

# An atypical micropterous new genus and species of Calisiinae with a short scutellum, and notes on the biology of the subfamily (Heteroptera, Aradidae)<sup>1</sup>

D. H. JACOBS

**Abstract:** *Breviscutheissia*, a new atypical micropterous genus, belonging to the subfamily Calisiinae of the Aradidae, is described. It is characterised by a short lunate scutellum that barely reaches the anterior margin of abdominal tergite 3, the hemelytra which are reduced to very small pads and the absence of hind wings. The type species, *B. ernsti*, is described and figured. They live and feed on the succulent creeper *Carpobrotus edulis* (Mesembryanthemaceae) where they can be found on the brown stems and dying leaves. It is suggested that the Calisiinae primarily live on the trunks and larger branches of living trees. It is uncertain on what they feed and it may be either plant juices or fungi growing amongst the bark.

**Key words:** Aradidae, *Breviscutheissia*, Calisiinae, micropterous, new genus, new species, South Africa.

## Introduction

The Calisiinae, one of the eight subfamilies of the Aradidae, is a relatively small group with six described genera and about 100 species. They occur in all major biogeographic regions but most species seem to be concentrated in the Southern Hemisphere (Australian – 56, Neotropical – 19, Afrotropical – 10) (KORMILEV & FROESCHNER 1987). About 90% of the species belong to the cosmopolitan genus *Calisius* while the other genera have more restricted distributions. In particular the fauna of the Afrotropical Region with four described genera is very diverse.

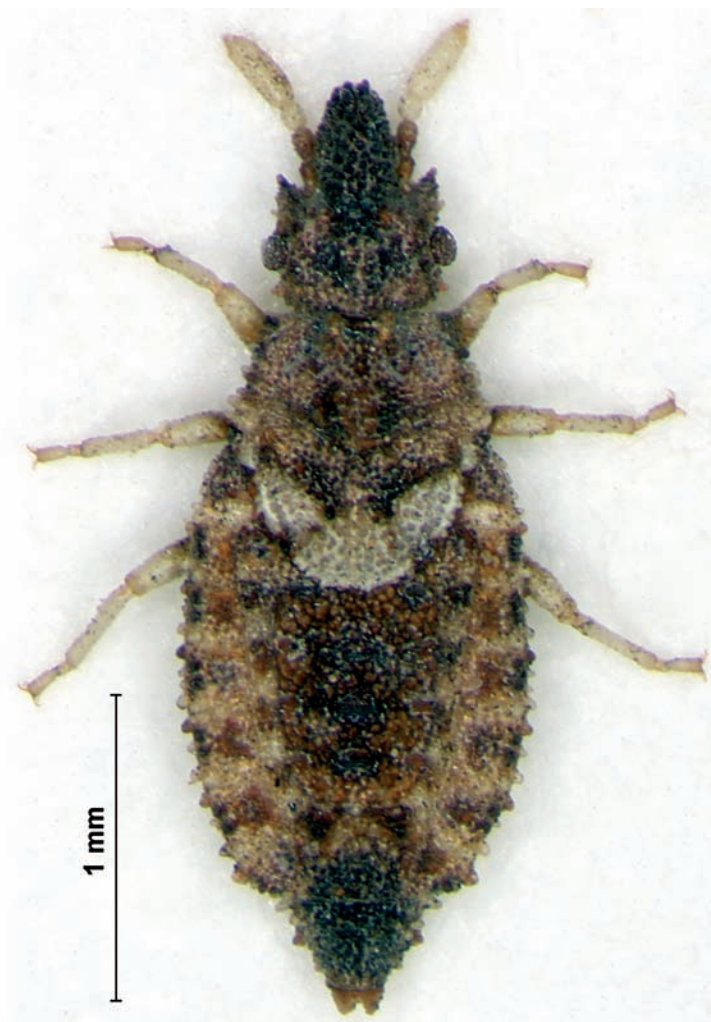
The Calisiinae are characterised by their greatly enlarged scutellum that covers all but a narrow margin of the abdominal disk inside the connexival sutures. All described species are winged with the hemelytra nearly completely hidden and membraneous, except for the sclerotized and thickened costal margins that are exposed along the edges of the basal half of the scutellum. Furthermore

the outer edges of the connexivum usually appear to have a double row of tubercles or teeth.

The reduction of wings and the loss of the ability of flight are common among the Aradidae. The majority of the Carventinae and many species of Mezirinae are apterous, while apterous or micropterous taxa have also been described in the Aneurinae, Aradinae, Chinamyersiinae and Prosypniestinae. In the Calisiinae the reduction of wings (KORMILEV 1967) and flightlessness (STANISIC et al. 2005) have also been reported and it seems to go hand in hand with the abbreviation of the scutellum (in *Calisius breviscutatus* at least). The development of the scutellum in the flightless species reported by STANISIC et al. (2005) and the development of the wings in other species where an abbreviation of the scutellum has been reported (KORMILEV 1966), are unfortunately not mentioned.

In the present paper a new atypical micropterous genus and species with an ex-

<sup>1</sup>This paper and the genus and species described in it are dedicated to my friend, Ernst Heiss, on his 70<sup>th</sup> birthday in appreciation for his friendship and invaluable contribution to our knowledge of the Aradidae.



**Fig. 1:** Dorsal aspect of male holotype of *Breviscutheissia ernsti* nov.gen. et nov.sp.



**Fig. 2:** Dorsal aspect of female allotype of *Breviscutheissia ernsti* nov.gen. et nov.sp.

tremely reduced scutellum are described and figured. The biology of the Calisiinae is also briefly discussed.

## Material and Methods

As described by JACOBS (1986, 1990, 1996), with the following modifications. Specimens prepared for SEM examination were investigated with the aid of a JEOL JSM-840 SEM using an acceleration voltage of 5kV. Colour photographs were taken with the aid of a Nikon SMZ800 stereo-microscope and a Zeiss Axiovert 200 inverse microscope using a Zeiss Axiocam MRC5 digital camera. Several photographs of a subject were taken at different focus levels before they were stacked with the aid of Helicon Focus or Combine-Z software programs.

The morphological terminology follows JACOBS (1986), and abbreviations are as follows: DELTg – dorsal external laterotergite (= connexivum); MTg – mediotergite.

The material examined is in the following collections: Albany Museum, Grahamstown (AMGS); American Museum of Natural History, New York (AMNH); The Natural History Museum, London (BMNH); National Museum, Bloemfontein (BMSA); California Academy of Sciences, San Francisco, California (CASC); D.H. Jacobs collection, Pretoria (DHJS); E. Heiss collection, Innsbruck (EHIA); Institut Royal des Sciences Naturelles de Belgique, Bruxelles (ISNB); Museum National d'Histoire Naturelle, Paris (MNHN); Musée Royal de l'Afrique Centrale, Tervuren (MRAC); Zoological Institute, Lund University, Lund (MZLU); Naturhistoriska Riksmuseet,

Stockholm (NHRS); Natal Museum, Pietermaritzburg (NMSA); Queensland Museum, Brisbane (QMBM); South African Museum, Cape Town (SAMC); National Collection of Insects, Pretoria (SANC); State Museum of Namibia, Windhoek (SMWH); Transvaal Museum, Pretoria (TMSA); Smithsonian Institution, National Museum of Natural History, Washington D.C. (USNM).

### Genus *Breviscutheissia* nov.gen. (Figs 1-18)

Type species: *Breviscutheissia ernsti*

Elongate oval. Micropterous with a short scutellum. Head, pronotum, anterior elevated part of scutellum, and submarginal region of DELTg's (= connexivum) with prominent, robust granules.

**Head** longer than broad across eyes. Clypeus prominent, covered with nodules, longer than posterior transversely rectangular part of head. Eyes small, globular; ocelli absent. Antennae 4-segmented, segments 1-3 short, subequal in length, segment 4 thick, as long as first three together. Labium 4-segmented, 1 and 2 short; 3 the longest; 4 slightly shorter than 3, reaching to just anterior of neck. Rostral groove open behind.

**Pronotum** trapezoidal, anterior lobe longer than posterior lobe, bearing 2+2 (2 lateral, 2 submedian) ill defined ridges anteriorly, The submedian ridges split near its posterior border resulting in that the posterior lobe shows 6 (3+3) irregular ridges.

**Scutellum** short, lunate, wider than long, barely reaching tergum 3 of abdomen (Figs 1-3).

**Hemelytra** reduced to very small pads, their exterior edges sclerotized and thickened, bearing one or two nodules (Fig. 18), visible just lateral of the scutellum base. Hind wings absent.

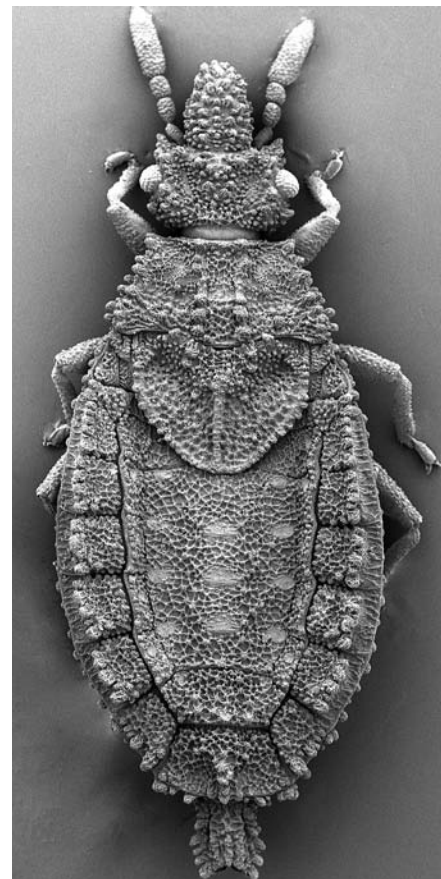
**Legs** typical for the Calisiinae. At about the middle of meso- and metafemora, a nodule is present anterodorsally (Fig. 8), appearing like a plectrum. However, a corresponding strigil on the abdomen is not discernable.

**Abdomen. Dorsum:** MTg 1 and 2 fused but line of demarcation clearly visible (Figs 14-15), largely covered by the scutellum.

DELTg 1 visible from above as a thin transversely rectangular sclerite. Tergal disk (MTg's 3-6) divided into a median sclerite and 2 (1+1) lateral strips by well developed sulci (Figs 14-15). Distinct remnants of three scent gland openings, equidistant from each other, present on the hind borders of terga 3-5. DELTg 2-7 (= connexivum) well developed; 2-6 in females with lateral tubercles lacking but a high, well developed, longitudinal ridge sublaterally, 7 with 2 or 3 lateral tubercles; males without the sublateral ridges but with lateral (or almost lateral) tubercles on DELTg 2-7. Tergite 8 of female large, trapezoidal, with anterior to postero-median area triangularly elevated; tergite 8? of male large, subtriangular, anteriorly fused to the posterior rim of sternite 7 (Fig. 16), extending posteriorly to cover most of the elongate pygophore (Fig. 11). **Venter.** Sternites 2 and 3 fused medially with intersegmental suture visible laterally; sternites 4-5 well developed with intersegmental sutures complete. Sternites 6 and 7 in female fused laterally, medially developed as 2 (1+1) separate sclerites that cover the genitalia; sternites 6 and 7 of male fused. Sternite 8 of male well developed, fused with paratergites 8. Paratergites 8 of female large, triangular, situated directly beneath depressed lateral area of tergite 8. Spiracles small and hardly visible (Fig. 12), 2-6 sublateral, 7 lateral and 8 terminal on paratergite 8.

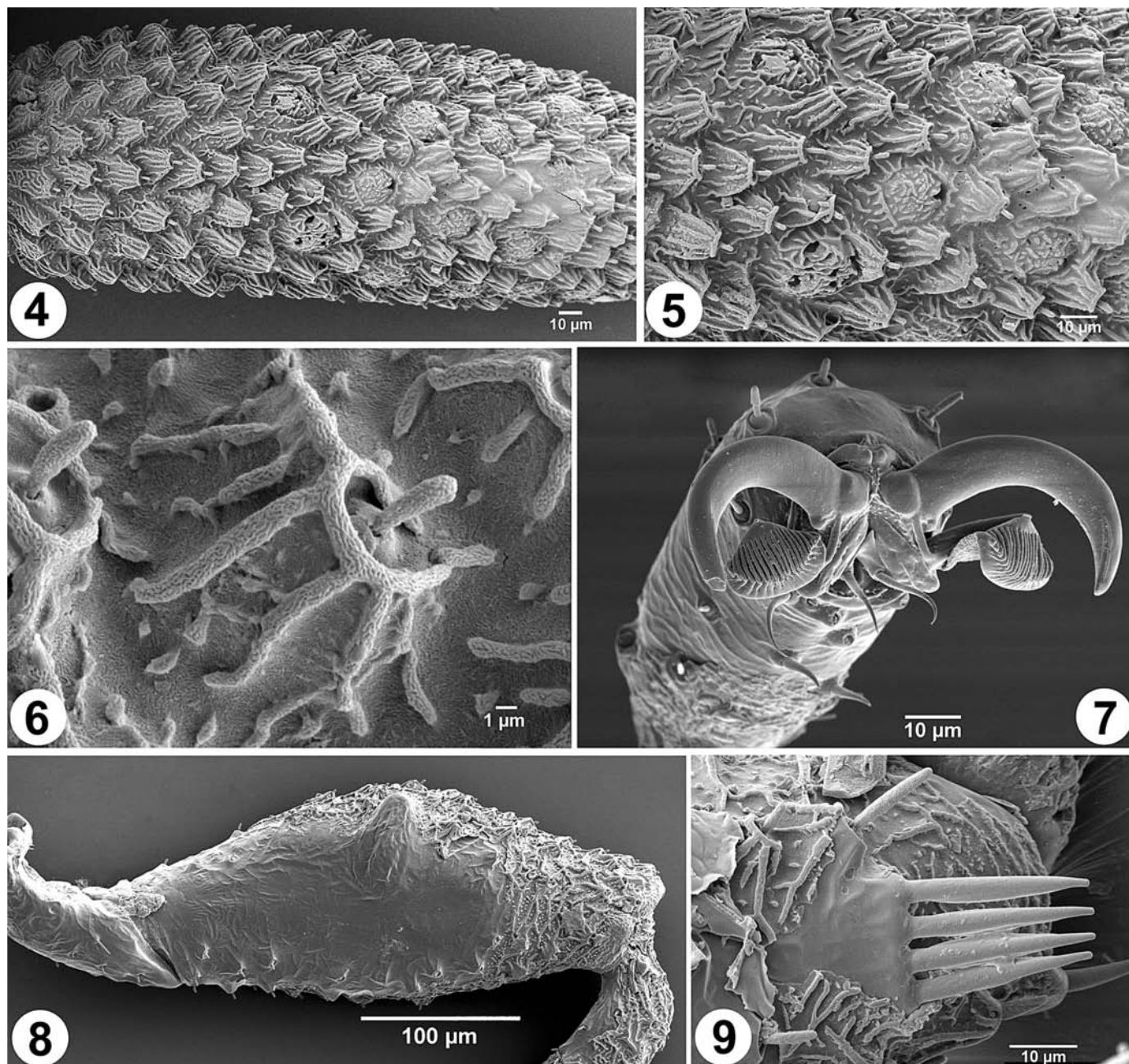
**Derivation of specific epithet:** "Breviscut" referring to the short scutellum and "-heissia" to Ernst Heiss, in admiration of all his excellent and meticulously illustrated papers on the Heteroptera and particularly the Aradidae.

**Remarks:** *Breviscutheissia* is easily distinguished from all other calisiine genera by its extremely reduced, lunate scutellum that hardly reaches tergum 3 and the extreme reduction of the hemelytra and absence of the hind wings.



**Fig. 3:** Scanning electron photomicrograph of dorsal aspect of female paratype of *Breviscutheissia ernsti* nov.gen. et nov.sp.





**Figs 4-9:** Scanning electron photomicrographs of *Breviscutheissia ernsti* nov.gen. et nov.sp. to illustrate morphological features  
(4-6) Sculpture of the 4<sup>th</sup> antennal segment at different magnifications  
(7) Apical tarsal segment with claws, bristle-like parempodia and lamellate pulvilli attached to it  
(8) Mesothoracic leg with antero-dorsal plectrum-like nodule on the femur  
(9) Protibial comb consisting of four pegs.

***Breviscutheissia ernsti* nov.sp.  
(Figs 1-18)**

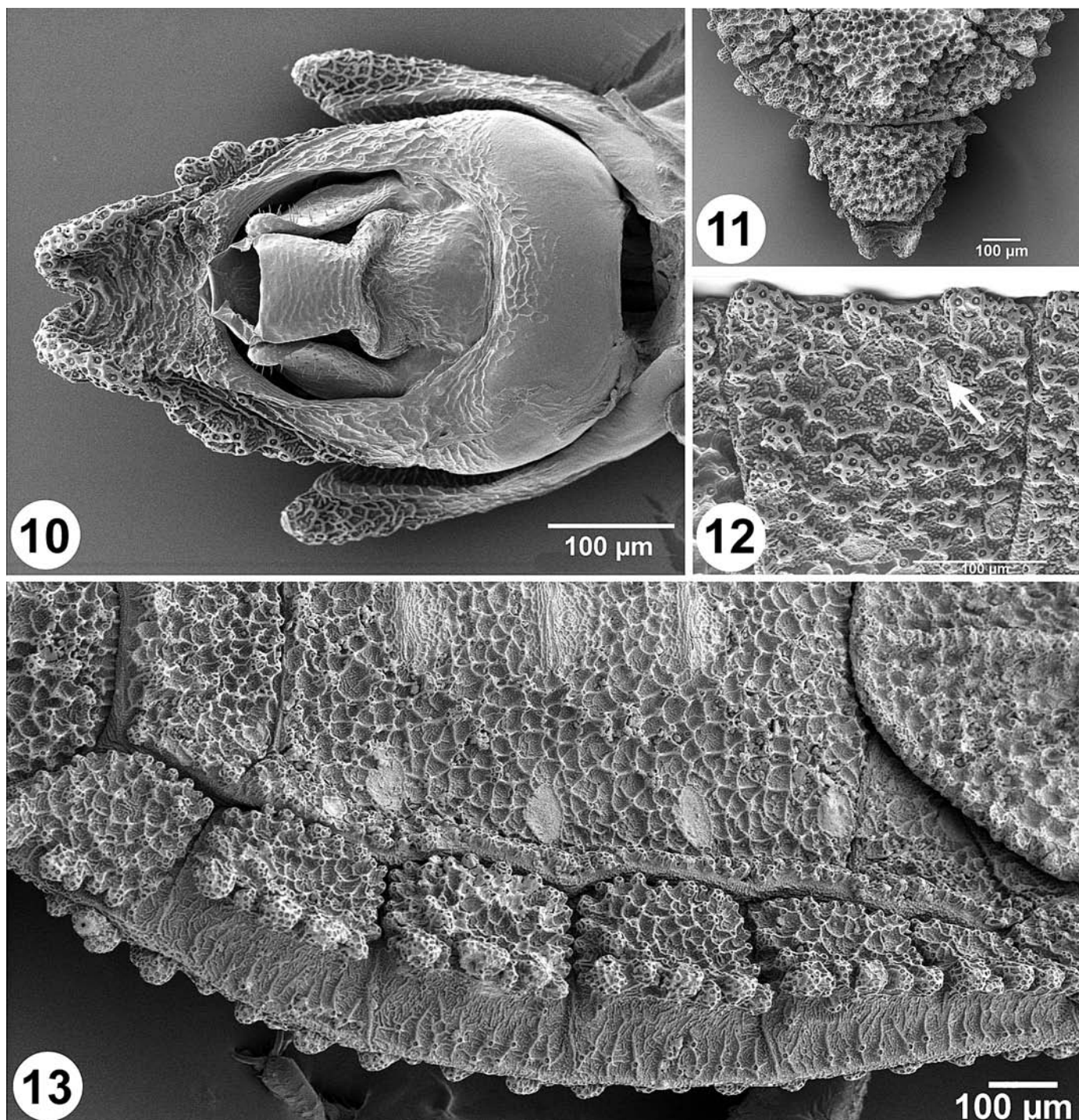
**Size:** Length of male 2.7-3.3 mm, female 3.5-4.0 mm; width of male 1.0-1.3 mm, female 1.3-1.6 mm.

**Habitus:** Elongate oval. Micropterous with a short scutellum. General colour mottled dark brown, light brown and stramineous; legs, segments 3-4 of antennae and most of the latero-posterior part of the scutellum (except for 1+1 brown markings on the postero-lateral margin) whitish; clypeus and nota 7 and 8 dark brown; each DELTg 2-7 brown anteriorly and strami-

neous posteriorly. Head, pronotum, anterior elevated part of scutellum, and submarginal region of DELTg's (= connexivum) with prominent, robust granules.

**Head** longer than broad across eyes (1.17:1). Clypeus prominent, covered with nodules. Posterior transversely rectangular part of head shorter than clypeus, bearing large nodules submedially and an irregular row just medially of the relative small eyes. Antenniferous spines acute. Antennae 4-segmented, gradually thickening from segment 1 to 4; segment 1 thin, about as long as segment 2; segment 2 pyriform; segment 3





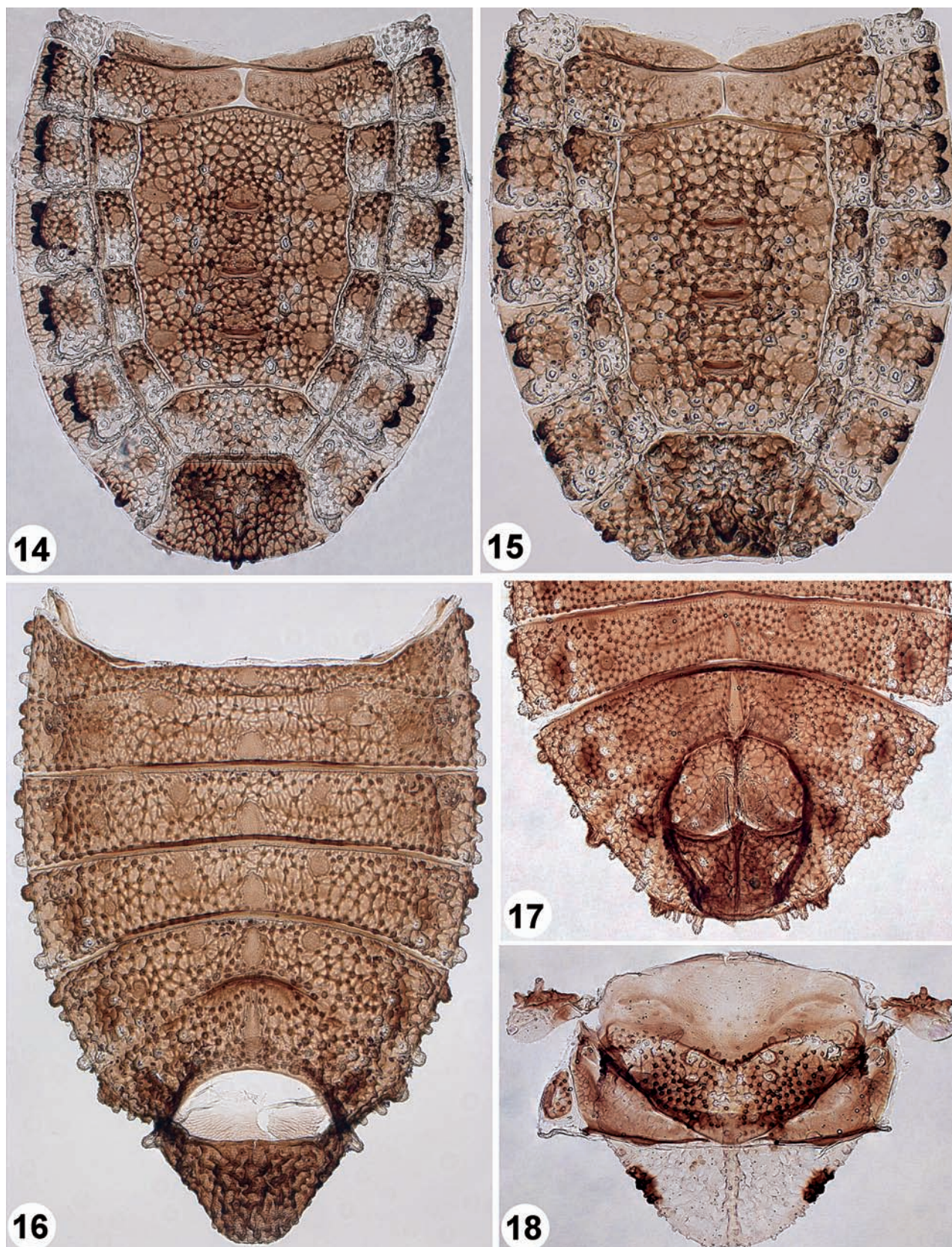
moniliform and the shortest; segment 4 robust, thick, granulated and longer than the first three segments together; relative lengths of segments 1.25: 1.23: 1: 3.55. Labium 4-segmented, segments 1 and 2 short; 3 the longest; 4 slightly shorter than 3, reaching to just anterior of neck; relative lengths of segments 1.1: 1: 2.7: 2.3. Rostral groove open behind. Bucculae fairly high and well developed along first two rostral segments but becoming suddenly low along the ante-

rior part of segment 3 and very low for the most of its posterior part.

**Pronotum** trapezoidal, about 2.03 times wider over humeral angles than median length, posterior margin bisinuate. Anterior lobe distinctly longer than posterior lobe, weakly separated from it by a shallow impression; bearing 2+2 (2 lateral, 2 submedian) ill defined ridges anteriorly, each composed of about 3 large tubercles; 2 (1+1) weakly defined ridges split laterally off from

**Figs 10-13:** Scanning electron photomicrographs of *Breviscutheissia ernsti* nov.gen. et nov.sp. to illustrate morphological features (10) Dorsal view of male pygophore (11) Dorsal view of the male terminal abdominal segments illustrating a large tergite 8? that covers the greater part of the pygophore (12) Ventral aspect of the lateral part of sternite 4 showing the inconspicuous spiracle (arrow) (13) Dorso-lateral view of the female abdomen showing the sublateral ridge on segments 2-6.





**Figs 14-18:** Photomicrographs of dissected parts of the abdomen and thorax of *Breviscutheissia ernsti* nov.gen. et nov.sp. (14) Female abdominal dorsum illustrating the sublateral ridges on segments 2-6 and the division of the tergal disk (15) Male abdominal dorsum (16) Male abdominal venter with tergite 8? fused with the posterior rim of sternite 7 (17) Terminal segments of female abdominal venter showing laterally fused sternites 6+7 and the split median plates that cover the genitalia (18) Mesothorax with the micropterous wing pads anteriorly attached to it and the lunate scutellum posteriorly.



the submedian ridge near the posterior border of the anterior lobe resulting in that the posterior lobe shows 6 (3+3) irregular ridges consisting of one or two tubercles each with the lateral ridge more or less double.

**Scutellum** lunate, about 1.38 times wider than long, barely reaching back to the anterior margin of tergum 3; sub-triangular medio-anterior part elevated, lateral of elevation 1+1 distinct depressions are present sublaterally; lateral margins nodulated on anterior 2/3; a nodulated ridge that reaches the hind margin is present medially.

**Hemelytra** reduced to very small pads (Fig. 18), their exterior edges sclerotized and thickened, bearing one or two nodules, visible just lateral of the scutellum base. Hind wings absent.

**Legs** typical for the Calisiinae: trochanter well developed, femora slightly inflated, tibiae slightly shorter than the femora, tarsi 2-segmented. Terminal segment of tarsi bears 2 claws, 2 bristle-like parempodia and 2 lamellate pulvilli (Fig. 7). Protibial comb with 4 pegs (Fig. 9)

**Abdomen. Dorsum:** MTg 1 short, posteriorly fused with MTg 2 but line of demarcation clearly visible, largely covered by the scutellum. DELTg 1 visible from above as a thin transversely rectangular sclerite that is fused to a lateral extension of postnotum 3 of the thorax.

**Tergal disk** (MTg's 3-6) divided into a median sclerite and 2 (1+1) lateral strips by well developed sulci. The median sclerite exhibits the distinct remnants of three scent gland openings, equidistant from each other on the borders of terga 3/4, 4/5 and 5/6; 1+1 well developed median glabrous areas are present in the antero-lateral corner of each tergite. The lateral strips bear the small sublateral glabrous impressions; the different tergites that form the lateral strips more or less fused but they show a similar colour pattern as the DELTg's (dark in front and lighter behind) which clearly indicate the limits of the different segments; lateral strips covered with small nodules in females while those of males have a few larger tubercles laterally.

**DELTg's** 2-7 well developed; 2-6 in females with lateral tubercles lacking but a

high, well developed, longitudinal ridge sublaterally (remote from lateral edge and nearly halfway between their median and lateral borders) (Figs 13-14), consisting of 3-4 large, prominent tubercles and 1-3 small ones, DELTg 7 without above ridge but with 2 or 3 lateral tubercles; males without the sublateral ridges but with 3 lateral (or almost lateral) tubercles on DELTg's 2-6 and 2 on DELTg 7 (Fig. 15).

**Tergite 7** of female rectangular, relatively flat; tergite 8 large, trapezoidal, with anterior to postero-median triangular area elevated. Tergite 7 of male broadly rectangular with medio-posterior part elevated to accommodate the pygophore; tergite 8? large, subtriangular, anteriorly fused to the posterior rim of sternite 7, extending posteriorly to cover most of the elongate pygophore of which only the bifurcate posterior extension is visible from above (Fig. 11).

**Abdomen. Venter:** Sternites 2 and 3 fused with line of fusion vaguely discernable medially but with intersegmental suture visible laterally (Fig. 16); sternites 4-5 well developed with intersegmental sutures complete; sternites 6 and 7 in female fused laterally with line of demarcation vaguely visible, sternite 7 medially comprising of 1+1 suboval sclerites separated by the median cleft and demarcated from the remainder of the segment by well developed sutures; sternites 6 and 7 of male fused with a remnant of the intersegmental suture present medially, sternite 7 with a posterior rim that is fused with tergite 8? dorsally. Sternite 8 of male well developed, fused with paratergites 8. Paratergites 8 of female large, triangular, situated directly beneath depressed lateral area of tergite 8.

**Spiracles** small and hardly visible, even under high magnification (Fig. 12), 2-6 sublateral, 7 lateral and 8 terminal on paratergite 8.

**External female genitalia:** first valvifers large, paralleliform, attached to paratergites 8 laterally but separated from them by sutures; second valvifers elongate rectangular.

**External male genitalia:** pygophore elongate with a bifurcate extension posteriorly (Fig. 10), opening dorsal, covered by tergum 8? (Fig. 11).

**Chromosome number:**  $2n(\sigma) = 18XY$   
(16 autosomes + XY).

**Derivation of specific epithet:** This interesting species is dedicated to Ernst Heiss in appreciation of his tireless and invaluable contribution to our knowledge of the Aradidae.

Material examined: South Africa.  $\sigma$  Holotype: Farm Dwarsrivier, Cedarberg, 32°29'S 19°16'E, 10-15.x. 2002, D. Jacobs & M. Stiller (DHJS);  $\varphi$  Allotype: ditto (DHJS); 126 $\sigma\sigma$ , 77 $\varphi\varphi$ , 33 nymph paratypes as follows: 125 $\sigma\sigma$ , 76 $\varphi\varphi$ , 33 nymphs: Same data as holotype (2 $\sigma\sigma$ , 2 $\varphi\varphi$  each AMGS, AMNH, BMSA, ISNB, MNHN, MZLU, NHRS, NMSA, QMBA, SANC, SMWH, USNM; 4 $\sigma\sigma$ , 4 $\varphi\varphi$  each BMNH, CASC, EHIA, MRAC, SAMC, TMSA; 77 $\sigma\sigma$ , 28 $\varphi\varphi$ , 33 nymphs DHJS); 1 $\varphi$ : South Africa, CP, Kareedouw, 33°57'S 24°17'E, 3.i. 1979, S. Naser, On *Carpobrotus edulis* (SANC); 1 $\sigma$ : S. Africa, Distant Coll, B.M. 1911 - 383 (BMNH).

## The biology of the Calisiinae

The Calisiinae are usually rare in collections and virtually nothing is known about their biology. They have been reported to be associated with various trees (*Quercus*, *Salix* – USINGER & MATSUDA 1959; *Populus pruinosus* – KIRITSHENKO 1959; *Matisia cordata*, *Hirtella triandra* – FROESCHNER 1992; *Eucalyptus* – KORMILEV 1966, STANISIC et al. 2005), but the nature of these associations is not clear. In most of the above cases they seem to be associated with the trunks of living trees. KIRITSHENKO (1959) reported that they were collected in the cracks in the bark of *Populus pruinosus*, KORMILEV (1966) stated that *Calisius intervenius* was collected under the bark of *Eucalyptus* trees in Australia, FROESCHNER (1992) narrated that 31 specimens of *Calisius kormilevi* (including 10 nymphs) were collected from *Matisia cordata* and *Hirtella triandra* trees by insecticidal fogging, and STANISIC et al. (2005) collected four species by pyrethrum spraying on eucalypt trunks.

Over the past 30 years I found *Calisius africanus* in fair numbers under the bark of large exotic *Eucalyptus* trees near Pretoria (25°38'05.48"S 28°17'51.56"E) in South Africa every winter (May to September) where they are obviously overwintering. Although I have searched the area repeatedly I had no success in locating them during the summer.

In the National Collection of Insects in Pretoria I found a single specimen of *Brevicuteissia ernsti* nov.sp. which was collected on *Carpobrotus edulis* (Mesembryanthemaceae), a lush green mat-forming, creeping succulent. I was of the opinion that it was collected fortuitously on this plant as the cryptic colouration of the bug does not seemed to fit in with a green succulent. In the Cedarberg, however, I found large numbers of *B. ernsti* nov.sp., including eggs and nymphs of all stages, on *C. edulis*. They were mostly found on the older brown stems of the plants where they are well camouflaged. They also seem to prefer the plants where they grow over rocks. Several specimens were observed feeding on the older, yellow, dying leaves of the plants.

At the Wonderboom Nature Reserve (25°41'16"S 28°11'20"E) in Pretoria I collected fair numbers of adults and nymphs of an undescribed species probably belonging to *Paracalisius* on *Croton gratissimus* (Euphorbiaceae), a small to medium sized tree. The bugs were collected by beating and they seem to be present only on larger branches with a diameter of 50 mm or more and were more common on trees which grow in the partial shade of other trees.

From the above observations it seems that the Calisiinae are associated with living plants where they live on the stems or trunks. It is uncertain on what they feed but it could be on the juices of the plants. The possibility that they feed on fungi that grow on the bark of trees (or in the dying leaves of *Carpobrotus edulis* in the case of *B. ernsti*) can, however, not be excluded and needs further investigation.

The Calisiinae are rare in collections because they are not collected by most of the popular collection methods. They are not attracted to light, and sweep-netting and beating of thinner branches or leaves are unsuccessful. The most effective way to collect them will probably prove to be by fogging trees with a knock-down pesticide like a synthetic pyrethroid or by spraying the trunks of the trees with it. Vacuum sucking the trunks of trees may also be a practical and productive way in which to collect these bugs.



## Acknowledgements

My sincere thanks are due to Prof. C.H. Scholtz for critical comments on the manuscript. I am also indebted to the Laboratory for Microscopy and Microanalysis at the University of Pretoria for using their facilities and equipment and to Alan Hall, Chris van der Merwe and André Botha for their helpfulness and assistance.

## Zusammenfassung

*Breviscutheissia*, ein neues, atypisches, mikropteres Genus der Unterfamilie Calisiinae der Familie Aradidae wird beschrieben. Es wird charakterisiert durch das kurze, mondformige Scutellum, das kaum den Vorderrand von Abdominaltergit 3 erreicht, die Hemelytren, die zu kleinen Flügelresten reduziert sind und die fehlenden Hinterflügel. Die Typus-Art, *B. ernsti*, wird beschrieben und abgebildet. Sie lebt und saugt an der sukkulenten Kletterpflanze *Carpobrotus edulis* (Mesembryanthemaceae), wo sie an den braunen Stämmen und abgestorbenen Blättern gefunden wurde. Es wird vermutet, dass Calisiinae primär an den Stämmen und größeren Ästen lebender Bäume vorkommen. Es ist unsicher, wovon sie sich ernähren, sowohl Pflanzensäfte als auch Pilzmycelien kommen in Frage.

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## Address of the Author:

Dr. Dawid H. JACOBS  
Department of Zoology and Entomology  
University of Pretoria, 0001 Pretoria  
South Africa  
E-Mail: [dhjacobs@zoology.up.ac.za](mailto:dhjacobs@zoology.up.ac.za)  
or [dawidhj@mweb.co.za](mailto:dawidhj@mweb.co.za)

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