

A new species of the feather mite genus *Allodectes* (Acariformes: Proctophyllodidae) from the ruby-throated hummingbird, *Archilochus colubris* (Apodiformes: Trochilidae), in Canada

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Original research

ABSTRACT

A new feather mite species, *Allodectes archilochus* sp. n. (Pterodectinae: Rhamphocaulini) is described from the ruby-throated hummingbird, *Archilochus colubris* (Apodiformes: Trochilidae), in Manitoba, Canada. This is the first record of the genus *Allodectes* on hummingbirds in the northern part of North America. The new species is close to *A. thaluraniae* Hernandez, 2017, and distinguished from the latter in the following features: in both sexes, the anterior margin of the hysteronotal shield is deeply concave; in males, setae *d2* are situated at the midlevel of metapodosomal sclerites, and tarsus IV is without extension on the inner margin; in females, the anterolateral extensions of the prodorsal shield do not extend to the lateral margins of propodosoma, and the anteromedian area of the hysteronotal shield is covered with dense striation. A checklist of the 15 currently known *Allodectes* species is provided.

Keywords Astigmata; feather mites; Proctophyllodidae; *Allodectes*; systematics; Trochilidae

Zoobank <http://zoobank.org/FF8C2172-101E-4367-BC12-B6D8F2C65EF6>

Introduction

Feather mites of the genus *Allodectes* Gaud & Berla, 1963 (Proctophyllodidae: Pterodectinae) belong to the tribe Rhamphocaulini, which is restricted to hummingbirds (Apodiformes: Trochilidae) (Park & Atyeo 1971b, 1972a, 1972b 1973a, 1973b, 1974a, 1974b, 1975; Mironov 2009; Hernandez 2013; Klimov *et al.* 2017). Of eight genera currently referred to the tribe Rhamphocaulini, the genus *Allodectes* and three additional genera, *Rhamphocaulus* Park & Atyeo 1971, *Schizodectes* Park & Atyeo 1972, and *Sclerodectes* Park & Atyeo 1973, inhabit quill cavities of flight feathers, mainly the primaries, in contrast to all remaining representatives of Proctophyllodidae which occupy surfaces of the flight and tail feathers (Gaud & Atyeo 1996). Sometimes, individuals of these quill-inhabiting genera can be found outside quills in the basal part of rachis (Park & Atyeo 1973a). This allows the possibility of collecting these mites from dry museum skins by a scraping technique commonly used for collecting mites inhabiting flight feathers (Gaud & Atyeo 1996). A distinct morphological feature of rhamphocauline genera which live inside quills is the extensively sclerotized coxal fields I-IV, though the functional significance of this feature is not clear.

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The genus *Allodectes* was originally established for one species, *Proctophyllodes (Alloptes) norneri* Trouessart, 1885 (Gaud & Berla 1963). Park and Atyeo (1972a) described ten new *Allodectes* species from Mexico, Central and South Americas, and established a new subfamily, Allodectinae, based on this genus. Further, this subfamily was synonymized with Rhamphocaulinae, based on the genus *Rhamphocaulus* Park & Atyeo, 1971, representatives of which also live in quills of hummingbirds (Gaud & Atyeo 1996). Mironov (2009), based on the cladistic analysis of morphological characters, reduced the subfamily Rhamphocaulinae to the rank of tribe in the subfamily Pterodectinae. Additionally, four genera, *Syntomodectes* Park & Atyeo, 1973, *Toxerodectes* Park & Atyeo, 1973, *Trochilodectes* Park & Atyeo, 1971, and *Xynonodectes* Park & Atyeo, 1975, also restricted to hummingbirds and considered by Gaud and Atyeo (1996) as the members of Pterodectinae rather than Rhamphocaulinae, were placed by Mironov (2009) in the tribe Rhamphocaulini. This taxonomic decision was well supported by the phylogenetic study of proctophyllodid mites based on molecular data (Klimov *et al.* 2017).

In the past fifty years, only three new *Allodectes* species have been described (Černý 1974; Hernandez 2013), increasing the number of known species to 14 (Table 1). This paper is a continuation of our studies of feather mites in Canada (e.g., Mironov & Galloway 2002, 2019, 2021; Galloway *et al.* 2014), and describes a new *Allodectes* species from the ruby-throated hummingbird collected in Manitoba, Canada. This is the first description of an *Allodectes* species from a hummingbird in the northern part of North America.

Material and methods

Frozen bird specimens used for the collections of feather mites were obtained from the Wildlife Haven (Manitoba Wildlife Rehabilitation Organization, MWRO, Île des Chênes, Manitoba, Canada; specimen numbers are identified as /CEN/) and the Prairie Wildlife Rehabilitation Centre (PWRC, St. Adolphe, Manitoba, Canada). All birds from the MWRO and PWRC were the casualties of various accidents or infections.

Table 1 Checklist of *Allodectes* species of the World.

Mite species	Type host	Locality	Reference
<i>A. amadoni</i> Park & Atyeo, 1972*	<i>Colibri t. thalassinus</i> (Swainson, 1827)	Mexico	Park & Atyeo 1972b
<i>A. amaziliae</i> Park & Atyeo, 1972*	<i>Saucerottia tobaci erythronotus</i> (Lesson, RP, 1829)	Trinidad and	Park & Atyeo 1972b
<i>A. amplissimus</i> Park & Atyeo, 1972*	<i>Anthracothonax p. prevostii</i> (Lesson, RP, 1832)	Mexico	Park & Atyeo 1972b
<i>A. archilochus</i> sp. n. *	<i>Archilochus colubris</i> (Linnaeus, 1758)	Canada:	present work
<i>A. bipeltatus</i> Park & Atyeo, 1972	<i>Phaethornis philippii</i> (Bourcier, 1847)	Brazil	Park & Atyeo 1972b
<i>A. elatarcus</i> Park & Atyeo, 1972	<i>Phaethornis longirostris cephalus</i> (Bourcier & Mulsant, 1848) (= <i>P. superciliosus cassinii</i>)	Panama	Park & Atyeo 1972b
<i>A. longisetosus</i> Park & Atyeo, 1972*	<i>Heliomaster constantii leocadiae</i> (Bourcier & Mulsant, 1852)	Mexico,	Park & Atyeo 1972b
<i>A. nanus</i> Park & Atyeo, 1972	<i>Phaethornis s. striigularis</i> Gould, 1854 (= <i>P. longuemareus striigularis</i>)	Colombia	Park & Atyeo 1972b
<i>A. norneri</i> (Trouessart, 1885)*	<i>Aglaiocercus kingii mocoa</i> (Delattre & Bourcier, 1846)	Bolivia, Peru	Trouessart 1885; Gaud & Berla 1963; Park & Atyeo 1972b
<i>A. paulicaulus</i> Park & Atyeo, 1972*	<i>Pampa c. curvipennis</i> (Deppe, 1830)	Mexico	Park & Atyeo, 1972b
<i>A. prolaticaulus</i> Park & Atyeo, 1972	<i>Phaethornis longirostris cephalus</i> (Bourcier & Mulsant, 1848)	Panama	Park & Atyeo 1972b
<i>A. sejugasps</i> Hernandez, 2013*	<i>Thalurania glaucopis</i> (Gmelin, JF, 1788)	Brazil: Paraná	Hernandes 2013
<i>A. similis</i> Černý, 1974	<i>Chionomesa fimbriata</i> (Gmelin, JF, 1788)	Surinam	Černý 1974
<i>A. thaluraniae</i> Hernandez, 2013*	<i>Thalurania glaucopis</i> (Gmelin, JF, 1788)	Brazil: Paraná	Hernandes 2013
<i>A. wetmorei</i> Park & Atyeo, 1972*	<i>Phaethornis m. mexicanus</i> Hartert, EJO, 1897	Mexico	Park & Atyeo 1972b

Remark: * – species of the group characterized by the absence of apical claw-like processes on tarsi I, II in both sexes.

The washing technique for collection of feather mites from frozen bird specimens was described in detail in our previous publications (Mironov and Galloway 2002, 2019, 2021). Collected mites fixed in 95% ethanol were cleaned and softened in 5–10% lactic acid at room temperature for 2–3 days, then mounted on microscope slides using Hoyer's medium (Krantz & Walter 2009), and dried in an oven at 60 °C for 7 days. Drawings and measurements were made with a Leica microscope (DM2500, Leica Microsystems, Inc.) equipped with differential interference contrast optics (DIC) and a *camera lucida*.

Description of the new species follows the format proposed by Hernandez (2013) for the genus *Allodectes*. General morphological terms and idiosomal chaetotaxy follow Gaud & Atyeo (1996), with minor corrections for coxal setae by Norton (1998). Leg chaetotaxy is that of Grandjean (1939). Regarding the homology of opisthosomal chaetotaxy in males, we follow the original concept of Park and Atyeo (1972a) and treat the median pair of setae on the posterior margin of the anal field as setae *ps3*, and the long filiform setae arising at bases of macrosetae *h2* as setae *h3*. Hernandez (2013) treated these setae as *h3* and *ps2*, respectively. All measurements are in micrometers (µm).

Scientific names of birds and supraspecific classification follow Gill *et al.* (2023). The abbreviations used in accession numbers for specimens and depositories are as follows: CNC – Canadian National Collection of Insects, Arachnids and Nematodes, Agriculture and Agri-Food Canada, Eastern Cereal and Oilseeds Research Centre, Ottawa, Ontario, Canada; WRME – J.B. Wallis/R.E. Roughley Museum of Entomology (Department of Entomology, University of Manitoba, Winnipeg, Manitoba, Canada); ZISP – Zoological Institute of the Russian Academy of Sciences (Saint Petersburg, Russia).

Systematics

Family Proctophyllodidae Trouessart & Mégnin, 1884

Subfamily Pterodectinae Park & Atyeo, 1971

Tribe Rhamphocaulini Park & Atyeo, 1971

Genus *Allodectes* Gaud & Berla, 1963

Type species: *Proctophyllodes (Alloptes) norneri* Trouessart, 1885, by original designation.

Allodectes archilochus Mironov & Galloway sp. n.

Zoobank: [063EF62A-61D0-42C1-9298-AC02082BA64D](https://doi.org/10.63EF62A-61D0-42C1-9298-AC02082BA64D)

(Figures 1–4)

Type material

From *Archilochus colubris* (Linnaeus, 1758) (Apodiformes: Trochilidae), CANADA, Manitoba: male holotype, 2 male and 3 female paratypes (RTHU/408/CEN/12, SM 2253), Vassar, 3 May 2012, coll. T.D. Galloway and S.R. Repa; other paratypes: 2 males and 3 females (RTHU/555/CEN/01, SM 526), Winnipeg, 18 Jun. 2001 coll. T.D. Galloway; 2 females, (RTHU/861/CEN/08, SM 1620), Winnipeg, 30 Aug. 2008, coll. T.D. Galloway and D. Holder; 2 females (RTHU/555/PWRC/13, SM 2391), Winnipeg, 26 Aug. 2013, coll. T.D. Galloway; 1 female (RTHU/866/CEN/14, SM 2503), Winnipeg, 3 Sep. 2014, coll. T.D. Galloway.

Depository — Holotype, 2 male and 3 female paratypes – CNC; remaining paratypes – WRME and ZISP.

Description

Male — (holotype, range for 4 paratypes in parentheses) (Figures 1, 3A–D, 4A). Idiosoma, length × width, 325 (330–345) × 195 (195–210), length of hysterosoma 225 (225–235).

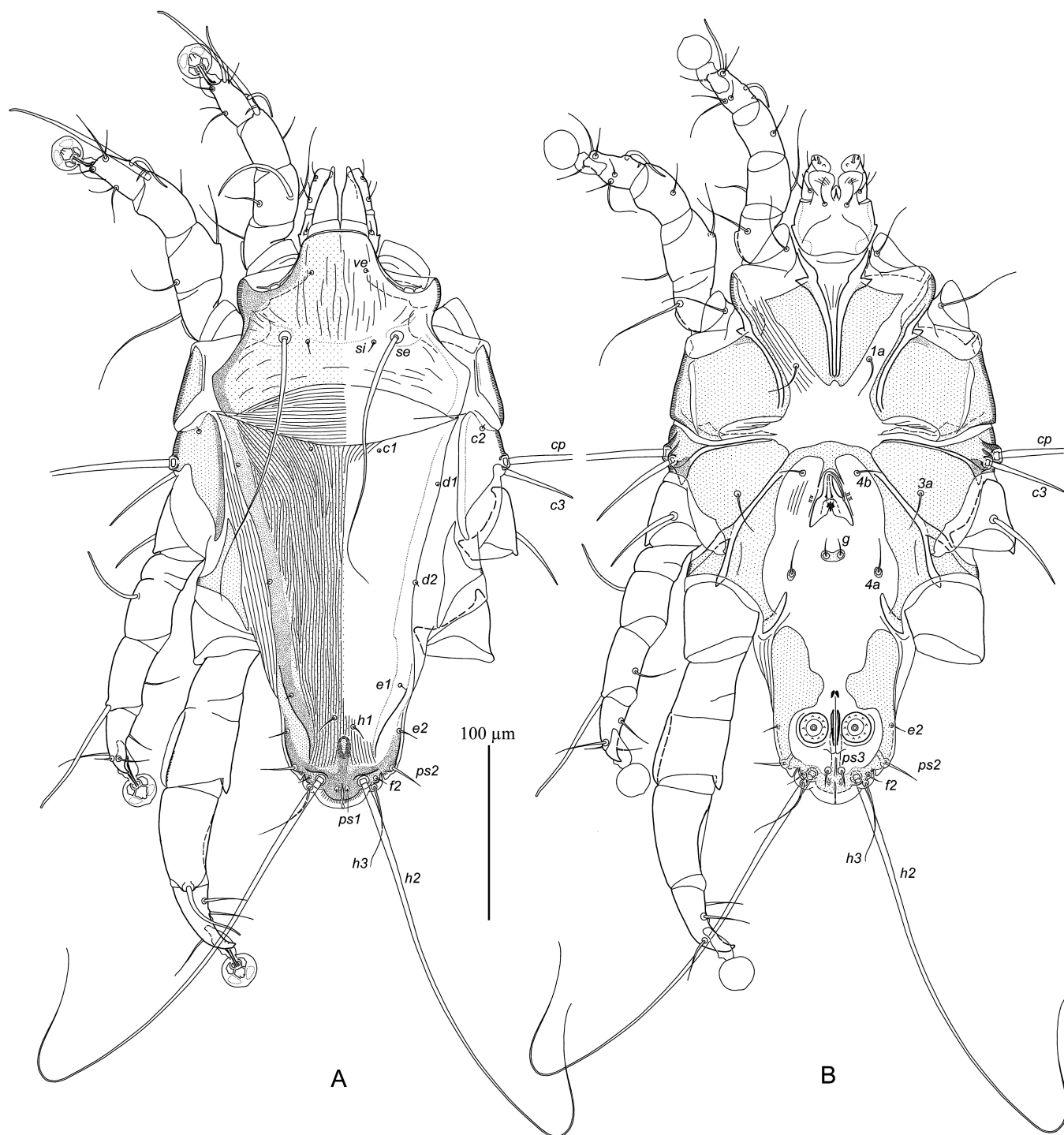


Figure 1 *Allodectes archilochus* sp. n., male: A – dorsal view, B – ventral view.

Prodorsal shield: anterolateral extensions reaching margins of propodosoma and fused with epimerites Ia, posterior margin strongly concave, greatest length 105 (100–110), length along midline 88 (85–90), width at posterior margin 148 (150–160), anterior part with sparse longitudinal striae, posterior part with sparse short transverse striae. Setae *ve* minute. Scapular setae *se* separated by 65 (65–70). Scapular shields present dorsally, with inner margin shaped as

blunt angle. Sejugal sclerites on striated tegument between prodorsal and anterior hysteronotal shields absent. Humeral shields well developed, with setae *c2* on their anterior margins. Subhumeral setae *c3* spiculiform, 50 (43–50) long. Metapodosomal shields present. Distance between prodorsal and hysteronotal shields long midline 32 (32–35). Hysteronotal shield: greatest length 220 (220–235), width in anterior margin 140 (140–155), anterior margin concave, almost entire surface except for lateral and posterior margins covered with dense, mostly longitudinal striation. Supranal concavity ovate and well outlined. Opisthosoma gradually narrowed posteriorly; posterior end generally rounded; opisthosomal lobes small; terminal cleft slit-like, lateral margins almost touching, 12 (12–17) long. Posterolateral margins of lobes with narrow terminal membranes having smooth and convex free margin. Lateral margins of opisthosoma, posterior to bases of setae *ps2*, with small triangular lateral membranes. Setae *d2* at midlength of metapodosomal shields. Setae *h1* slightly anterior to level of setae *e2*. Setae *h2* represented by macrosetae approximately as long as body length. Setae *f2* at level of setae *h2*. Setae *ps2* thin spiculiform, 20 (18–23) long, situated on lateral margins of opisthosoma. Setae *h3* setiform, 40 (40–45) long, situated posterolateral to bases of setae *h2*. Setae *ps1* minute filiform, situated at level of setae *h3*, close to slit-like terminal cleft. Distance between dorsal setae: *c2:d2* 90 (90–98), *d2:e2* 85 (88–92), *e2:h3* 32 (32–38), *d1:d2* 60 (55–65), *e1:e2* 25 (22–28), *h1:ps2* 25 (25–32), *h2:h2* 28 (26–28), *h3:h3* 38 (37–40), *ps2:ps2* 58 (57–60).

Epimerites I fused into a narrow V, with posterior tips connected by thin commissure. Coxal fields I partly sclerotized, lateral 1/3 of these fields bordering on epimerites II covered with striated tegument; coxal fields II–IV entirely sclerotized. Transventral sclerite, connecting inner borders of coxal fields III, 17 (13–18) along midline. Anterior end of epiandrum fused with transventral sclerites; free branches of epiandrum thin and acute, laterally flanking anterior part of genital apparatus. Rudimentary sclerite rEpIIa absent. Epimerites IVa present, fused with coxal fields IV, not extending to bases of setae *4a*. Base of genital apparatus at midlength of trochanters III; genital arch short, not extending beyond transventral sclerite, 32 (32–35) × 25 (25–28). Aedeagus (from anterior bend to apex) approximately half as long as genital arch, 16 (17–20) long. Genital papillae at midlength of genital arch. Genital shields present, bearing bases of setae *g*. Adanal suckers 17 (17–19) in diameter, corolla with 9–11 acute denticles. Opisthoventral shields well developed, strongly widened anterior to anal opening and almost completely encircling anal field. Setae *1a* off sclerotized areas of coxal fields I; setae *4b* anterior to setae *3a*; setae *g* situated on small genital shield anterior to level of setae *4a*, setae *ps3* on posterior margin of anal field and close to each other. Distance between ventral setae: *4b:3a* 12 (12–18), *4b:g* 50 (43–50), *g:4a* 12 (16–17), *g:ps3* 125 (125–135), *ps3:ps3* 8 (8–10).

Tarsi I, II without apical claw-like process; tarsi III, IV with apical claw-like process. Femora I, II with small ventral crest near base of setae *vF*. Solenidion ωI of tarsus II slightly longer than solenidion ωI of tarsus I. Solenidion σ of genu I about 1.5 times longer than this segment, situated at its midlength. Genua setae *cGI*, II, and *mGI*, II, setiform. Seta *sR* of trochanter III spiculiform, 50 (50–54) long. Genu IV with small spine-like process on paraxial margin and with longitudinal crest along lateral margin. Tarsus III 38 (38–40) long. Tarsus IV 50 (50–52) long, without extension on inner margin; setae *e* vestigial, represented by alveolus near apex of segment, seta *d* indistinct. Length of solenidia: σI 56 (56–60), σIII 40 (40–42), ϕIII 72 (65–78), ϕIV 48 (46–50).

Female — (range for 10 paratypes) (Figures 2, 3E–F, 4B). Idiosoma, length × width, 415–445 × 175–195. Prodorsal shield: anterolateral extensions not reaching lateral margins of propodosoma and not fused with epimerites Ia, posterior margin strongly concave, greatest length 120–125, along midline 110–115, width at posterior margin 145–165, anterior part with sparse longitudinal striae, posterior part without ornamentation. Setae *ve* minute. Scapular setae *se* separated by 75–82. Scapular shields narrow, with concave inner margins. Sejugal sclerites between prodorsal and anterior hysteronotal shields absent. Humeral shields narrow, bearing setae *c2* on their anterior ends. Setae *c3* narrowly lanceolate, 20–24 × 4.5–5. Distance between prodorsal and hysteronotal shields along midline 33–40. Hysteronotal shield completely split into anterior and lobar pieces, dorsally separated by narrow arched forward band of

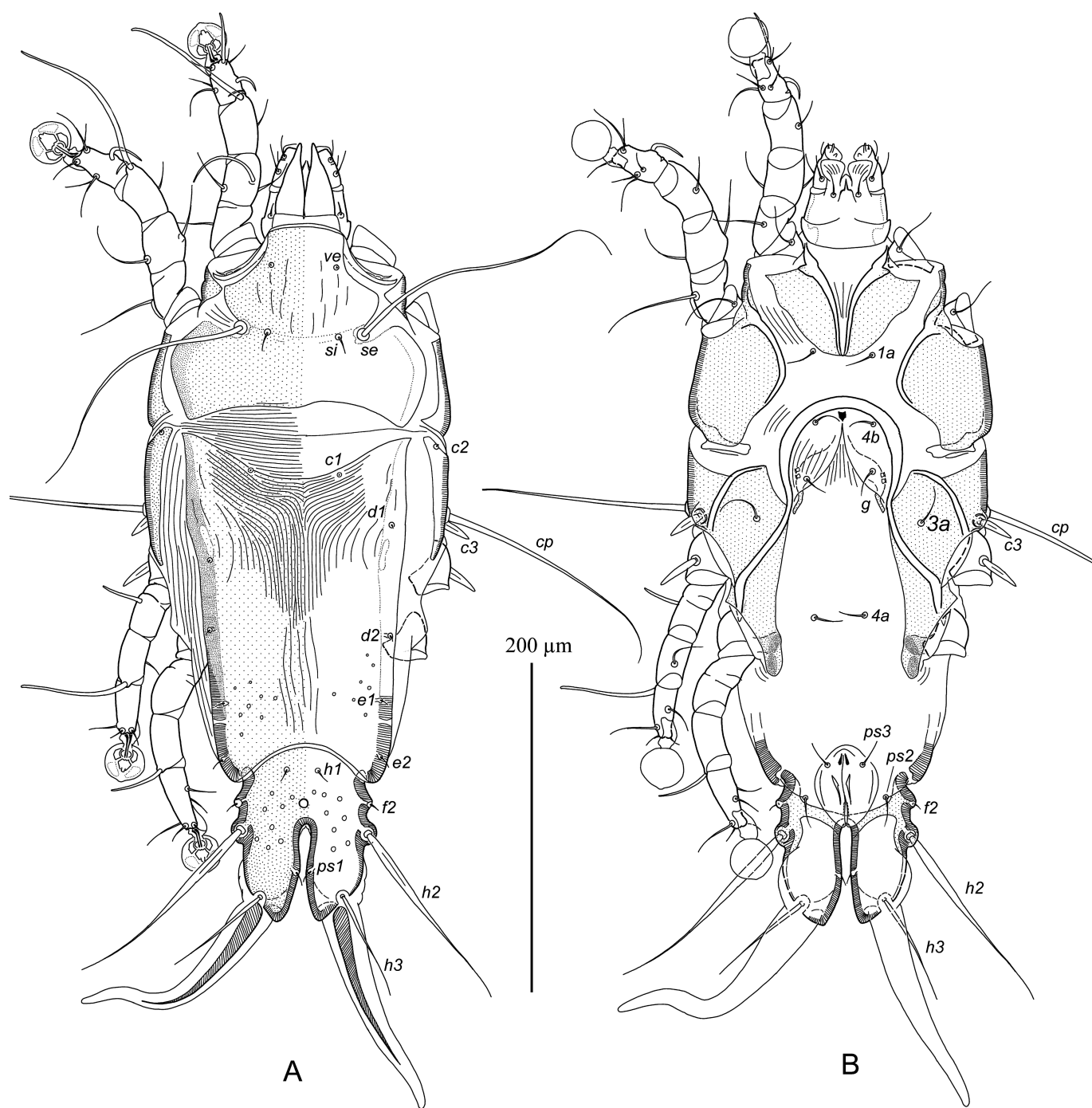


Figure 2 *Allodectes archilochus* sp. n., female: A – dorsal view, B – ventral view.

soft tegument. Anterior hysteronotal shield: anterior and posterior margins deeply concave, greatest length 205–225, width at anterior margin 130–150, anterior and median parts with dense striation, posterolateral areas with several small circular lacunae or without them. Lobar region: anterior margin strongly convex, surface with small circular lacunae, greatest length 105–115, width 88–92. Supranal concavity small, circular, poorly sclerotized. Setae *h1* and *f2*

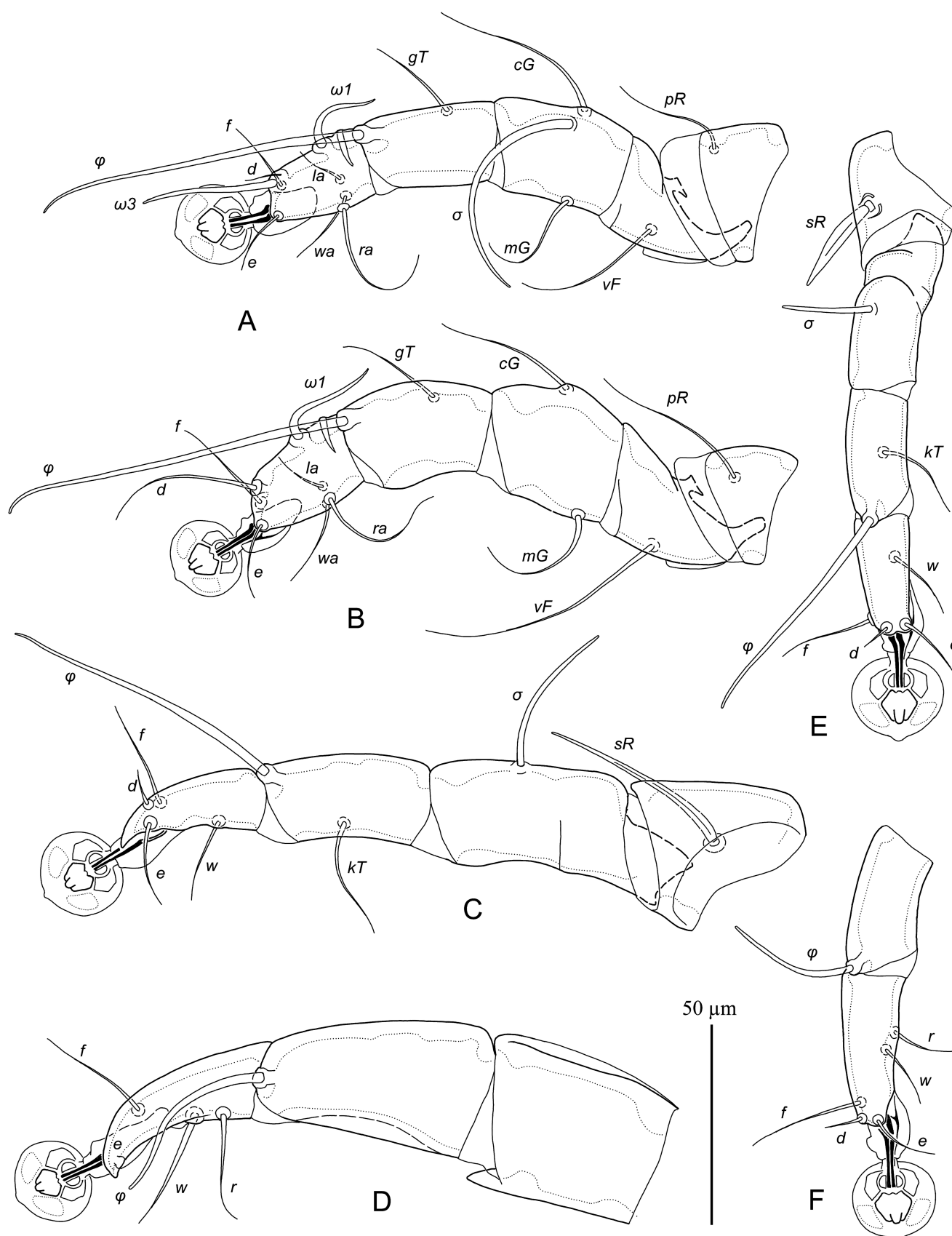


Figure 3 *Allodectes archilochus* sp. n., legs: A–C – legs I–III of male, D – genu, tibia and tarsus IV of male, E – leg III of female, F – tibia and tarsus IV of female.

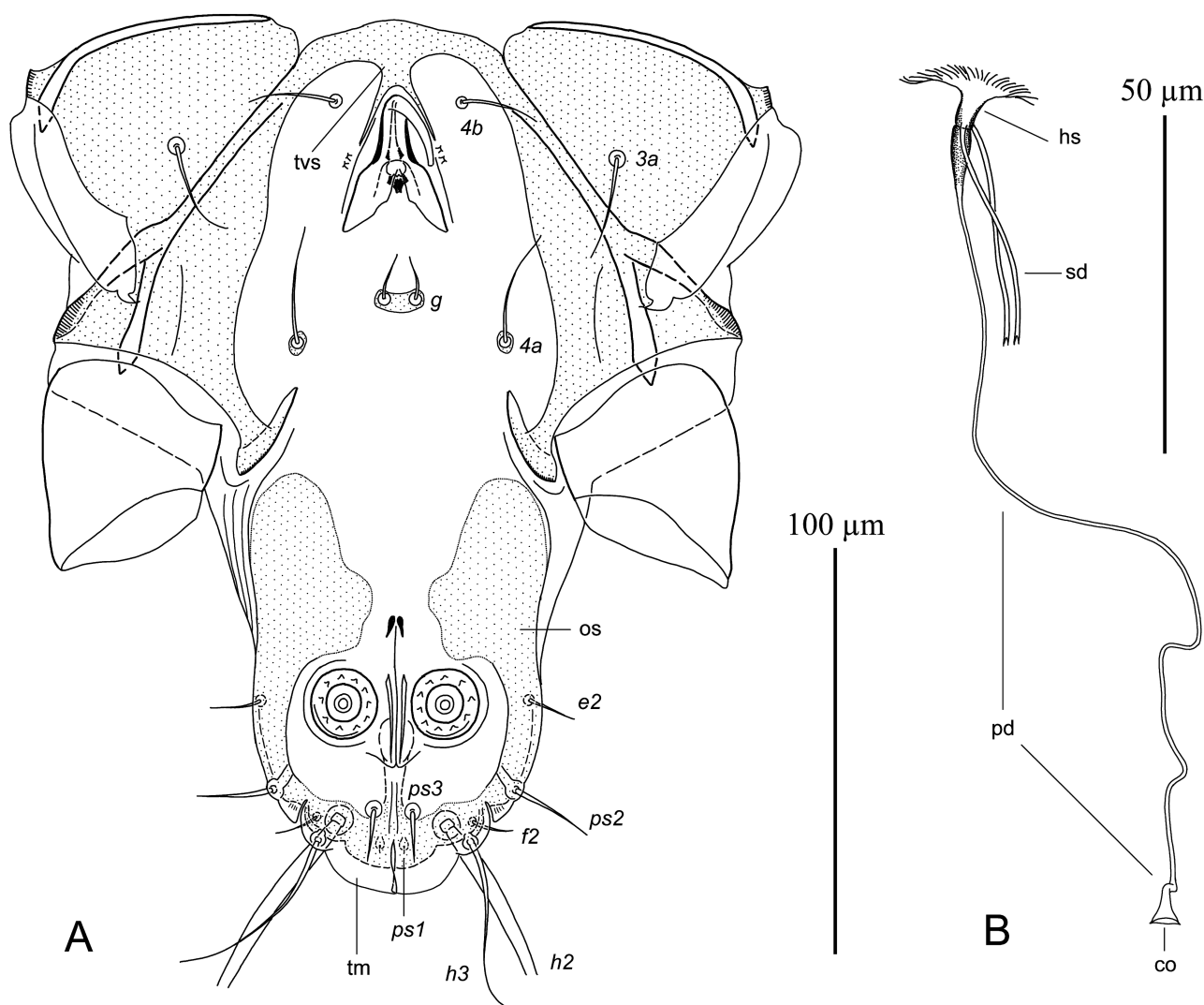


Figure 4 *Allodectes archilochus* sp. n., details: A – opisthosoma of male, ventral view, B – spermatheca and spermaducts. Abbreviations: co – copulatory opening, hs – head of spermatheca, os – opisthoventral shield, pd – primary spermaduct, sd – secondary spermaduct, tm – terminal membrane, tvs – transventral sclerite.

in trapezoidal arrangement. Terminal cleft shaped as a narrow inverted U, 58–63 long, 7–10 wide. Macrosetae *h2* strongly widened in basal half, 120–150 long, 10–12 wide. Setae *h3* setiform, 67–70 long, about half the length of terminal appendages. Distance between dorsal setae: *c2:d2* 110–125, *d2:e2* 78–87, *e2:h2* 42–45, *h2:h3* 38–48, *d1:d2* 60–75, *e1:e2* 25–35, *h1:h2* 38–40, *h2:ps1* 23–28, *h2:h2* 78–82, *h1:h1* 18–20.

Epimerites I fused in a narrow V, with posterior tips connected with thin commissure. Epimerites IVa present, heavily sclerotized. Coxal fields I partly sclerotized, lateral 1/3 bordering on epimerites II covered with striated tegument; coxal fields II–IV entirely sclerotized. Epigynum without lateral extensions, greatest width 68–78. Apodemes of oviporus separated from epimerites IIIa. Translobar apodemes fused to each other anterior to terminal cleft. Copulatory opening situated ventrally, posterior to anal opening, and covered with posterior ends of anal flaps. Primary spermaduct with small ampuliform enlargement near head of spermatheca, secondary spermaducts 25–30 long (Figure 4B). Setae *1a* off sclerotized areas

of coxal fields I. Pseudanal setae *ps2* and *ps3* setiform, in trapezoid arrangement; setae *ps2* at midlength of anal opening; distances between these setae: *ps2:ps2* 47–50, *ps3:ps3* 15–21, *ps2:ps3* 18–22.

Femur II with small ventral crest near base of setae *vF*; other leg segments I, II without processes. Solenidia of genu and tarsi I, II as in the male. Genual setae *cGI*, II, and *mGI*, II setiform. Seta *sR* of trochanter III narrowly lanceolate 28–30 long, 3–3.5 wide. Length of solenidia: σ I 53–58, σ III 21–23, ϕ III 56–60, ϕ IV 32–35.

Differential diagnosis

The new species, *Allodectes archilochus* **sp. n.**, belongs to the species group characterized by the absence of the claw-like apical processes on tarsi I, II in both sexes, and in having the vestigial terminal membrane in males (Park & Atyeo 1972b) (Table 1, species marked with asterisk). In this group, the new species is most similar to *A. thaluraniae* Hernandez, 2013 in having, in males, the median area of the hysteronotal shield being striated, setae *c3* and *sRIII* subequal in length, the spine-like process on the distal margin of genu III, and the relatively elongate idiosoma (1.6–1.7 times longer than wide). *Allodectes archilochus* **sp. n.** is distinguished from *A. thaluraniae* in the following features: in both sexes, the anterior margin of the hysteronotal shield is deeply concave, and the lateral areas of coxal fields I (approximately 1/3) are not sclerotized, and covered with soft striated tegument; in males, setae *d2* are at the midlevel of the metapodosomal sclerites, and tarsus IV lacks the blunt-angular extension on the inner margin; in females, the anterior part of the prodorsal shield bears sparsely disposed longitudinal striae, the anterolateral extensions of this shield do not extend to the lateral margins of propodosoma, and the anteromedian area of the hysteronotal shield is covered with dense striation. In both sexes of *A. thaluraniae*, the anterior margin of the hysteronotal shield is almost straight or slightly concave, the lateral areas of coxal fields I are extensively sclerotized, and only narrow bands along epimerites II are covered with soft tegument; in males, setae *d2* are at the level of posterior ends of the metapodosomal sclerites, and tarsus IV has a blunt-angular extension on the inner margin near the base of seta *w*; in females, the prodorsal shield lacks striation, the anterolateral extensions of this shield extend to the lateral margins of the propodosoma, and the anterior half of the hysteronotal shield is without striation.

Etymology

The specific epithet is taken from the generic name of the type host and is a noun in apposition.

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