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**ANACHIPTERIA SACculIFERA N. SP.**
(ACARI: ORIBATIDA: ACHIPTERIIDAE)
FROM ARBOREAL LICHENS IN NEW YORK STATE

BY H. T. ROOT¹, ², A. Y. KAWAHARA³, & R. A. NORTON¹

( Accepted September 2007 )

**SUMMARY:** A new arboreal species of the oribatid mite family Achipteriidae is proposed, based on adults collected from arboreal microhabitats, primarily lichens, in the Adirondack Mountains of New York State. *Anachipteria sacculifera* n. sp. is only the second member of the genus known to have an octotaxic system composed of saccules.

**INTRODUCTION**

Oribatid mites of forest canopies have been little explored, and sampling frequently yields new taxa that appear restricted to this environment (BEHAN–PELLETIER & WINCHESTER, 1998; BEHAN–PELLETIER & WALTER, 2000). Arboreal mite sampling in North America has focused largely on the rich forests of the Pacific Northwest (BEHAN–PELLETIER, 2000; BEHAN–PELLETIER et al., 2001; LINDO & WINCHESTER, 2006). Root et al. 2007 showed that canopies of sugar maple (*Acer saccharum* Marshall) in the Adirondack Mountains of New York also host a diversity of oribatid mites, particularly associated with epiphytic lichens.

The most numerically dominant oribatid mite species in these maple canopies is an undescribed new species of *Anachipteria*. This widespread genus, one of nine in the family Achipteriidae, currently includes 14 named species (SuBías, 2004) that are typically associated with leaf litter or mosses. Eight of these have been reported from North America (MARSHALL et al., 1987). The objective of this paper is to describe adults of this species under the name *Anachipteria sacculifera* n. sp. The species co-occurred in samples with *Anachipteria magnilamellata* Ewing; since immatures of the latter are not yet described, we could not associate the few collected nymphs with either species.

**MATERIALS AND METHODS**

Morphological terminology is mostly that of F. GRANDJEAN (1952; see TRAVÉ, 1960 and TRAVÉ & VACHON, 1975 for general references, NORTON, 1977 for leg setal nomenclature). Length and width were measured when viewed in cavity slides in lactic acid

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FIGS. 1-5. *Anachipteria sacculifera* n. sp. 1. — dorsal aspect, legs removed. 2. — ventral aspect, distal regions of legs removed. 3. — lamellar cusps, dorsal aspect, three variations. 4. — distal region of tutorium, showing three variations of cusp. 5. — bothridial seta, dorsal aspect, three variations.
from the dorsal aspect: length spans the tip of lamellar cusps to the posterior edge of the notogaster; width was measured at the widest part of the notogaster. Unideficience nomenclature is used for notogastral setae. All ventral, notogastral, and prodorsal setae are measured on a male, 439 \( \mu m \) long, in a cavity slide in lactic acid with exceptions as follows: setae \( 1c, 4c, ex \) and subcapitular setae were measured on slide-mounted dissected males. Tarsal setae count of leg I includes the famulus; solenidial counts are included in parentheses.

Specimens were prepared for scanning electron microscopy with a JEOL 5800 LV by submerging them in an ultrasonic bath for 10 seconds and dehydrating with a graded series of ethanol-acetone mixtures to pure acetone. After approximately 1 hr in acetone, specimens were mounted on stubs with double-sided adhesive carbon disks, allowed to air dry overnight, and sputter-coated with 15 nm of gold palladium. For line drawings, initial pencil sketches were digitally scanned, then edited using Adobe Illustrator® computer software.

Abbreviations of type repositories are as follows: Field Museum, Chicago, Illinois, United States (FMNH); New York State Museum, Albany, New York, United States (NYSM); Canadian National Collection of Insects and Arachnids, Agriculture and Agri-Food Canada, Ottawa, Ontario, Canada (CNC); personal collection of Roy A. Norton (RAN).

**Anachipteria sacculifera** n. sp. (Figs. 1-25)

**Etymology.** The specific epithet “sacculifera” refers to the nature of the octotaxic system of dermal glands, the cuticular part of which take the form of saccules.

**Measurements.** Average total adult body length: female 447 \( \mu m \) (range 432-464, \( n = 11 \)); male 425 \( \mu m \) (range 403-443, \( n = 11 \)). Average notogastral width: female 302 \( \mu m \) (range 290-314, \( n = 11 \)); male 278 \( \mu m \) (range 262-290, \( n = 11 \)).

**Integument.** Apparently smooth under light microscope; scanning electron microscopy reveals microringular texture on notogaster (Fig. 14), pedotectum I (Fig. 19). ventral plate and subcapitulum (Fig. 23). Areas of raised striation occur as noted below. Obvious cerotegument restricted to area on and near humeral vesicle; excrescences dense, minute, conical (Fig. 24).

**Prodorsum.** Rostrum with rounded, weakly undulating margin (Figs. 2, 11); small medial postmarginal carina (Fig. 17) results in distinct pointed appearance at slightly higher focal plane. Lamellar cusp 50-65 \( \mu m \) long, with variable lateral dens (Fig. 3); the latter 10-20 \( \mu m \) long. Bothridium with distinct medial tooth extending anteriorly beyond notogaster in dorsal aspect (Fig. 12). Bothridial seta (bo) apparently smooth, 65-70 \( \mu m \) with distal third swollen; tip pointed or rounded according to specimen and viewing aspect (Figs. 5, 12, 17). Lamellar seta (le) apparently smooth, \( \sim 55 \mu m \). Interlamellar seta (in) with small barbs, \( \sim 100 \mu m \). Rostral seta (ro) conspicuously barbed, slightly curved medially, \( \sim 70 \mu m \). Exobothridial seta (not illustrated) thin, apparently smooth, \( \sim 15 \mu m \).

**Lateral aspect of podosoma.** Tutorium narrow, with distinct, sharp distal cusp highly variable in size: ratio of cusp length to tutorium width varying from 1:0.3 to 1:0.7 (Figs. 4, 18, 19). No custodium apparent. Pedotectum I large, fully covering acetabulum I; usually with striations parallel to anterior edge (Fig. 19). Pedotectum II much smaller, ear-shaped, covering less than a quarter of acetabulum II. Everted, mushroom-shaped, thin-walled humeral (subalar) vesicle present dorsal to acetabulum III, hidden under pteromorph; covered with dark, easily removed cerotegument; diameter of vesicle 30-38 \( \mu m \) (Fig. 24); diameter of apparent aperture in cuticle 9-13 \( \mu m \) (Fig. 25).

**Notogaster.** Ratio of length to width \( \sim 1 \). 1:1-2:1 in intact specimens. Anterolateral corner of pteromorph with varied acuity, usually approximately right-angled (Figs. 13, 21); often with small striate region near anterior edge. Lenticulus roughly triangular, with irregular margins in transmitted light (Fig. 1), not discernable in SEM. Octotaxic system of dermal glands represented by saccules (Fig. 1; \( S_1, S_2, S_3 \)). Saccule \( S_1 \) largest (\( \sim 12 \mu m \) diameter), others 7-10 \( \mu m \) diameter; \( S_1 \) aligned between setae \( lp \) and \( h_3 \) (Figs. 14, 15). Four pairs of lyrifissures present (\( ia \)
Figs. 6-7. Anachipteria sacculifera n. sp. 6. — right leg I, abaxial aspect (trochanter omitted). 7. — right leg II, abaxial aspect (trochanter omitted).

not discerned); im aligned with saccules Sa and S3, closer to former; others not visible in dorsal aspect: ip ventromedial to saccule S3, forming a small equilateral triangle with it and seta h1; ih and ips ventral to circumgastric muscle band, anterior to seta p3. Ten pairs of apparently smooth notogastral setae: c2 52 μm (range 40-61, n=19); la ~ 55 μm; h1, lp, h2 35-40 μm; p2, p3 ~ 30 μm; p1, lm, h3 22-25 μm.

Ventral region. Relatively smooth throughout, with shallow groove posterior to anal plates (Figs. 1, 21). Capitular angle of coxisternum (Fig. 23) strongly projecting as sharp tooth. Epimeral setae thin, apparently smooth, formula (I to IV) 3-1-3-3. Seta 4c very thin, minute (~10 μm), positioned just anterior to leg IV; visible only on dissected specimens (Fig. 20). Seta lc on pedotectum I, ~ 15 μm (Fig. 17). Setae 1a, 2a, 3a, 4b, 3b, 4a 18-24 μm. Seta 1b longest, ~ 52 μm. Aggenital seta ~ 25 μm, sometimes unilaterally absent. Six pairs of genital setae 20-25 μm, longest anteriorly. Two pairs of anal and three pairs of adanal setae 20-25 μm, apparently smooth. Lyrifissure iad close and parallel to anal aperture, near seta ad3.

Ovipositor. With 3 pairs coronal setae 6-7 μm. Six pairs eupathidial distal setae: dorsal lobe setae ψ1 18-20 μm, ψ2 ~ 38 μm; ventral lobe setae τ2, 4 18-21 μm, τ1 38-42 μm. Eggs ovoid with irregular, loboic chorion (Fig. 16) ~ 140 x 242 μm.

Gnathosoma. Subcapitular mentum without anterior tectum; setae h, m, and a ~ 22, 30, and 18 μm long respectively. Chelicerae normal, strongly dentate (Fig. 22).

Legs. Ratio of leg IV to body length ~ 0.5:1. Approximate ratio of leg segments (femur: genu: tibia: tarsus): I 1.4:0. 6:0. 7:1; II 1.9:0. 7:0. 8:1; III 1.4:0. 6:1:1; IV 0.9:0. 7:0. 8:1 (Figs. 6-9). Each pretar-
sus hetero-tridactylous: empodial claw large, smooth; lateral claws thin, with minute dorsal barbs. Genu IV elongated, curved, typical of family (Fig. 9). Large porose area present on anterior face of femora I-IV (therefore not shown in Figs. 6, 7); pores becoming diffuse at margin. Porose areas of trochanters III-IV on proximal half of posterior face (therefore not shown in Figs. 8, 9). Adaxial face of all femora with raised parallel striae, in partial fingerprint pattern that differs on each femur; pattern most strongly developed on femur II, present only ventrodistal to porose area on femora III-IV. Setation (I-IV): trochanters 1-1-2-1; femora 5-5-2-2; genua 3(1)-3(1)-1(1)-2; tibiae 4(2)-4(1)-3(1)-3(1); tarsi 19(2)-15(2)-15-10; setal homologies indicated in Table 1. Leg II with several unusual setae: seta $v''$ on femur very long, 75-80 $\mu$m; seta $l''$ of genu conspicuously thickened, spine-like, slightly darkened; seta s of tarsus large, coarsely pectinate. Primiventral pair (pv) with anterior (') disjunction, pairs tc and ft with posterior (") disjunctions. Apparently with single accessory ventral seta, $v'$ on tarsus I, none on other tarsi (immatures not known). Setae s, p', and p" are eupathidial on tarsus I.

<table>
<thead>
<tr>
<th>Trochanter</th>
<th>Femur</th>
<th>Genu</th>
<th>Tibia</th>
<th>Tarsus</th>
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<tr>
<td>Leg I</td>
<td>$v'$</td>
<td>$d$, ($l$), $bv''$, $v''$</td>
<td>($l$), $v'$, $q$, $q_2$</td>
<td>($l$), ($v$), $q$, $q_2$</td>
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<tr>
<td>Leg II</td>
<td>$v'$</td>
<td>$d$, ($l$), $bv''$, $v''$</td>
<td>($l$), $v'$, $q$</td>
<td>($l$), ($v$), $q$</td>
</tr>
<tr>
<td>Leg III</td>
<td>$t$, $v'$</td>
<td>$d$, $ev'$</td>
<td>$t$, $q$</td>
<td>($l$), ($v$), $q$</td>
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<tr>
<td>Leg IV</td>
<td>$v''$</td>
<td>$d$, $ev'$</td>
<td>$d$, $l'$</td>
<td>$t$, ($v$), $q$</td>
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Table 1. Leg setiform organs of adult *Anachipteria sacculifera* n. sp. (Parentheses around setae denote a pair).
FIGS. 10-16. Anachipteria sacculifera n. sp. 10. — dorsal aspect. 11. — frontal aspect. 12 — anterior third, dorsal aspect (arrow on bothridial tooth). 13. — lateral aspect. 14. — detail of notogaster, dorsal view, showing opening of saccule $S_I$ (arrow) flanked by broken remnants of setae $l_p$ (left) and $h_3$ (right). 15. — saccule $S_I$ in subsurface focal plane. 16. — egg, showing lobose chorion. (Figs. 10-14. — scanning electron micrographs, Figs. 15-16. — light micrographs. Scale bars: 10, 11, 13 = 50 $\mu$m; 12 = 20 $\mu$m; 14, 15 = 5 $\mu$m; 16 = 10 $\mu$m.)
Figs. 17-25. *Anachipteria sacculifera* n. sp. 17. — anterior third, lateral aspect (arrow on medial carina of rostrum). 18. — detail of tutorial cusp in previous figure. 19. — lateral region of prodorsum, showing striations on pedotectum I (arrowhead) and long variation of tutorial cusp (arrow). 20. — epimeral seta 4c, lateral aspect. 21. — ventral aspect. 22. — left chelicerae, adaxial aspect. 23. — subcapitulum and surrounding region, ventral aspect (arrow on capitular angle). 24 — subalar vesicle, lateral aspect. 25. — same, with focus at base of vesicle, showing apparent aperture in cuticle. (Figs. 17-19, 21, 23. — scanning electron micrographs, 20, 22-25 light micrographs. Scale bars: 17, 19 = 20 μm; 18, 20, 25 = μm; 22, 23, 24 = 10 μm.)
**Material Examined:** Holotype: adult female. United States. New York: Essex Co., Newcomb, Huntington Wildlife Forest (UTM NAD 83 Zone 18: 560418, 4875259), 7 August 2005 (Heather T. Root) from the lichen Parmelia squarrosa on a crown branch of Acer saccharum; deposited in FMNH. Paratypes: 23 with same data as holotype (except UTM 560553, 4875259), 22 June 2005 on Punctelia rudecta; 19 with same data as holotype (except UTM 558513, 4872822), 26 June 2005 on Flavoparmelia caperata; 38 with same data as holotype (except 5 July 2005) on Flavoparmelia caperata, Pertusaria velata, Punctelia rudecta, and Parmelia squarrosa; 10 with same data as holotype except UTM 560651 4870410), 6 July 2005; 3 with same data as holotype (except on Flavoparmelia caperata); 3 with same data as holotype (except UTM 565856, 4871410), 18 July 2005; 7 with same data as holotype (except UTM 560651, 4870410) 5 August 2005 on Flavoparmelia caperata. Paratypes are deposited as follows: 20 (FMNH), 10 (NYSM), 19 (CNC), and 46 (RNC), with 9 retained by the senior author.

**Diagnosis**

With general characters of *Anachipteria* as given by Shaldybina (1975) and Pérez-Inigo (1993), except as relates to octotaxic system of dermal glands on notogaster. Adults distinguishable from all but one known congener in having gland cuticle expressed as saccules instead of porose areas. Differentiated from *Anachipteria dubia* Weigmann, which also has saccules, by the following character states (those of *A. dubia* in parentheses; from Weigmann, 2001): total body length 403-464 μm (vs. 470 μm); notogastral seta c2 length 40-61 μm (vs. 30 μm); bothridial seta noticeably swollen in the distal third (vs. weakly fusiform, nearly isodiametric); lamellar cusp truncate distally, with dens on anterolateral corner and lamellar seta inserted on anteromedial corner (vs. cusp oblique distally, without clear lateral dens and lamellar seta inserted ventrally).

**Habitat**

*Anachipteria sacculifera* was the numerically dominant oribatid mite on crown branches of sugar maple trees (*Acer saccharum*) studied by Root et al. 2007: 257 of a total 838 oribatid mites. The foliose lichens Flavoparmelia caperata, Parmelia squarrosa, and Punctelia rudecta hosted 85% of *A. sacculifera* individuals sampled, whereas 15% were collected from the crustose lichen Pertusaria velata. No mites of this species were found in samples of bare bark. Silvicultural treatment of the forest stands seemed to have some affect on *A. sacculifera* n. sp.; it was significantly more common in reserve shelterwood stands (193 of 257 individuals) than in old growth. While currently known only from maple trees at the type locality, it probably has a much wider geographic and host-tree distribution.

**Remarks:** 1. A humeral porose organ that takes the form of a dome-shaped subalar vesicle, exserted from an ovoid apparent cuticular aperture, has previously been described for *Achipteria nitens* Nicolet by Grandjean (1962), but in a congener, *Achipteria nitens* Nicolet, it takes the form of an invaginated secretory sacculle (Alberti et al., 1997). A brief study of three other *Anachipteria* species revealed that all – *A. magnilamellata* Ewing, *A. howardi* Berlese, and *A. austroaloides* Jacot – had exserted vesicles. In these, the cerotegument covering the vesicle is less darkened than in *A. sacculifera*.

2. *Anachipteria* is usually distinguished from other genera of Achipteriidae rather simplistically, by having notogastral porose areas but lacking a knife-like humeral projection (e.g. Balogh & Balogh, 1992). Weigmann (2001), argued that the presence of saccules on *Anachipteria dubia* did not warrant proposing a separate genus, since all other characters are consistent with placement in *Anachipteria*. Despite the fact that an analogous difference was used to distinguish *Parachipteria* and *Achipteria* – two genera with humeral projections but respectively with porose areas and saccules – we agree with Weigmann’s assessment. The nature of octotaxic porose organs is a useful systematic character in some groups of poronotic oribatid mites, but it can be a plastic and homoplastic character in others (Norton & Alberti, 1997).

3. In his catalog of world oribatid mite species, Subias (2004, p. 167) listed Weigmann’s species – *A. dubia* – under *Achipteria*, a genus with the octotaxic system represented by saccules. This was not an
intentional transfer (L. S. Subías, pers. comm. 2006); rather he followed an incorrect listing by Schwalbe & Franke (2002).

4. Anachipteria sacculifera is clearly a sexual species. Of 23 specimens examined for gender, the ratio of females to males was 12:11. Currently there are no known parthenogenetic species in the family Achipteridae.

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Dr. Robert Hanna (N. C. Brown Center for Ultrastructure Studies, SUNY-ESF), assisted with scanning electron microscopy. Funding for the fieldwork involved in this project was provided by a grant to Drs. Ralph Nyland and Gregory McGee (SUNY-ESF) from Northeastern States Research Cooperative in conjunction with the University of Vermont and the United States Department of Agriculture. Dr. Robert Robeson (Arizona State University, Tempe, AZ) provided the second author access to the Leica Axioskop microscope used while preparing illustrations. Dr. Valerie Behan-Pelletier (Agriculture and Agri-foods Canada, Ottawa) provided a helpful critique of the manuscript. We are grateful to all.

REFERENCES


Lindo (Z.) and Winchester (N. N.), 2006. — A comparison of microarthropod assemblages with emphasis on oribatid mites in canopy suspended soils and forest floor associated with ancient western redcedar trees. — Pedobiologia 50: 31-41.


Subías (L. S.), 2004. — Listado sistemático, sinonímico y biogeográfico de los Ácaros Oribátidos (Acariformes, Oribatida) del mundo (1748-2002), Graellsia, 60: 3-305.

