e.g. Lee 1987) only a seta 'v' has been shown on femur II, in order to indicate its relationship to a ventral flange that is sometimes present; more specifically this is seta v2.

SYSTEMATICS

Subfamily FOVORIBATULINAE sf. nov.

Nomotype genus: *Fovoribatula* gen. nov.

Diagnosis

Oribatulidae. Hysteronotum with 14 pairs of short, medium length or long setae. Translamella either absent, lineate or costate; if laminar it is confined to the lateral part and not present across midline. Lateral proteronotal foramen (F1) small but clearly multiporose. Sensory seta (s2) clavate with subglobose caput. Integument usually with extensive foveate and/or reticulate sculpturing, often with substantial cerotegument, sometimes forming thick, white, refractile, columnar wax. Anterior margin of hysteronotum either convex with dorsosejugal furrow curving around lenticulus or truncated with straight dorsosejugal furrow and no lenticulus. Femur II with fewer than normal five setae, at least seta v2 absent (0, 2/1, 1). Legs slim, medium length or long, leg IV (femur-tarsus)

usually longest, sometimes subequal in length to leg I.

General Morphology and Character State Polarization

On the basis of the absence of femoral setae, both Fovoribatulinae and Crassoribatulinae are regarded as a primitive group within the Oribatulidae (see section on 'Notation and Leg Chaetotaxy'). The Oribatulidae in turn is regarded as a primitive family within the Oripodoidea because of its multiporose hysteronotal foramina and a lack of pteromorphs. The Fovoribatulinae is, therefore, recognised by the absence of derived character states. The Crassoribatulinae, which also lacks seta v2 on femur II, is distinguishable from the Fovoribatulinae by three derived character states: ten pairs of hysteronotal setae, six pairs of genital setae and a midsternal gap in the ventrosejugal apodeme.

The classification established here for genera within the Fovoribatulinae is based on the premise of a polarization of the increasing number of setae on femur I and II being more derived. There are considered to be two lineages, a primitive one in which there is no posterior seta on femur II, including *Ceroribatula* and *Reticuloppia*, and a derived lineage in which this posterior seta is present. On the basis of this, the similarities between *Reticuloppia* and *Decoribatula*, although due to derived characters (long hysteronotal setae and divided hysteronotal foramen F3), are convergent. The same is true for *Ceroribatula megaforamina* and *Fovoribatula mesosetosa*.

On the basis of this polarization, the states of other possibly important characters are polarized as follows. The seta s1 on the proteronotum, seta v on trochanter I and the hysteronotal setae are regarded as primitive if they are shorter and as derived if they are longer. For the proteronotal ridges, the presence of weakly laminar, complete lamellae or the presence of one or two translamellae (as *Ceroribatula bitygata*, Fig. 6) is considered to be primitive, whilst the absence of lamellae and translamellae (as *Reticuloppia reticulata* Balogh & Mahunka, 1966) is considered derived. For the hysteronotum, the presence of a lenticulus associated with a mid-dorsal, forward pointing protruberance and an undivided anterior multiporose foramen (F3) is regarded as primitive, whilst a straight anterior hysteronotal margin with no lenticulus and a divided anterior multiporose foramen (F3a and F3b), as for *Decoribatula pustulosa*, is derived. For the pretarsal claws, relatively short (cf. tarsus) claws with slim lateral claws (Fig. 4, leg II) is regarded as primitive, whilst long claws with stout lateral claws (Fig. 12) is derived.

Distribution

The Fovoribatulinae appears to be endemic to the Oriental and Australasian Regions. Within these regions it has not yet been found in cooler temperate southern Australia and New Zealand. This is based on few data, but from the South Australian sampling, *Ceroribatula* and *Fovoribatula* are represented by seven species (substantial species diversity) which are confined to the four drier, hotter sites. The previous records are of *Brassiella* from Ceylon, New Guinea, Samoa, New Caledonia and Tonga, *Decoribatula* from Singapore, *Reticuloppia* from tropical Queensland and *Romanobates* from southern Roumania. This suggests that the relevant faunas of the mallee and arid regions are derived from tropical faunas either as relicts from tertiary tropical climates in the region or as invaders from recent tropical climates to the north. As viewed here, the most primitive species occur in the mallee and arid region faunas, suggesting that they are the relicts.

Remarks

The Fovoribatulinae includes oribatulid genera that have a lack of certain femoral setae, and compared with the oribatulid Crassoribatulinae with a similar lack of setae, they have fewer genital setae, an entire rather than an incomplete ventrosejugal apodeme, and more hysteronotal setae. These latter three character states they share with Oribatulinae. The Fovoribatulinae are very different from the Lamellareidae, which also has a primitive lack of the same femoral setae. Without the recognition of the reduced chaetotaxy, members of a particular fovoribatuline group would be included in the Oribatulinae with species in either *Oribatula* Berlese, 1895 or *Zygoribatula* Berlese, 1916. There has, therefore, been a considerable reweighting of the importance of particular characters. The relationships between the six included genera, as presented here based on the femoral chaetotaxy places them in two sister-groups: the primitive *Ceroribatula* and *Reticuloppia*, and the derived *Brassiella*, *Decoribatula*, *Fovoribatula* and *Romanobates*. On the other hand, *Ceroribatula* is superficially most similar to *Fovoribatula*.

The nature and possible adaptive significance of the incrustation can only be given preliminary consideration. What is probably a similar incrustation is described on the humeral hysteronotal region of *Oribatula exudans* Tr    , 1961, but it is a homogeneous wax and not made up of columns. Wax blooms, although not so substantial, have also been described on an *Oppia* species (Brody 1970). The temporary presence of wax filaments making an arid region tenebrionid beetle white rather than black has been observed

as an adaption to control water loss (Louw & Seely 1982). This possible relevance of wax incrustations to water conservation could be true for *Reticuloppia* and *Ceroribatula*, but it is also possible that it is an excretory product.

The following six genera are included in the Fovoribatulinae: *Brassiella* Balogh, 1970, *Ceroribatula* gen. nov., *Decoribatula* Lee & Birchby, 1989, *Fovoribatula* gen. nov., *Reticuloppia* Balogh & Mahunka, 1966 and *Romanobates* Feider, Vasiliu & Călugăr, 1970. A key is provided for the eight Australian species included in the subfamily.

KEY TO AUSTRALIAN FOVORIBATULINAE (ADULTS)

- 1 — Hysteronotal setae longer than distance between their bases. Lamella absent or incomplete, not reaching bothridium to seta $\alpha 2$, which is turret-like (height subequal to diameter of pore). Five pairs of hysteronotal multiporose foramina. *Reticuloppia reticulata* Balogh & Mahunka
- Hysteronotal setae shorter than distance between their bases. Lamella present, reaching bothridium to seta $\alpha 2$, which has low profile (height less than $0.5 \times$ diameter of pore). Four pairs of hysteronotal multiporose foramina. 2
- 2 — Femora I and II lack posterior setae (Fig. 4). Pretarsal claws smaller; central claw less than $0.3 \times$ length of tarsus II. *Ceroribatula* gen. nov., 3
- Femora I and II with a posterior seta (Fig. 13). Pretarsal claws larger; central claw greater than $0.3 \times$ length of tarsus II. *Fovoribatula* gen. nov., 7
- 3 — Long proteronotal seta $\beta 1$ (subequal to distance $j2 - \alpha 1$, Fig. 10) and trochanter I seta ν (able to reach seta $\nu 2$ on femur I). *C. megafurcata* sp. nov.
- Short proteronotal seta $\beta 1$ ($0.6 \times$ or less distance $j2 - \alpha 1$, Fig. 1) and trochanter I seta ν (only able to reach seta $\nu 1$ on femur I or shorter). 4
- 4 — Femur I with seta $\nu 2$ present (Fig. 4). Translamella present or absent. 5
- Femur I without seta $\nu 2$ (Fig. 5). Translamella present. 6
- 5 — Translamella absent. Rostrum without incisions. Hysteronotal foramen $F3$ with longitudinal axis less than $2 \times$ breadth (Fig. 1). *C. incrustata* sp. nov.
- Translamella present. Rostrum divided by two incisions into three points. Hysteronotal foramen $F3$ with longitudinal axis more than $3 \times$ breadth (Fig. 8). *C. retrostrata* sp. nov.
- 6 — No ridge between proteronotal setae $j2 - j2$. Setae $j2$ and $\alpha 1$ ciliate and clavate (Fig. 7). Mid-sternal and hysteronotal integumental sculpturing foveolate. *C. monozygata* sp. nov.
- Lamella-like ridge present between proteronotal setae $j2 - j2$. Setae $j2$ and $\alpha 1$ smooth and lorate (Fig.

6). Midsternal and hysteronotal integumental sculpturing reticulate. *C. bitygata* sp. nov.

- 7 — Translamella present. Hysteronotal setae short ($j2$ length less than $0.5 \times$ distance from setal base $j3$) (Fig. 14). Lateral pretarsal claws depth more than $0.5 \times$ depth of central claw (Fig. 12). *F. brevisetosa* sp. nov.
- Translamella absent. Hysteronotal setae medium length ($j2$ length $0.5 - 1.0 \times$ distance from setal base $j3$) (Fig. 16). Lateral pretarsal claws depth less than $0.5 \times$ depth of central claw (Fig. 13). *F. mesosetosa* sp. nov.

Genus *Ceroribatula* gen. nov.

Type-species: *Ceroribatula incrustata* sp. nov.

Diagnosis

Fovoribatulinae. Hysteronotal setae short or medium-length (shorter than distance between their bases). Lenticulus present, associated with mid-dorsal forward pointing protruberance of hysteronotum. Lamellae present, laminar and complete (between $\alpha 1 - \alpha 2$). Translamella present (may be second costate ridge) or absent. Rim of bothridium (base of seta $\alpha 2$) low, not turret-like. Four pairs of hysteronotal multiporose foramina. Discidium present as costate ridge. Femora I and II without posterior setae usually three setae (0, 2/1, 0) but femur I may have four setae (0, 2/2, 0). Pretarsal claws short (central claw II less than $0.3 \times$ length of tarsus II).

Remarks

Ceroribatula is superficially similar to *Fovoribatula* gen. nov., but it is regarded as more closely allied to *Reticuloppia* Lee & Birchby, 1989, because of the chaetotaxy on femora I and II. The name is derived from the Latin 'cera' meaning wax, as used in the term 'cerotegument'. The cerotegument is sometimes particularly conspicuous and comprises contiguous merged vertical columns of wax as on *C. incrustata* (also is present on *Reticuloppia*). The genus includes two species-complexes: the *incrustata*-complex and *megafurcata*-complex.

incrustata-complex

Diagnosis

Ceroribatula. Hysteronotal setae (shorter than $0.5 \times$ distance between bases), proteronotal seta $\beta 1$ (shorter than diameter of bothridial aperture) and trochanter I seta ν (shorter than distance between setae $\beta 1 - j2$) short. Translamella present or absent. Femur I either with (0, 2/2, 0) or without (0, 2/1, 0) seta $\nu 2$.

Remarks

The *incrustedata*-complex is regarded as the more primitive group within *Ceroribatula*, having some species with only three setae on femora I and II and short soma (except for proteronotal setae *j1*, *j2* and *z1*) and trochanter I setae. It is diverse, comprising four new species as follow: *C. incrustedata* (type-species), *C. bilygata*, *C. monozygata*, *C. triostrata*.

Ceroribatula incrustedata sp. nov.

Figs 1-4

Female

Dorsal profile of hysteronotum subcircular, colour dark brown, cerotegument substantial posteriorly and pleurally around legs, white incrustation of wax always on proteronotum, rarely on hysteronotal humeral region (Fig. 3), sometimes on venter of femora I and II. Idiosomal length, 468 (mallee-heath, *n* = 9, 406-504) and 497 (mallee-broombush, *n* = 3, 488-509). Leg lengths (femur-tarsus for idiosomal length 488, mallee-heath): I - 239, II - 224, III - 222, IV - 270. Tibial maximum heights (for 488): I - 26, II - 18, III - 18, IV - 16.

Proteronotum with weakly laminar lamellae and costate sublamellae, translamella absent. Seta *j2* shorter (less than 0.75 \times) than *z1*, both ciliate, and clavate, cerotegument may increase size of caput. Dorsolateral aspect illustration (Fig. 3) represents the right seta *j2* as shorter due to parallax. Conspicuous cerotegument anterior to seta *z1* is undivided (Fig. 3) or may be bilobar, with the lateral subhexagonal wax columns being longer and curving outwards. Posterior to thick cerotegument, integument conspicuously reticulate-foveate and may have small vertical tubercles at angles of hexagons, and no incrustation further back where integument foveate or weakly alveolate with well-spaced circular shallow depressions. Lamella usually carries highly refractive segmented strip of cerotegument. Sensory seta *z2* clavate with globose caput and many fine pointed cilia, smaller and more numerous than represented (Figs 1 and 3).

Hysteronotal setae subequal in length, with two longitudinal distal files of cilia (usually only one file visible when viewed from above). Lenticulus smooth, pale, surrounding integument weakly alveolate, further laterally cerotegument conspicuous, either reticulate-foveate or forming columns in places (Fig. 3), posterodorsally mainly foveate. Multiporose foramina subequal in size and oval, position of *F5* and *F6* usually as illustrated (Fig. 1), sometimes closer to mid-line, when *F5* on adaxial side of seta *S5*.

Podosternum with circumpedal ridge merged with rest of subpedal ridge, extending to weak custodial ridge fading just anterior to pedotectum

II. Two adaxial setae on coxite I similar in length (*I1* and *I2* subequal). Central region with foveolate sculpturing similar to that illustrated (Fig. 2) around posterior margin of genital orifice.

Opisthosternum with setae of fairly uniform length, *Sal* subequal to *Sa3*. Adanal pore *Saf* nearly longitudinal, further from anal orifice than its length. Eggs oval, 170 \times 75 (mean of 11 horizontally aligned eggs, 40% of mean female length), smooth or wrinkled exochorion. Number of eggs in female (number of females) as follows: four (2), six (2), eight (5).

Legs medium-length (mean femur-tarsus: 49% of soma), slim (mean maximum tibial height: 30% of mean length). Dorsal porose areas and weak alveolate abaxial sculpturing, usually with reticulate cerotegument on all femora and trochanters III and IV. Only three setae on femur II (0.2/1.0) and four setae on femur I (0.2/1.0).

Male

As for female except genital orifice not or only narrowly abutting onto ventrosejugal apodeme. White proteronotal incrustation present on 16 of 20 males ex mallee-heath and all 5 males ex mallee-broombush. Soma smaller, idiosomal length 425 (mallee-heath, *n* = 20, 398-475) and 429 (mallee-broombush, *n* = 5, 416-445).

Material Examined

Holotype: ♀ (N1989164), sand, litter, under banksia shrubs (*Banksia ornata*), Tamboore Homestead (35°57'S, 140°29'E), 4.viii.1974.

Paratypes: 6 ♀♀ (N1989165-N1989169), 16 ♂♂ (N1989170-N1989183); 1 ♀, 2 ♂♂ - BMNH; 1 ♀, 2 ♂♂ - FMNH; 1 ♀, 2 ♂♂ - NZAC; same data as holotype.

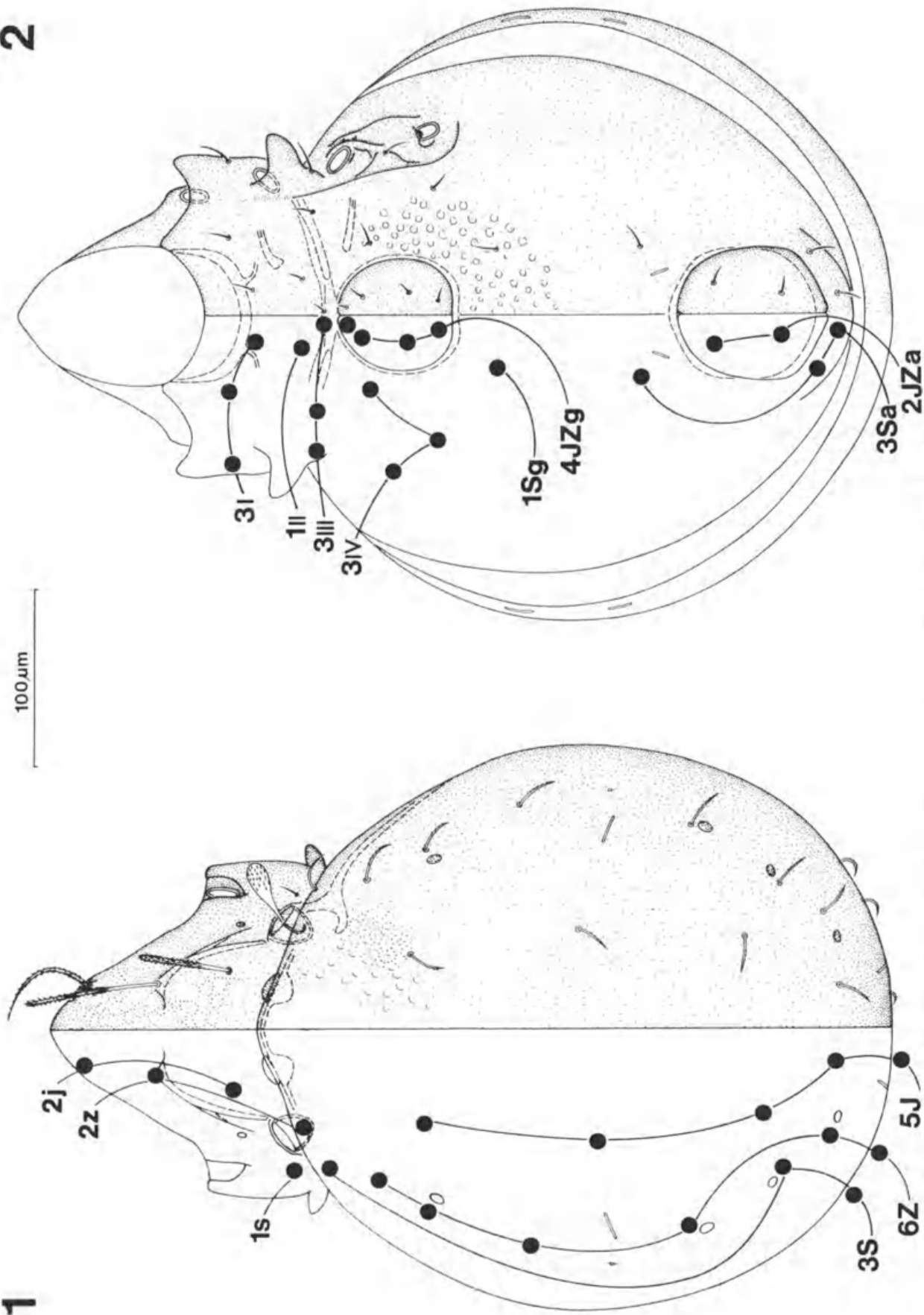
Undesignated: 3 ♀♀ (N1989184-N1989186), 5 ♂♂ (N1989187-N1989191), sand, litter, sparse moss, under ridge-fruited mallee (*Eucalyptus incrassata*) amongst broombush shrubs (*Melaleuca uncinata*), Ferries-McDonald Reserve (35°15'S, 139°09'E), 20.vi.1974.

Distribution

Australia (Aa), South Australia. Mallee-broombush, open scrubland (Ferries-McDonald Reserve), Murray-Darling basin, 3 ♀♀, 5 ♂♂ of 8 \times 25 cm². Mallee-heath, tall open scrubland (Tamboore Homestead, near Mt Rescue Conservation Park), Murray-Darling basin, 9 ♀♀, 20 ♂♂ of 8 \times 25 cm².

Remarks

Ceroribatula incrustedata is the type-species of the genus and the species-complex. The name is derived from the Latin '*incrustatio*' meaning 'crust' or 'hard coating', referring to the wax incrustation often



FIGURES 1 and 2. *Ceroribatula incrustata* sp. nov., female soma. 1, notum without incrustation; 2, idiosternum.

3

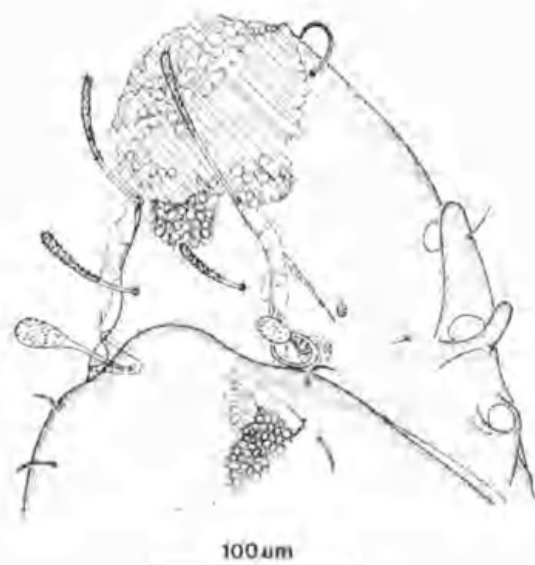


FIGURE 3. *Ceroribatula incrustata* sp. nov., female anterior soma, dorsolateral aspect showing proteronotal and hysteronotal incrustation of wax.

present on the proteronotum and sometimes on the humeral region of the hysteronotum (Fig. 3). The hysteronotum is circular in horizontal aspect, but otherwise specimens without an incrustation are similar to *C. monozygata*, because of the size and the form of the notal setae. On the other hand, the presence of a distoventral seta (*v2*) on femur I means that *C. incrustata* is similar to *C. trirostrata* in its chaetotaxy. The wax incrustation, hysteronotal shape and femoral chaetotaxy are similar to those of *Reticuloppia reticulata* Balogh & Mahunka, 1966, and this is regarded as reflecting a close relationship between these genera, as opposed to what are regarded as convergent similarities between *Ceroribatula* and *Fovoribatula*.

Ceroribatula bitygata sp. nov.
Fig. 6

Female

Dorsal profile of hysteronotum ovoid, colour dark brown, cerotegument forms continuous notal (except over lenticulus) and pleural layer, substantial thickness (greater than diameter of setal bases) including abutting refractile wax granules and vegetable detritus, giving translucent dirty white appearance and obscuring setae. Idiosomal length 617 ($n = 2$, 609–625). Leg lengths (femur-tarsus for 625): I – 319, II – 301, III – 280, IV – 334. Tibial

maximum heights (for 625): I – 31, II – 26, III – 21, IV – 21.

Proteronotum with costate translamella, laminar lamellae, costate sublamellae (not merging anteriorly with lamellae). Seta *j2* shorter (about 0.75 \times) than *z1*, both hyaline and lorate, weakly ciliate (not illustrated in Fig. 6). Integument mainly weakly reticulate. Costate ridge between setae *z2-j2-j2-z2* appearing as second 'translamella'. Short curved subtutorium. Sensory seta *z2* with globose caput, smooth, without cilia.

Hysteronotal setae subequal in length, lorate, weakly ciliate distally (not illustrated in Fig. 6), rank 5 (*J5*, *Z5*, *S5*) curved upwards. Anterior margin extends forward to lie close to seta *j2*. Lenticulus smooth, pale, otherwise integument with reticulate sculpturing. Anterior foramen (*F3*) as illustrated (Fig. 6) or may encompass adaxial margin of *Z2* setal base and be attenuated anteriorly, posterior foramina (*F4*, *F5*, *F6*) less than 0.5 \times size of *F3*. Pore to hysteronotal gland (*hGf*) opens into refractile sac.

Podosternum with deep cavity behind acetabulum IV, forms circumpedal ridge level with seta *IV2*, which does not merge with discoidal ridge so subpedal ridge not continuous (i.e. as *C. trirostrata*, Fig. 9, not as *C. incrustata*, Fig. 2). Setae on coxite I differ in size, *I1* 0.5 \times *I2*. Integument reticulate.

Opisthosternum with setae of differing form and lengths: *JZg*, *Sg* and *JZa* short and setose (similar to *C. incrustata*, Fig. 2); *Sal* lanceolate, length about 0.33 \times distance *JZa1-JZa2*; *Sa2* and *Sa3* lorate, similar to hysteronotal setae, length subequal to distance *JZa1-JZa2*. Most of integument reticulate, genital shield smooth, anal shield mainly reticulate-foveate, just foveate near lateral margins. Eggs subcylindrical with convex ends, 202 \times 79 (mean of 7 horizontally aligned eggs, 32% of mean female length), smooth exochorion. Number of eggs in female (number of females) as follows: four (1), six (1).

Legs medium-length (mean femur-tarsus: 49% soma), slim (mean maximum tibial height: 30% of mean length). Dorsal porose areas and strong reticulate abaxial sculpturing on all femora and trochanters III and IV. Only 3 setae on femora I and II (0-2/1-0).

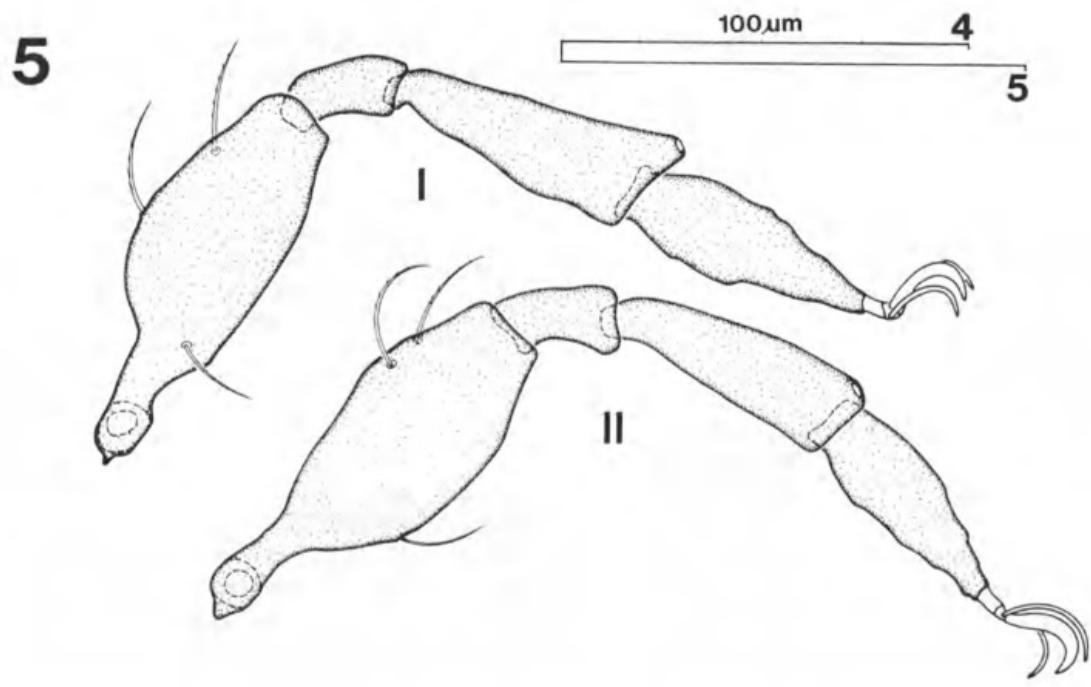
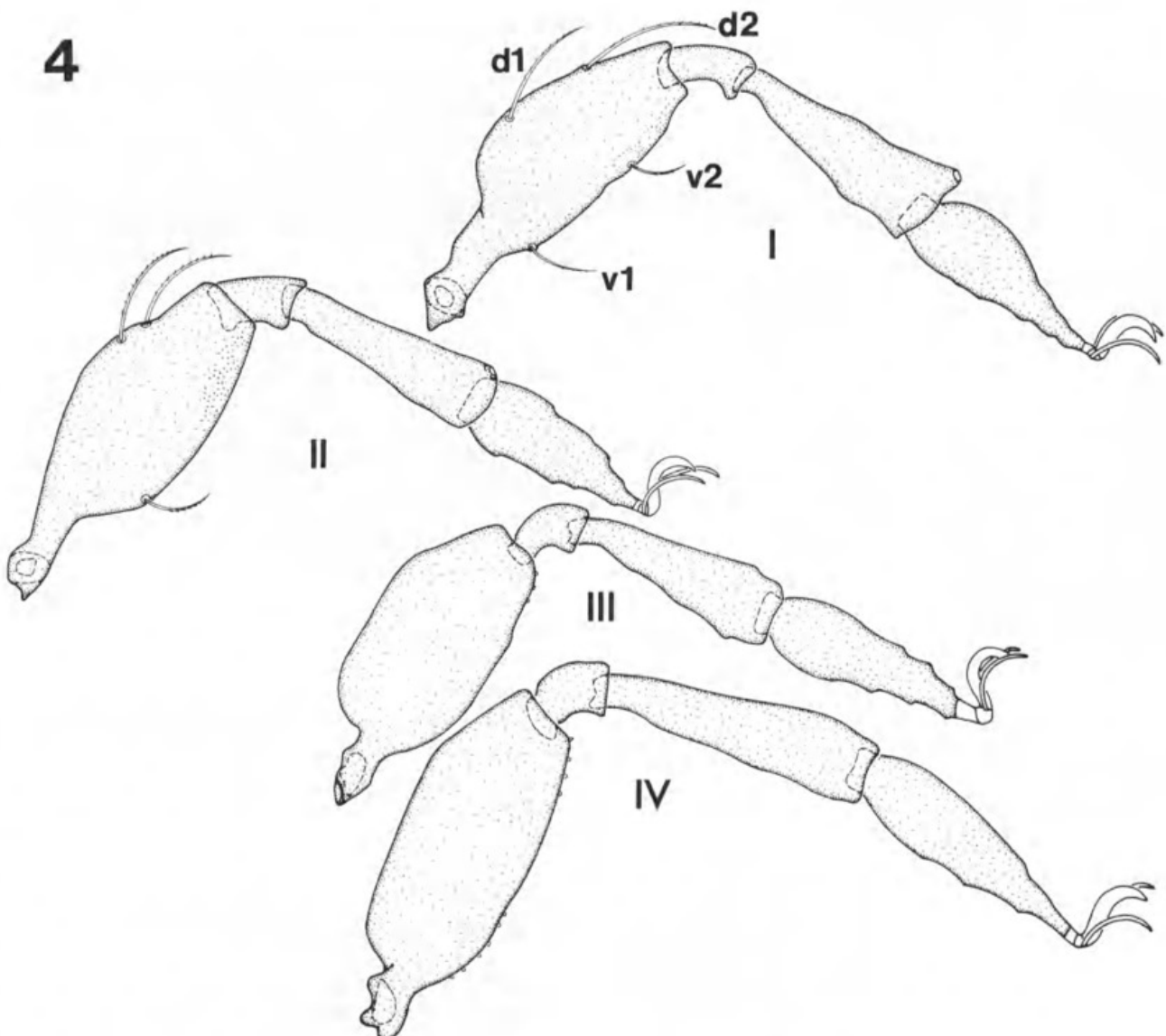
Male

Unknown

Material examined

Holotype: ♀ (N1989192), soil, litter, moss and other low growth plants under bladder saltbush (*Atriplex vesicaria*) amongst sparse false sandalwood (*Myoporum platycarpum*), Koonamore Vegetation Reserve (32°07'S, 139°21'E), 27.vi.1974.

Paratype: 1 ♀ (N1989193) same data as holotype.



Distribution

Australia (Aa), South Australia. Semi-arid low shrubland (Koonamore Vegetation Reserve), Lake Eyre Basin, 2 ♀♀ / 2 of 8 × 25cm².

Remarks

Ceroribatula bizygata is regarded, along with *C. monozygata*, as the most primitive species in the genus, having the lowest number of femoral setae. It is the second largest species, and is strongly sclerotized, with the result that some characters are clear, but the thick dirty cerotegument and weakly refractile lorate setae make the chaetotaxy difficult to assess. The prefix of its name is derived from the Latin 'bis' meaning 'two', whilst the rest is based on the Greek 'zygon' meaning 'yoke' or 'pair', referring to the translamella as in *Zygoribatula* Berlese, 1916 (Oribatulidae), and so to the presence of a second 'translamella', i.e. the costate ridge between the lamellae and setae *j2-j2*.

Ceroribatula monozygata sp. nov.

Figs 5 and 7

Female

Dorsal profile of hysteronotum ovoid, usually brown with some straw coloured specimens regarded as teneral, cerotegument forms continuous notal (except over lenticulus) and pleural layer, thin, foveate indentations matching those of integument, either hyaline or finely granulate, some attached plant detritus, but little effect on mite's appearance. Idiosomal length 495 (semi-arid shrubland, *n* = 6, 465–519); 530 (arid grassland, *n* = 1); 454 (mallee-heath, *n* = 3, 425–482). Leg lengths (femur-tarsus for idiosomal length 493, semi-arid shrubland): I – 225, II – 220, III – 208, IV – 272. Tibial maximum heights (for 493): I – 23, II – 21, III – 18, IV – 17.

Proteronotum with translamella costate across midline but laminar laterally, weakly laminar lamellae, sublamellae costate, merging anteriorly with lamella. Setae *j2* and *z1* subequal in length, both refractile and clavate, conspicuously ciliate. Integument weakly foveate around rostrum, otherwise smooth. Indistinct line near seta *j2*. No subtritorium. Sensory seta *z2* with globose caput, covered in minute cilia.

Hysteronotal setae subequal in length, setose, ciliate distally. Lenticulus smooth, pale, otherwise integument foveate. Anterior foramen (*F3*) as illustrated (Fig. 7) or may abut onto posterior margin of *Z2* setal base, posterior foramina (*F4*, *F5*, *F6*) subequal in size to *F3*.

Podosternum with circumpedal ridge merging with discoidal ridge to form a continuous subpedal ridge weakening anteriorly, similar to *C. incrustata* (Fig. 2). Coxite setae in ranks 1 and 2 similar in size to each other and longer than on *C. incrustata*. Integument with reticulate sculpturing anteriorly, on coxite IV small alveoles.

Opisthosternal setae in file *S* similar in size, setae on genital and anal shields (*JZg*, *JZa*) slightly smaller. Most of integument with foveate sculpturing, anterior zone of smaller pits more extensive than on *C. incrustata* (Fig. 2), genital shield smooth. Eggs oval, 188 × 85 (mean of 5 horizontally aligned eggs, 33% of mean female length), smooth exochorion. Number of eggs in female (number of females) as follows: none (2), one (1), two (1), four (1), eleven (1).

Legs medium length (mean femur-tarsus: 46% of soma), slim (mean maximum tibial height: 31% of mean length). Femora I and II both with three setae (0.2/1.0). Cerotegument rarely visible on legs.

Male

As for female except margin of genital orifice well separated from ventroscutal apodeme. Soma smaller, idiosomal length 438 (semi-arid shrubland, *n* = 24, 411–465); 403 (mallee-heath, *n* = 10, 382–420).

Material examined

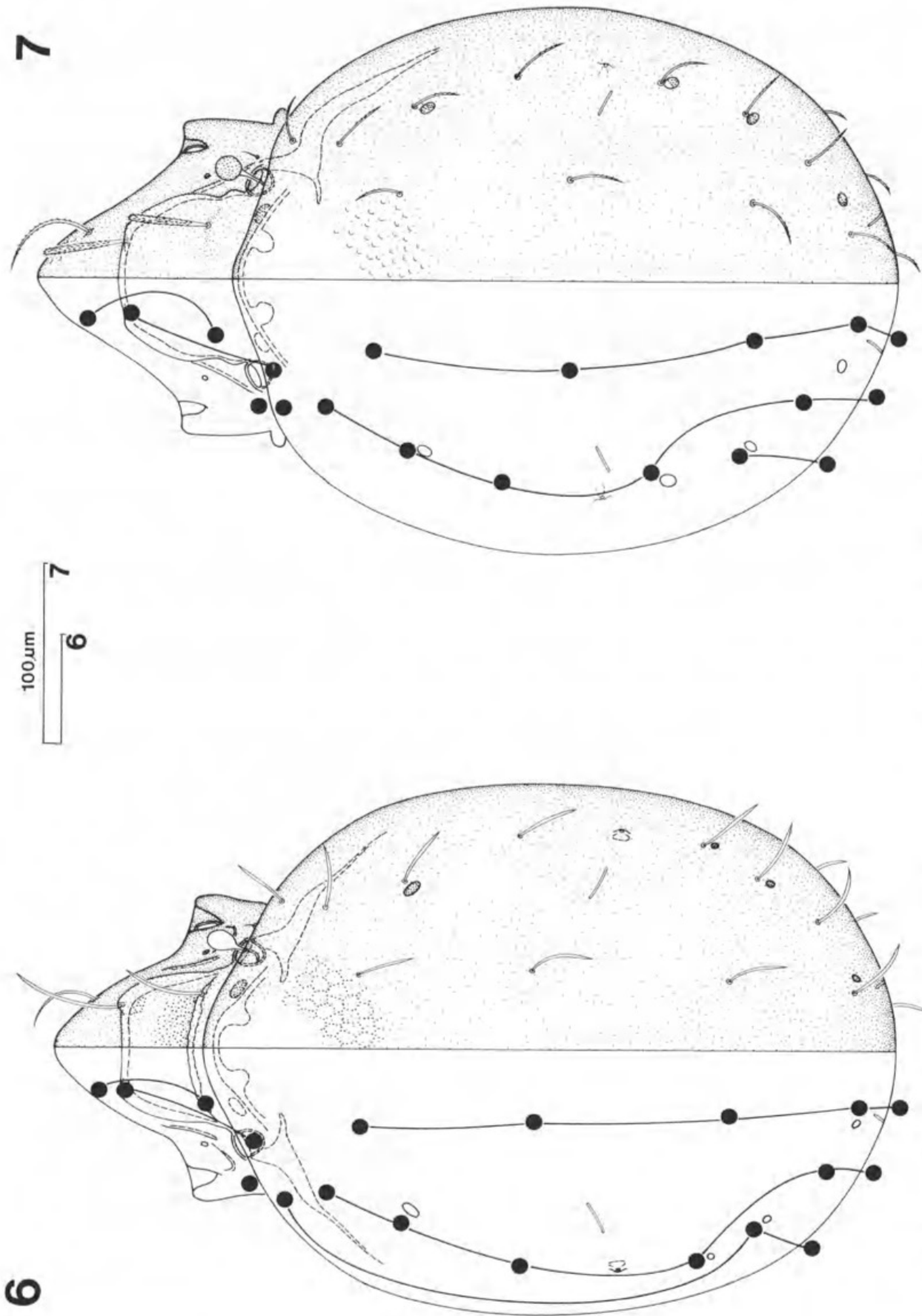
Holotype: ♀ (N1989194), soil, litter, moss and other low growth plants under bladder saltbush (*Atriplex vesicaria*) amongst sparse false sandalwood (*Myoporum platycarpum*), Koonamore Vegetation Reserve (32°07'S, 139°21'E), 27.vi.1974.

Paratypes: 5 ♀♀ (N1989195–N1989199), 18 ♂♂ (N1989200–N1989217); 2 ♀♀ – BMNH; 2 ♀♀ – FMNH; 2 ♀♀ NZAC; same data as holotype.

Undesignated: 1 ♀ (N1989218), bases of love grass (*Eragrostis eriopoda*) tussocks, near Emu (28°41'S, 132°08'E), 11.x.1976. 3 ♀♀ (N1989219–N1989221), 10 ♂♂ (N1989222–N1989231), sand, litter, under banksia shrubs (*Banksia ornata*), Tamboore Homestead (35°57'S, 140°29'E), 4.viii.1974.

Distribution

Australia (Aa), South Australia. Arid tussock grassland (Great Victoria Desert), West Plateau, 1 ♀ / 1 of 8 × 25cm². Semi-arid low shrubland (Koonamore Vegetation Reserve), Lake Eyre Basin, 6 ♀♀, 24 ♂♂ / 4 of 8 × 25cm². Mallee-heath, tall open shrubland (Tamboore Homestead, near Mt Rescue Conservation Park), Murray-Darling Basin, 3 ♀♀, 10 ♂♂ / 3 of 8 × 25cm².



FIGURES 6 and 7. Somal notum. 6, *Ceroribatula bizygata* sp. nov.; 7, *Ceroribatula monozygata* sp. nov..

Remarks

Ceroribatula monozygata is regarded, along with *C. bitygata*, as the most primitive species, having the least number of femoral setae. The cerotegument is thin and inconspicuous and because of the size of the notal setae and form it looks very similar to *C. incrustata* without any incrustation. The prefix of its name is derived from the Greek 'monos' meaning 'one' and, in a similar manner to the formation of the name of *C. bitygata*, it refers to the presence of a single translamella, without a second 'translamella'.

***Ceroribatula tirostrata* sp. nov.**

Figs 8 and 9

Female

Dorsal profile of hysteronotum ovoid, dark brown, cerotegument forms continuous notal (except over lenticulus) and pleural layer, medium thickness (subequal to $3 \times$ diameter of setal base), including refractile wax granules (where thick, form irregular white patches) and attached vegetable detritus, obscuring setae, sculpturing and foramina. Idiosomal length 745 ($n=1$). Leg lengths (femur-tarsus): I - 368, II - 342, III - 352, IV - 427. Tibial maximum heights: I - 33, II - 26, III - 21, IV - 21.

Proteronotum with translamella mainly costate (brief laminar part near seta z1), laminar lamellae, sublamellae costate (merging anteriorly with lamellae). Setae j2 and z1 subequal in length, hyaline, ensiform, weakly ciliate. Short subtutorium. Caput of seta z2 without cilia. Integument reticulate between j2-j2. Rostrum tripartite with two incisions.

Hysteronotal setae subequal in length, short, ensiform, without cilia. Lenticulus smooth, pale, otherwise integument foveate. Anterior foramen (F3) long and narrow compared with suboval posterior foramina (F4, F5, F6).

Podosternum with subpedal ridges fragmented into distinct parts and custodial ridge absent. Coxite setae in rank 2 of legs I, II, III longer than in rank 1. Midsternal and postpedal apodeme present. Integument foveate, and patch of finely punctate sculpturing between setae II-II (not illustrated in Fig. 9).

Opisthosternal setae either setose (JZg1-4, Sg, Sa1) or ensiform (JZa1-2, Sa2, Sa3). Integument foveate. Eggs oval, 237×106 (32% of female length), smooth exochorion, 14 eggs in single female.

Legs long (mean femur-tarsus: 50% soma), very slim (mean maximum tibial height: 24% of mean length). Leg III with long femur, unusual in being longer than leg II. Femur I with four setae (0,2/2,0), femur II with three setae (0,2/1,0). Some cerotegument around basal leg segments.

Male

As female, except hysteronotal foramen F3 about half length although similarly narrow, and margin of genital orifice well separated from ventrosejugal apodeme. Soma smaller, idiosomal length 639 ($n=2$, 660, 617).

Material examined

Holotype: ♀ (N1989232), soil, litter, moss and other low growth plants under bladder saltbush (*Atriplex vesicaria*) amongst sparse false sandalwood (*Myoporum platycarpum*), Koonamore Vegetation Reserve (32°07'S, 139°21'E), 27.vi.1974.

Paratypes: 2♂♂ (N1989233, N1989234), same data as holotype.

Distribution

Australia (Aa), South Australia. Semi-arid low shrubland (Koonamore Vegetation Reserve), Lake Eyre Basin, 1 ♀, 2 ♂♂ / 3 of $8 \times 25 \text{ cm}^2$.

Remarks

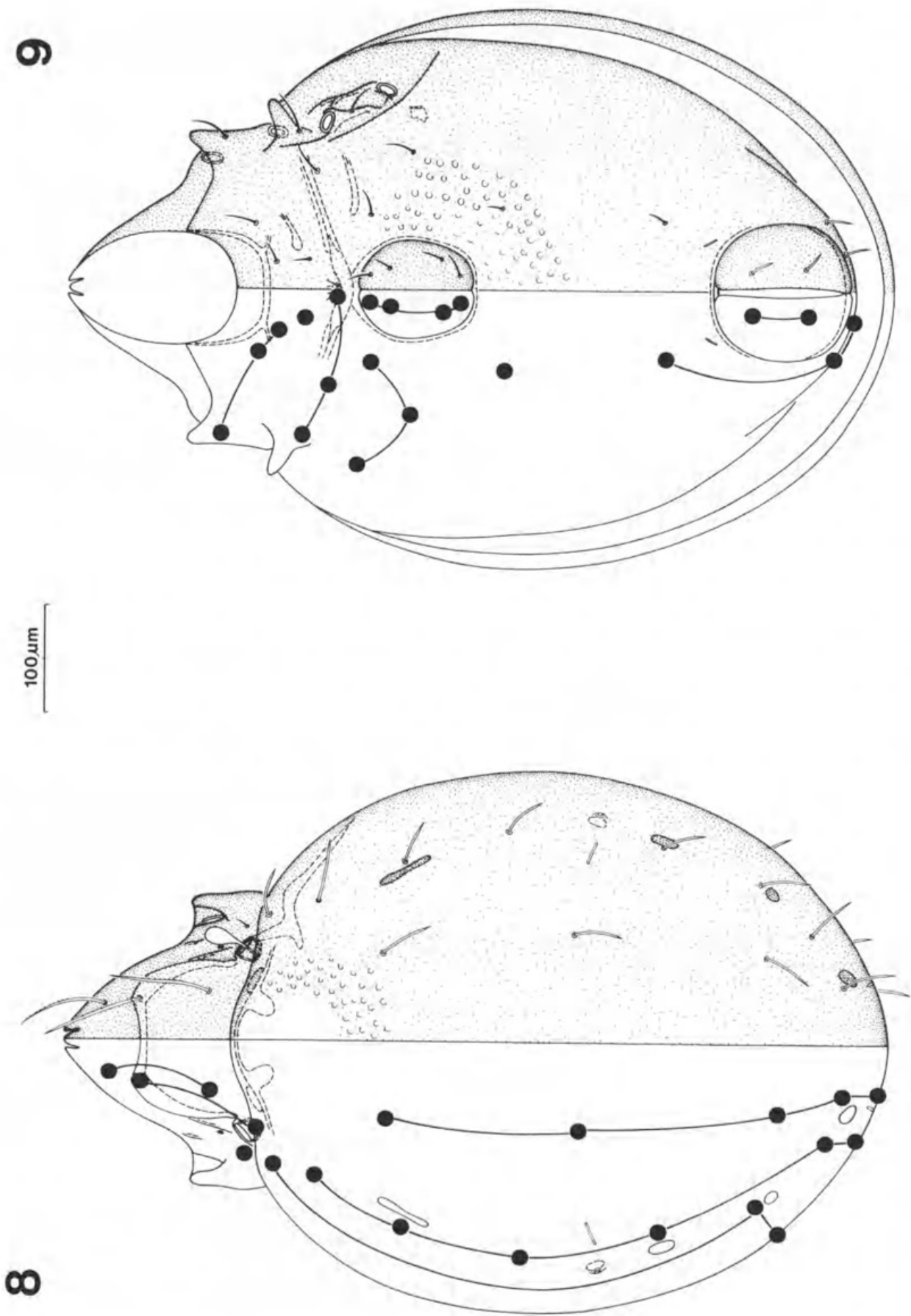
The name of *Ceroribatula tirostrata* is from the Latin 'tres' meaning 'three' and it refers to the rostrum which is broken up by two incisions into three parts. It is similar to *C. incrustata* in having four setae on femur I, but is superficially like *C. bitygata* because of its proteronotal ridges and setae. It is also similar to species of *Zygoribatula*, especially those with a long, slim hysteronotal multiporose foramen F3 such as *Z. longiporosa* Hammer, 1953 from Queensland. Whilst *Z. longiporosa* is similar, it has five setae on both femora I and II, the integument is smooth with an inconspicuous cerotegument.

megaforamina-complex**Diagnosis**

Ceroribatula. Hysteronotal setae (longer than $0.5 \times$ distance between bases), proteronotal seta s1 (longer than diameter of bothridial aperture) and trochanter I seta v (longer than distance between setae II-II) medium length. Translamella absent. Femur I with seta v2 (0,2/2,0).

Remarks

The *megaforamina*-complex is regarded as derived from the *incrustata*-complex in having four setae on femur I and medium-length setae on the hysteronotum and elsewhere. These character states and the absence of a translamella make it similar to *Fovoribatula mesosetosa* sp. nov., but the absence of posterior setae on femora I and II indicates that it belongs to a separate lineage. It includes only the nominate species, *C. megaforamina*.



FIGURES 8 and 9. *Ceroribatula tirostrata* sp. nov., female soma. 1, notum; 2, idiostrnum.

Ceroribatula megaforamina sp. nov.

Figs 10 and 11

Female

Dorsal profile of hysteronotum subcircular, colour light brown, cerotegument inconspicuous. Idiosomal Length: 580 (n = 6, 540-617). Leg lengths (femur-tarsus for idiosomal length 609): I - 332, II - 311, III - 306, IV - 386. Tibial maximum heights (for 609): I - 26, II - 21, III - 19, IV - 18.

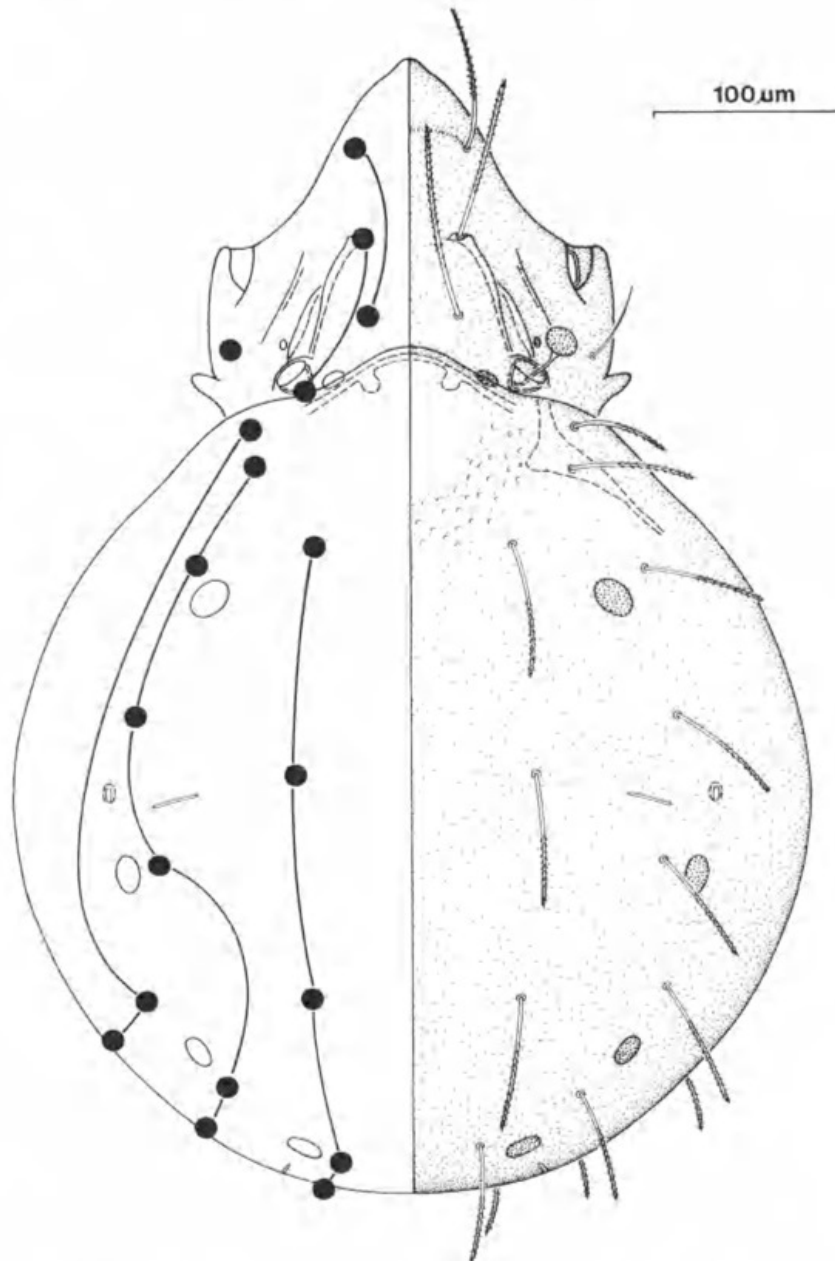
Proteronotum with weakly laminar lamellae and costate sublamellae. Seta *j2* slightly longer (more than 1.1×) than *z1*, both ciliate and bacilliform. Integument smooth. Sensory seta *z2* clavate, with globose caput and many fine, pointed cilia, smaller and more numerous than represented (Fig. 10).

Hysteronotal setae mostly subequal in length, but *S1* shorter, with three longitudinal files of cilia. Lenticulus smooth, pale, surrounding integument foveate with small, well spaced pits. Multiporose foramina large, anterior one (*F3*) largest, oval.

Podosternum with circumpedal ridge merged with rest of subpedal ridge, extending to weak custodial ridge fading just anterior to pedotectum II. Two adaxial setae on coxite I similar in length (*I1* and *I2* subequal). Integument foveate around midline, smooth peripherally.

Opisthosternum with setae of fairly uniform length, *Sal* subequal to *Sa3*. Adanal pore *Saf* nearly longitudinal, further from anal orifice than its length. Eggs oval, 223 × 100 (mean of 15 horizontally aligned eggs), 39% of mean female

10

FIGURE 10. *Ceroribatula megaforamina* sp. nov., female notum.

length, smooth or wrinkled exochorion. Number of eggs in female (number of females) as follows: six (2), seven (1), eight (3).

Legs long (mean femur-tarsus: 54% of soma), slim (mean maximum tibial height: 22% of mean length). Leg IV unusually long and slim with spinate ventral setae on tibia and tarsus (Fig. 11). Only four setae on femur I (0,2/2,0) and three setae on femur II (0,2/1,0).

Male

As female except two specimens (idiosomal length 486 and 563) with clear, finely punctate cerotegument covering hysteronotum other than over lenticulus, all specimens with margins of genital orifice not merging with ventroscutal apodeme. Soma smaller, idiosomal length: 518 (arid grassland, $n = 15$, 439–568); 439 (Semi-arid shrubland, $n = 1$).

Material examined

Holotype: ♀ (N1989235), bases of lovegrass (*Eragrostis eriopoda*) tussocks, near Emu (28°41'S, 132°08'E), 11.x.1974.

Paratypes: 5 ♀♀ (N1989236–N1989240), 12 ♂♂ (N1989241–N1989252); 1 ♂ – BMNH; 1 ♂ – FMNH; 1 ♂ – NZAC; same data as holotype.

Undesignated: 2 ♂♂ (N1989253, N1989254) same data as holotype. 1 ♂ (N1989255), soil, litter, moss and other low growth plants under bladder saltbush (*Atriplex vesicaria*) amongst sparse false sandalwood (*Myoporum platycarpum*), Koonamore Vegetation Reserve (32°07'S, 139°21'E), 27.vi.1974.

Distribution

Australia (Aa), South Australia. Arid tussock grassland (Great Victoria Desert), West Plateau, 6 ♀♀, 17 ♂♂ / 4 of 8 × 25 cm². Semi-arid low shrubland (Koonamore Vegetation Reserve), Lake Eyre basin, 1 ♂ / 1 of 8 × 25 cm².

Remarks

The relationships of *Ceroribatula megaforamina* are considered under the 'Remarks' on the *megaforamina*-complex. Its name is based on the Greek 'mega' meaning 'large' and the Latin 'foramen' meaning 'hole', referring to the large size of the multiporose hysteronotal foramina. The integument is very clean for a species of *Ceroribatula*, most specimens being without any evident cerotegument or attached vegetable detritus. Even the two males that are covered in fine, regular deep punctata, apparently representing fine canals through a shallow cerotegument, are without attached detritus. Besides their punctata, no differences from other specimens were recognised for these two males. It is assumed that they belong to the same species and have an ephemeral

cerotegument, but they are not included in the type series in case this is contradicted by further evidence.

Genus *Fovoribatula* gen. nov.

Type-species: *Fovoribatula brevisetosa* sp. nov.

Diagnosis

Fovoribatulinae. Hysteronotal setae short or medium-length, not longer than distance between their bases. Lenticulus present, associated with mid-dorsal forward pointing protruberance of hysteronotum. Lamellae present, laminar and complete (between z1–z2). Translamella present (costate) or absent. Rim of bothridium (base of seta z2) low, not turret-like. Four pairs of hysteronotal multiporose foramina. Discidium present as costate ridge. Femora I and II with four setae, posterior setae present (0,2/1,1). Pretarsal claws long (central claw II more than 0.3 × length of tarsus II).

Remarks

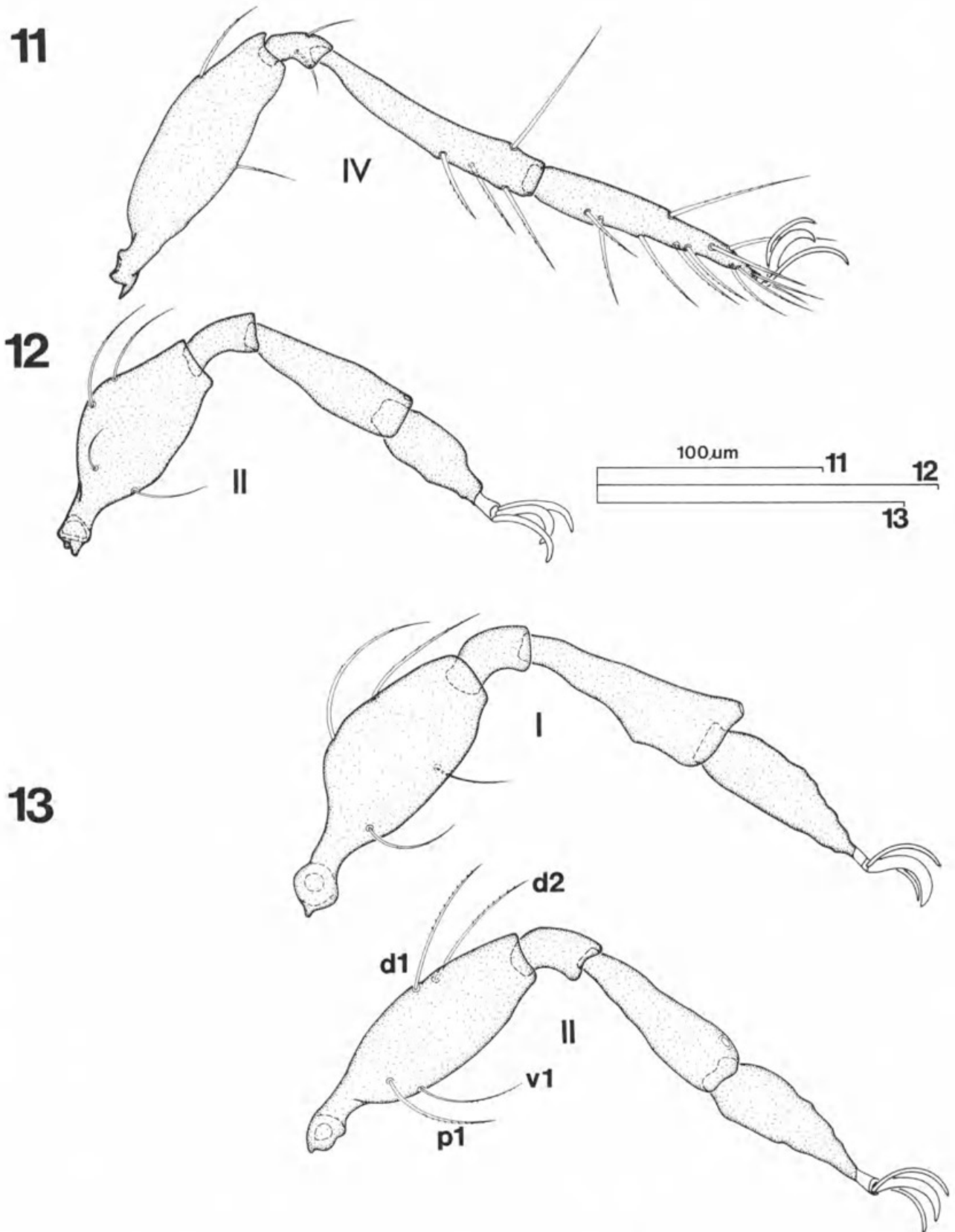
Fovoribatula is superficially similar to the South Australian genus *Ceroribatula* gen. nov., but it is regarded as more closely allied to *Decoribatula* Lee & Birchby, 1989, from Singapore, because of the chaetotaxy on femora I and II. But it is noted that on femur I the ventral seta is positioned as v2 not v1 as on *Decoribatula*. Other similarities to *Decoribatula* are the larger pretarsal claws (not conspicuously so on *Fovoribatula mesosetosa*) and leg II being shorter than leg III (femur-tarsus), only known for *C. trirostrata* among the *Ceroribatula*. The name is derived from the Latin 'fovea' meaning 'pit', referring to the foveate (pitted) integument of its members, whilst the cerotegument is not conspicuous as in most members of *Ceroribatula*. It includes two species which are dissimilar in their proteronotal ridges, hysteronotal setae and pretarsi. Whilst the type-species is unusual in appearance and is considered as being the more derived, the other species (*F. mesosetosa*) is similar to *Ceroribatula megaforamina* sp. nov., both possessing derived character states. Whilst *F. brevisetosa* has unusually large lateral claws on the pretarsus approaching the relative size of *Decoribatula pustulata*, those on *F. mesosetosa* are larger than for *Ceroribatula* although not obviously so. *Fovoribatula* includes two new species as follows: *F. brevisetosa*, *F. mesosetosa*.

Fovoribatula brevisetosa sp. nov.

Figs 12, 14, 15

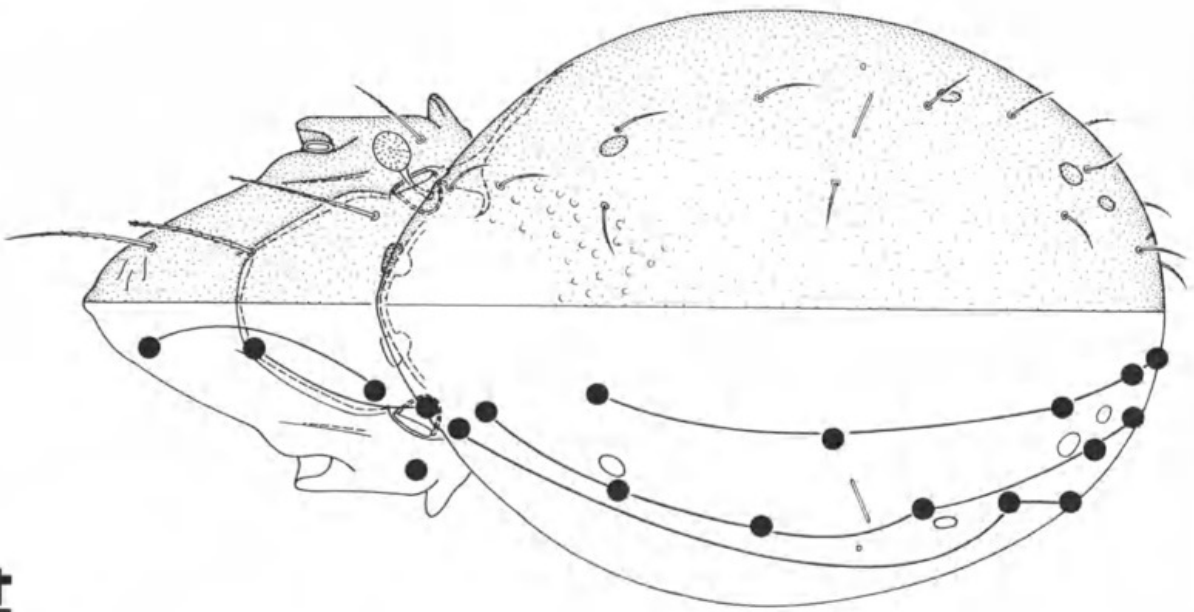
Female

Dorsal profile of hysteronotum ovoid, light brown, cerotegument inconspicuous. Idiosomal



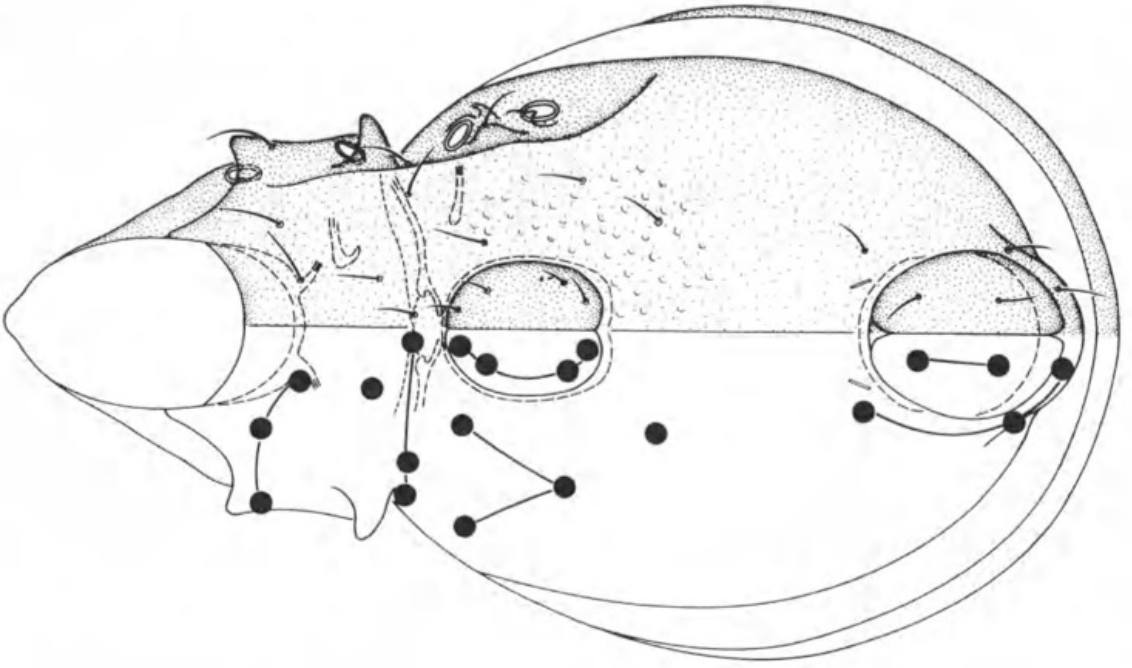
FIGURES 11, 12 and 13. Right legs, posterior aspect to femur-pretarsus showing setae on all segments of leg IV and femora only of legs I and II. 11, *Ceroribatula megaforamina* sp. nov., leg IV. 12, *Fovoribatula brevisetosa* sp. nov., leg II. 13, *Fovoribatula mesosetosa* sp. nov., legs I and II. Notation: d = dorsal, v = ventral, p = posterior.

14



100µm

15



FIGURES 14 and 15. *Fovoribatula brevisetosa* sp. nov., female soma. 14, notum; 15, idiosternum.

length 375 (n=1). Leg lengths (femur-tarsus): I - 213, II - 170, III - 193, IV - 213. Tibial maximum heights: I - 21, II - 18, III - 13, IV - 13.

Proteronotum with translamella costate, lamellae weakly laminar, costate near seta z1, no sublamellae, linear subtutorium. Setae j2 and z1 subequal in length, z1 more robust. Caput of seta z2 with minute cilia. Integument smooth except for transverse wrinkles on rostrum.

Hysteronotal setae subequal in length, short, setose, weakly ciliate. Lenticulus smooth, pale, otherwise integument with weak, sparse foveate sculpturing. Anterior foramen (F3) oval, similar in size to F5.

Podosternum with circumpedal ridge merged in with a continuous subpedal ridge, extending to weak custodial ridge fading level with seta j3. Two adaxial setae on coxite I similar in length (j1 and j2 subequal).

Opisthosternum with setae of fairly uniform length, adaxial shorter. Adanal pore Saf oblique, sloping inwards anteriorly, closer to anal orifice than its length. Eggs oval, 175 × 69 (mean of 3 eggs present), 47% of female length, smooth exochorion.

Legs long (mean femur-tarsus: 52% of soma), slim (mean maximum tibial height: 26% of mean length). Seta v on trochanter I reaches forward to level of v2 on femur I. Claws large, lateral claws more than half as stout as central claw.

Male

Differs from female in that anterior margin of hysteronotal shield has tectum extending forward to cover posterior half of bothridium to seta z2. Genital shield smaller, anterior margin to genital orifice not abutting onto ventrosejugal apodeme, level with seta IV1. Soma smaller, idiosomal length 368 (n=1).

Material examined

Holotype: ♀ (N1989256), sand, litter, under banksia shrubs (*Banksia ornata*), Tamboore Homestead (35°57'S, 140°29'E), 4.viii.1974.

Paratype: 1 ♂ (N1989257) same data as holotype.

Distribution

Australia (Aa), South Australia. Mallee-heath, tall open shrubland (Tamboore Homestead, near Mt Rescue Conservation Park), Murray-Darling basin, 1 ♀, 1 ♂ / 2 of 8 × 25 cm².

Remarks

Fovoribatula brevisetosa is the type-species of the genus. The prefix of the name is derived from the Latin 'brevis' meaning short and this refers to the length of the hysteronotal setae. It is unusual amongst the Fovoribatulinae in having short tarsi and the largest pretarsal claws for an Australian

species, approaching the size of those in *Decoribatula* from Singapore, as well as having the largest known egg. The larger pretarsal claws are considered derived and an indication that *Fovoribatula* is allied to *Decoribatula*. The shortness of the dorsal setae is regarded as a regression, convergent with a similar character state on the primitive species of *Ceroribatula*, because certain setae (s1 on proteronotum and v on trochanter I) are relatively long and, therefore, considered derived.

Fovoribatula mesosetosa sp. nov.

Figs 13, 16, 17

Female

Dorsal profile of hysteronotum oval, colour medium brown, cerotegument shallow, containing wax granules in white patches anteriorly and posteriorly on soma and on hysteronotal humeral region. Idiosomal length: 536 (n = 2, 519, 553). Leg lengths (femur-tarsus for idiosomal length 519): I - 254, II - 236, III - 244, IV - 303. Tibial maximum heights (for 519): I - 26, II - 18, III - 18, IV - 18.

Proteronotum without translamella, lamellae substantially laminar anteriorly, costate near seta z2, sublamellae costate or more rarely linear and weak, linear subtutorium. Seta j2 shorter (about 0.85×) than z1, both ciliate and bacilliform. Sensory seta z2 with fine, pointed cilia on caput. Integument smooth.

Hysteronotal setae mostly subequal in length, but J6, Z6, S1 and S6 shorter, with three longitudinal files of cilia. Pale lenticulus with sparse, very shallow alveolae, surrounding integument clearly foveate. Multiporose foramina small, subequal, oval.

Podosternum with circumpedal ridge merging with subpedal ridge as far anterior as pedotectum II. Two adaxial setae on coxite I similar in length (j1 and j2 subequal), peripheral setae, especially III/3, longer. Integument smooth.

Opisthosternum with setae fairly uniform in length, except that Sa1 is short and Sa2, Sa3 are long. Adanal pore Saf nearly parallel to margin of anal shield. Eggs oval, 161 × 77 (mean of 6 horizontally aligned eggs), 30% of mean female length, smooth exochorion. Number of eggs in female (number of females) as follows: one (1), ten (1).

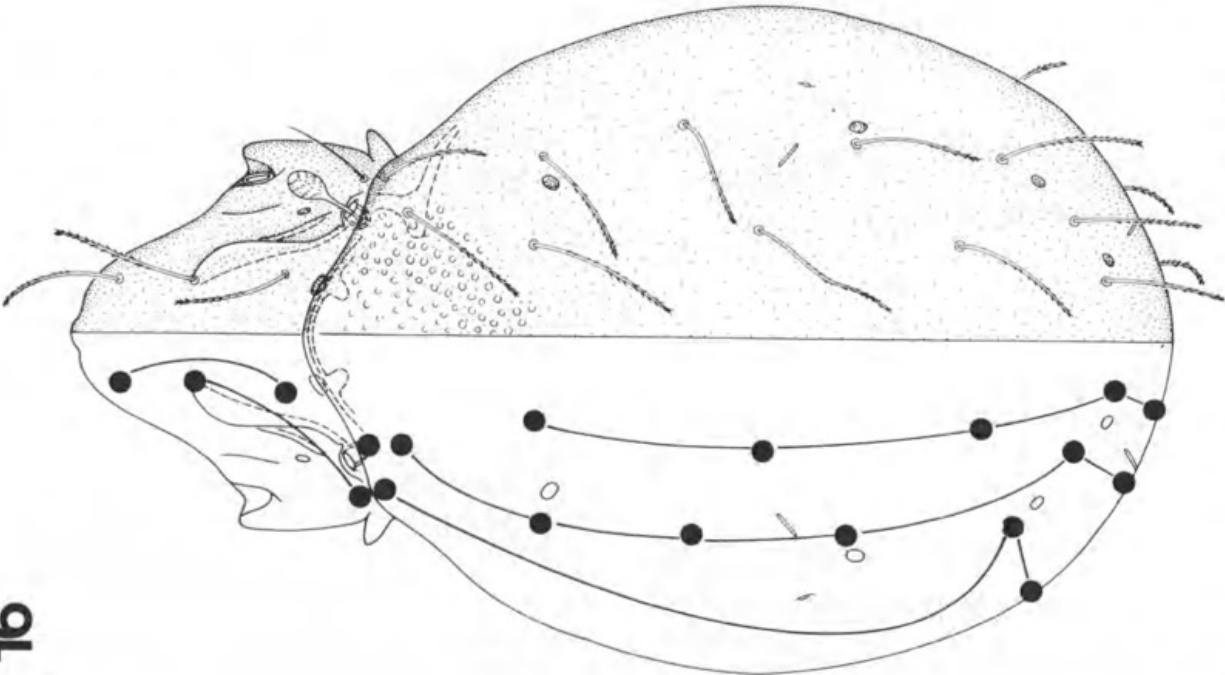
Legs long (mean femur-tarsus: 50% of soma), slim (mean maximum tibial height: 29% of mean length). Claws large, but lateral claws less than half as stout as central claw.

Male

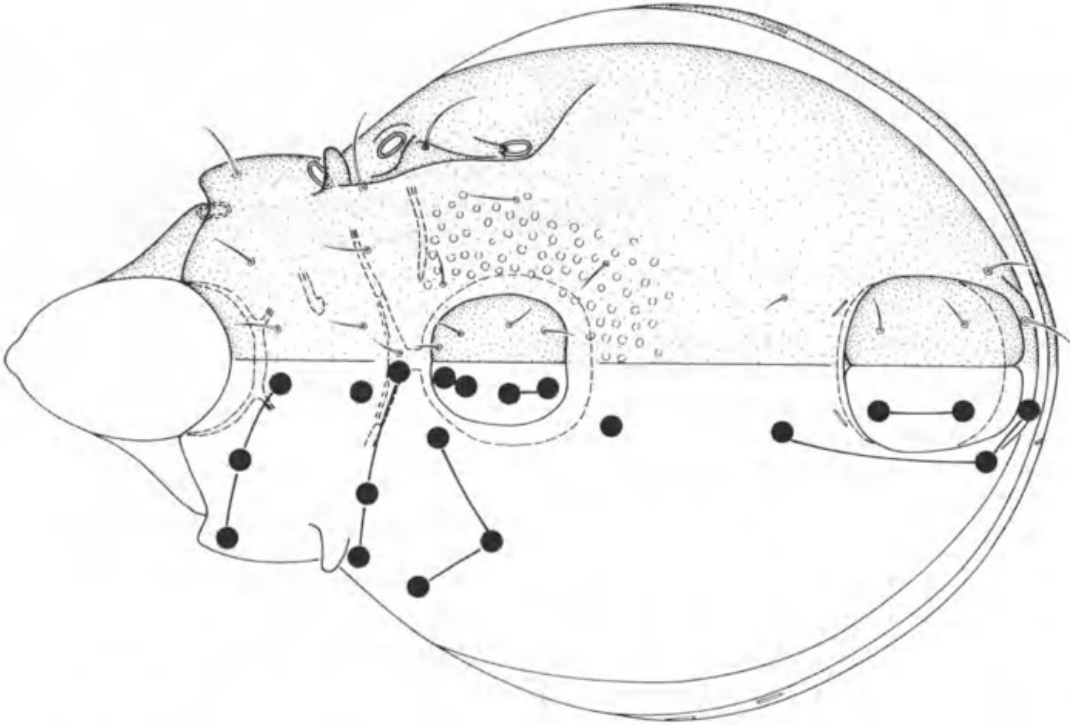
As female except that margin of genital orifice not merging with ventrosejugal apodeme. Soma smaller, idiosomal length: 491 (n = 7, 455-514).

16

100µm



17



FIGURES 16 and 17. *Fovoribatula mesosetosa* sp. nov., female soma. 16, notum; 17, idiosternum.

Material examined

Holotype: ♀ (N1989258), soil, litter, moss and other low growth plants under bladder salt bush (*Attriplex vesicaria*) amongst sparse false sandalwood (*Myoporum platycarpum*), Koonamore Vegetation Reserve (32°07'S, 139°21'E), 27.vi.1974.

Paratypes: 1 ♀ (N1989259), 4 ♂♂ (N1989260-N1989263); 1 ♂ BMNH; 1 ♂ FMNH; 1 ♂ NZAC; same data as holotype.

Distribution

Australia (Aa), South Australia. Semi-arid low shrubland (Koonamore Vegetation Reserve), Lake Eyre basin, 2 ♀, 7 ♂♂ / 3 of 8 x 25 cm².

Remarks

The prefix of the name of *Fovoribatula mesosetosa* is derived from the Greek 'mesos'

meaning 'middle', referring to the medium-length of the hysteronotal setae. It is easily distinguished from the only other species in its genus by the larger hysteronotal setae, absence of a translamella and relatively slimmer lateral pretarsal claws and shorter central claws. Central claw II (for example) is only slightly larger than those of *Ceroribatula*. It is superficially similar to *Ceroribatula megaforamina* as commented on in the 'Remarks' on *Fovoribatula*.

ACKNOWLEDGMENTS

We are indebted to the Australian Biological Resources Study for funding the salary of C.M.B. in a grant to D.C.L., as well as to Dr Henrik Enghoff (Zoological Museum, Copenhagen) for making two types available. Thanks are also due to Mrs Kathy Bowshall-Hill for the notation and presentation of the figures and Mrs Debbie Lowery for typing the manuscript.

REFERENCES

- AOKI, J. 1966. Epizotic symbiosis: an oribatid mite, *Symbioribates papuensis*, representing a new family, from cryptogamic plants growing on the backs of papuan weevils (Acari: Cryptostigmata). *Pacif. Insects* 8: 281-289.
- BALOGH, J. 1970. New oribatids (Acari) from New Guinea. II. *Act. zool. hung.* 16: 291-344.
- BALOGH, J. 1972. The Oribatid Genera of the World' Akadémiai Kiadó, Budapest.
- BALOGH, J. & BALOGH, P. 1984. Review of the Oribatulioidea Thor, 1929 (Acari: Oribatei). *Act. zool. hung.* 30: 257-313.
- BALOGH, J. & MAHUNKA, S. 1966. New oribatids (Acari) from Australian soils. *Folia Ent. Hung.* 19: 553-568.
- BERLESE, A. 1895. 'Acari, Myriopoda et Scorpiones hucusque in Italia reperta'. Vol. 77 (5).
- BERLESE, A. 1916. Centuria terza di Acari nuovi. *Redia* 12: 289-338.
- BRODY, A. R. 1970. Observations on the fine structure of the developing cuticle of a soil mite *Oppia coloradensis* (Acarina: Cryptostigmata). *Acarologia* 12: 421-431.
- FEIDER, Z., VASILIU, N. & CĂLUGĂR, M. 1970. Trois espèces nouvelles de la famille des Oribatulidae Thor, 1929 (Oribatei). *Rev. Roum. Biol-Zool.* 5: 213-313.
- HAMMER, M. 1953. A new species of oribatid mite from Queensland. *Aust. J. Zool.* 1: 236-238.
- HAMMER, M. 1967. Investigations on the oribatid fauna of New Zealand, Part II. *Biol. Skr.* 15 (4): 1-64, 40 pls.
- HAMMER, M. 1973. Oribatids from Tongatapu and Eua, the Tonga Islands, and from Upolu, western Samoa. *Biol. Skr.* 20 (3): 1-70, 29 pls.
- JACOT, J. P. 1925. Phylogeny in the Oribatoidea. *Am. Nat.* 59: 272-279.
- LEE, D. C. 1981. Sarcopitiformes (Acari) of South Australian soils. 1. Notation. 2. Bifemora and Ptyctima (Cryptostigmata). *Rec. S. Aust. Mus.* 18: 199-222.
- LEE, D. C. 1987. Introductory study of advanced oribatid mites (Acarida: Cryptostigmata: Planolissuræ) and a redescription of the only valid species of *Constrictobates* (Oripodoidea). *Rec. S. Aust. Mus.* 21: 35-42.
- LEE, D. C. & BIRCHBY, C. M. 1989. *Decoribatula* gen. nov. from Singapore, with annotations on the allied *Reticuloplia* (Acarida: Cryptostigmata: Oribatulidae). *Trans. R. Soc. S. Aust.* 113(2): 1-5.
- LEE, D. C. & PAJAK, G. A. 1988. *Setobates* (Acarida: Cryptostigmata: Scheloribatidae) from South Australian soils. *Trans. R. Soc. S. Aust.* 112(2): 21-27.
- LEE, D. C. & PAJAK, G. A. (in press). *Schelorbates* Berlese and *Megaschelorbates* gen. nov. (Acarida: Cryptostigmata: Oripodoidea) with comments on Scheloribatidae from South-Eastern Australia. *Invert. Tax.* 4(2).
- LOUW, G. H. & SEELY, M. K. 1982. 'Ecology of Desert Organisms'. Longman Group Ltd, U.K.
- NORTON, R. A. 1983. Redefinition of *Mochloribatula* (Acari: Mochlozetidae), with new species, recombinations, and notes on plant associations. *Acarologia* 24 (4): 449-464.
- THOR, S. 1929. Über die Phylogenie und Systematik der Acarina, mit Beiträgen zur ersten Entwicklungsgeschichte einzelner Gruppen. *Nytt Mag. Naturv. Oslo* 67: 145-210.
- TRAVÉ, J. 1961. Contribution à l'étude des Oribatulidae (Oribates, Acariens). *Vie et Milieu* 12: 313-351.



Lee, D C and Birchby, C. M. 1991. "Ceroribatula gen. nov. Fovoribatula gen. nov. & Fovoribatulinae sf. nov. (Acarida : Cryptostigmata : Oribatulidae) from South Australian soils." *Records of the South Australian Museum* 24, 71-89.

View This Item Online: <https://www.biodiversitylibrary.org/item/126849>

Permalink: <https://www.biodiversitylibrary.org/partpdf/258026>

Holding Institution

South Australian Museum

Sponsored by

Atlas of Living Australia

Copyright & Reuse

Copyright Status: In copyright. Digitized with the permission of the rights holder.

License: <http://creativecommons.org/licenses/by-nc-sa/3.0/>

Rights: <https://biodiversitylibrary.org/permissions>

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.