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New genus and species of microtrombidiid mite (Actinotrichida: Trombidioidae, Microtrombidiidae) parasitizing spiders (Araneae: Araneidae) in Costa Rica

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ABSTRACT — A new genus and species of microtrombidiid mite, Araneothrombium dimalogunovi n. gen. et n. sp. is described based on larvae collected from a juvenile araneid spider in Costa Rica. The genus, tentatively placed in Eutrombidiinae, displays affinity to Verdunella Southcott, 1993 and Spinnitrombium Fain and Jocqué, 1996. This is the first record of Trombidioidae (excl. Trombiculidae s.l.) in Costa Rica.

KEYWORDS — Parasitengona; Araneae; host-parasite association; Neotropics

ZOOBANK — 6A08EB21-CB39-45C2-99B0-8DFEB3113389

INTRODUCTION

Terrestrial Parasitengona mites (excl. Trombiculidae s.l.), with nearly 2,000 nominal species, are known for their larval host-parasite associations with arthropods (Makol and Wohltmann 2012, 2013). While the vast majority of parasitized hosts are Insecta, the Arachnida are the next largest host group for these mites. According to the brief summary of associations between spiders and parasitengone larvae (Makol and Felska 2011), members of Erythraeidae, Trombidiidae, Microtrombidiidae and Eutrombidiidae (now subfamily within Microtrombidiidae), include 26 named species, recorded as parasitizing 34 named species of spiders in 20 families.

The knowledge of terrestrial Parasitengona (excl. Trombiculidae s.l.) of Costa Rica is limited to members of Erythraeoidae: four species of Erythraeidae (Charletonia domawiti Haitlinger, 2004, Charletonia salazari Mayoral and Barranco, 2011, Leptus (L.) filipinae Haitlinger, 2000, Leptus (L.) nikanori Haitlinger, 2000), and two species of Smarididae (Clavismaris cybaea Southcott, 1963, Surasmaris longirostris Southcott, 1995), all known exclusively from larvae, except for C. cybaea, known only from adult instar (Makol and Wohltmann 2012).

Here we present the description of a new genus and species of microtrombidiid mite collected from an araneid spider in Costa Rica and being the first record of Trombidioidae (excl. Trombiculidae s.l.) in Costa Rica.
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MATERIALS AND METHODS
A larvae-bearing juvenile female spider representing Araneidae was collected in Costa Rica, Turrialba, Center for Tropical Agricultural Research and Higher Education (CATIE) botanical garden (09°54’N, 83°40’W), 16 June 2014, by Dmitri V. Logunov. The export license number: DGVS-361-2014 was assigned to the sample. The material was preserved in ethyl alcohol. Of seven larvae collected from the host, five were used for morphological examination, and two for molecular studies (as a result, heterogenous DNA sequences were obtained and the exuvia were not retained for morphological survey). Larvae used for light microscope studies were cleared in KOH for about 15 minutes and mounted on microscopic slides in Faure’s medium. Qualitative characters of the mites were examined and drawings were made under a Nikon Eclipse 80i microscope coupled with DIC and drawing tube. Measurements (given in micrometers, \( \mu \text{m} \)) were taken under a Nikon Eclipse E600 with DIC, coupled with NIS-Elements Br software. Morphological terminology follows Wohltmann et al. (2007). The type material is deposited at the University of Manchester, Manchester Museum (UMMM), United Kingdom and in the collection of the Department of Invertebrate Systematics and Ecology, Wrocław University of Environmental and Life Sciences, Wrocław, Poland (DISE). In retaining the Eutrombidiinae as taxon subordinate to Microtrombidiidae we follow the concept of Wohltmann (2006).

RESULTS

Family Microtrombidiidae Thor, 1935
Subfamily: Eutrombidiinae Thor, 1935

Araneothrombium n. gen.

Zoobank: 8AAF24E7-8AE4-4E6D-BD45-1C8354E2B10D

Diagnosis — Larva. Subcapitular setae (hypostomalae) short and robust, reniform. Scutum pentagonal in outline (when flattened), with anterior part triangular, extended anteroventrally. Lateral margins of scutum concave. Posterior margin of the sclerite bordered with lamellar band. Non-sensillary setae (AM, AL and PL) and sensilla (S) on scutum smooth. Eyes incorporated in scutum. Scutellum semi-circular, with distinctly sclerotized anterior margin and with well marked concavities along lateral lines. Setae \( c_1 (= SL) \) located posteriorly on scutellum, covered with short setules. Dorsal setation sparse (fD = (2)4-2-4-4-2), medial setae (c2, e1) longer than remaining ones. Coxal setae 1b, 2b and 3b simple, setulated. Solenidion on tarsus I located at proximal margin of the segment. Famulus on tarsus II placed proximally to solenidion. Tarsi I-III terminated with two claws and empodium. Smilum, scopula and lophotrix absent. Postlarval instars: not known.

Type species: Araneothrombium dimalogunovi n. sp.

Araneothrombium dimalogunovi n. sp.

Zoobank: 789DBBAE-1F67-4A53-AA2F-5E0ABFEB5A96

Diagnosis — Larva. Subcapitular setae (hypostomalae) short and robust, reniform. Scutum porous, pentagonal in outline (when flattened), with anterior part triangular, extended anteroventrally. Lateral margins of scutum concave. Posterior margin of the sclerite bordered with lamellar band. Non-sensillary setae (AM, AL and PL) and sensilla (S) on scutum smooth. Eyes incorporated in scutum. Scutellum semi-circular, with distinctly sclerotized anterior margin and with well marked concavities along lateral lines. Setae \( c_1 (= SL) \) located posteriorly on scutellum, covered with short setules. Dorsal setation sparse (fD = (2)4-2-4-4-4), medial setae (c2, e1) longer than remaining ones. Coxal setae 1b, 2b and 3b simple, setulated. Solenidion on tarsus I located at proximal margin of the segment. Famulus on tarsus II placed proximally to solenidion. Tarsi I-III terminated with two claws and empodium. Anterior claw on tarsi I-II thinner than posterior one, similar in length to the posterior claw; posterior (inner) claw on tarsus III shorter than anterior (outer) claw. Smilum, scopula and lophotrix absent. Postlarval forms. Not known.

Description — Larva. Description based on five specimens of seven attached to the host. Measurements pertaining to gnathosoma and idiosoma, followed by sample size, are provided in parentheses. For leg measurements see Table 1.

Colour in life reddish. Idiosoma oval (length of unengorged larva = 467, width = 369, n = 1).

Gnathosoma (Figure 1A-B) — Stephanostome present; internal horseshoe-like sclerite devoid of lateral teeth and inserted between inner and outer cuticular sheath. One pair of nude dorsal setae (or) (9 – 10, n = 2). Subcapitular setae (tritrostral setae, hypostomalae, bs), short (5 – 7 long \( \times \) 12 – 13 wide, n = 3) and robust, reniform, rounded at terminations,
with bases located at longer side. Chelicerae composed of base (60 – 68, n = 5) and movable claw; cheliceral blade (14 – 16, n = 4) distinctly curved. Pedipalp formula: 0-N-N-NNN2-BNNNNNωζ. Palp femur (15 – 19, n = 4) and palp genu (8 – 10, n = 4) each with short, thorn-like seta. Palp tibia (11 – 13, n = 5) with one longer, smooth seta in dorsal position, one shorter, also smooth, seta located ventrally and one stout seta, sharpened distally, placed close to odontus base. Odontus (8 – 11, n = 4) bifid on almost entire length. Palp tarsus (7 – 9, n = 5) with one long (61 – 65, n = 4) heavily setulated seta, two lanceolate, smooth setae of medium length, three smooth, shorter setae, one eupathidium and one solenidion.

Idiosoma, dorsum (Figures 1C, 2) — Scutum and scutellum porous on entire surface. Scutum (177 – 190 in length, n = 2; 150 – 160 in length, when anteriormost part bent downwards, n = 2; 175 in width, n = 2) pentagonal in outline when flattened, helmet-like when three-dimensional, with anterior part in the form of ventrally bent triangle in non-mounted specimens. Lateral margins of scutum slightly concave. Posterior margin almost straight, bordered with lamellar band showing the indistinct longitudinal striations in flattened specimens. Setae AM (10, n = 1) smooth, located anteriorly, at the level scutum narrows into antero-ventral, triangular part. Distance between AM bases: AA = 57 – 65 (n = 3). Setae AL (27 – 30, n = 4), PL (42 – 43, n = 2) and S (68, n = 1) also smooth, located posterolaterally on scutum. Distance between bases of AM and AL: MA = 69 – 72 (n = 2), distance between bases of AL.
FIGURE 1: *Araneothrombium dimalogunovi* n. sp.: A – gnathosoma (chelicerae omitted) [paratype F3441.153/UMMM]; B – chelicera [paratype H7794/1/DISE]; C – dorsal side of the body beyond the level of scutellum (scutellum broken, only extreme parts retained) [F3441.153/UMMM]; D – ventral side of the body beyond the level of legs II (legs III omitted beyond trochanters) [F3441.153/UMMM].
**FIGURE 2:** *Araneothrombium dimalogunovi* n. sp.: A – scutum (anterior part broken) [paratype H7794/3/DISE]; B – scutellum [holotype F3441.152/UMMM] (distance between Figures A and B not to scale); C – scutum (anterior part intact) [paratype F3441.154/UMMM].
and PL: AP = 26 – 28 (n = 5). Bases of sensilla, located between the level of AL and PL bases, surrounded by cuticular rims. Distance between AL bases (AW = 137 – 145, n = 3) slightly shorter than that between PL bases (PW = 145 – 152, n = 3); distance between sensilla the shortest (SB = 106 – 117, n = 3). ASB = 122 (n = 1), PSB = 50 – 60 (n = 4). Paired eyes, each composed of double lens, incorporated in scutum; ocular bases (23 – 25, n = 5) level with postero-lateral margins of the sclerite. Anterior lens (8 – 9, n = 5) indistinctly larger or equal to posterior one (8 – 9, n = 5). Scutellum (HS = 70 – 73, n = 5; LSS = 158 – 167, n = 4) semi-circular in outline, with slightly convex, distinctly sclerotized anterior margin, bears one pair of barbed setae c₁ (= SL). Lat-
eral margins of scutellum with well-defined concav-
ities. Setae c₁ (56 – 58, n = 3) located posteriorly on scutellum, covered with short setules. Bases of c₁ surrounded with weakly sclerotized pools, levelled with posterior margin of the sclerite. Distance between c₁ bases: SS = 73 – 77 (n = 5). Dorsal setation sparse (fD = (2)4-2-4-4-4). Setae of rows C-H smooth or with tiny barbs, situated on indistinct platelets. Medial setae (c₂, e₁) longer (DS_{max} = 44 – 51, n = 3) than remaining ones (DS_{min} = 17 – 22, n = 3). Bases of c₂, e₁ tear-shaped.

Idiosoma, venter (Figures 1D, 3) — Claparède’s organs (clp) placed between coxae I and II. Medial part of posterior margin of coxa II weakly sclero-
tized. Coxal plates punctate. Coxa I with seta 1a placed in anterior position, ca half-length the scle-
rite; setae 1b, 2b and 3b in postero-lateral position. All coxalae simple, setulated. Supracoxala I absent. Intercoxalae 3a weakly barbed. fV = 2u-2-2. Setae flanking anus with thinner shafts than in dorsal set-
eae. Anal opening without sclerites.

Legs (Figure 3) — Segmentation formula: 6-6-6. Leg chaetotaxy. Leg I: Tr (1n) – Fe (6n) – Ge (4n, 2σ, 1κ) – Ti (6n, 2ϕ, 1κ) – Ta (17 – 18n, 2ζ, 1ω, 1ξ). Leg II: Tr (1n) – Fe (5n) – Ge (2n, 1σ, 1κ) – Ti (5n, 2ϕ) – Ta (14n, 1ζ, 1ω, 1ξ). Leg III: Tr (1n) – Fe (4n) – Ge (2n, 1σ) – Ti (5n) – Ta (13n). Normal se-
tae on legs covered with barbs or setules. One seta on genu I distinctly elongated (ca 85). On tarsus I one subterminal eupathidium located dorsally and one eupathidium placed ventrally, close to base of tarsal claws. Famulus on tarsus I located distally to solenidion; solenidion placed close to the segment base. Tarsi I-III with paired, simple claws and claw-
like empodium. Anterior claw on tarsi I-II thinner than posterior one, similar in length to the posterior claw and similar in thickness to empodium. Poste-
rior (inner) claw on tarsus III similar in thickness to anterior (outer) claw, reduced in length to ca 2/3 of anterior claw.

Etymology — The generic name Araneothrom-
bium refers to the host affiliation of the newly de-
scribed type species. The species is dedicated to Dr. Dmitri (“Dima”) V. Logunov, araneologist, Cur-	or of Arthropods (UMMM) and collector of larvae which served for present study.

Type material — Holotype larva, slide ID: F3441.152 (UMMM). Paratypes: two larvae, slide IDs: F3441.153 and F3441.154 (UMMM); two larvae, slide IDs: H7794/1 and H7794/3 (DISE). Type host: Araneidae juv. (det. D.V. Logunov), preserved in alcohol (UMMM).

Distribution — Costa Rica.

Remarks — The larvae, except for one specimen, were fully engorged. All were attached to the poste-
rior part of cephalothorax, close to the pedicel (Fig-
ures 4, 5). For comparison with other species see Discussion and Table 2.

DISCUSSION

Out of the approximately 300 genera of terrestrial Parasitengona mites (excl. Trombiculidae s.l.) de-
scribed to date, only the monotypic Surasmaris Southcott, 1995 of Smarididae and Araneothrombium n. gen. of the Microtrombidiidae are known exclu-
sively from Costa Rica, thus both may represent the endemic fauna.

The subfamily affiliation of Araneothrombium n. gen. is ambiguous. The genus shares several char-
acters with the Eutrombidiinae, bearing at the same time also traits which depart from those known for the subfamily members.

Twelve genera have been placed in the Eu-
trombidiinae. Of those, Allhatrombium May-
oral and Barranco, 2005, Beronium Southcott, 1986,
FIGURE 3: Araneothrombium dinaloqunovi n. sp.: A - leg I (coxa – tarsus) [paratype F3441.154/UMMM]; B - leg II (coxa - tarsus) [paratype F3441.154/UMMM]; C - leg III (coxa – tarsus) [paratype F3441.154/UMMM].
FIGURE 4: Host specimen (Araneidae juv.) with parasitizing larvae of *Araneothrombium dimalogunovi* n. sp. (courtesy Amanda Bamford, University of Manchester, UK).

FIGURE 5: Spider (Araneidae juv.) host with larvae of *Araneothrombium dimalogunovi* n. sp. (after preservation in EOH).
### Table 2: Comparative data on three microtrombidiid genera and species associated with spiders.

<table>
<thead>
<tr>
<th>Characters</th>
<th>Spinnitrombium kenyense</th>
<th>Verdunella lockleii (Welbourn and Young, 1988)</th>
<th>Araneothrombium dimalogunovi n. gen. et n. sp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>position of setae c₁ (= SL)</td>
<td>anterior</td>
<td>anterior</td>
<td>posterior</td>
</tr>
<tr>
<td>on scutellum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>posterior margin of scutellum</td>
<td>convex</td>
<td>convex</td>
<td>convex, with concavity along postero-lateral line, on both sides of symmetry axis</td>
</tr>
<tr>
<td>fD</td>
<td>(2) 4-4-4-2-4</td>
<td>(2) 4-4-4-4</td>
<td>(2) 4-2-4-4-4</td>
</tr>
<tr>
<td></td>
<td>= (2) + 16</td>
<td>= (2) + 22</td>
<td>= (2) + 18</td>
</tr>
<tr>
<td>fV</td>
<td>2-2</td>
<td>2u-2-4</td>
<td></td>
</tr>
<tr>
<td>seta 1a on coxa I</td>
<td>simple, nude</td>
<td>simple, setulated*</td>
<td></td>
</tr>
<tr>
<td>seta 1b on coxa I</td>
<td>stout, bifid</td>
<td>简单, 分叉</td>
<td>simple, setulated</td>
</tr>
<tr>
<td>seta 2b on coxa II</td>
<td>stout, bifid</td>
<td>simple, setulated</td>
<td></td>
</tr>
<tr>
<td>seta 3b on coxa III</td>
<td>stout, bifid</td>
<td>simple, setulated</td>
<td></td>
</tr>
<tr>
<td>tarsus I termination</td>
<td>one claw and empodium</td>
<td>two claws and empodium</td>
<td>two claws and empodium</td>
</tr>
<tr>
<td>tarsus II termination</td>
<td>one claw and empodium</td>
<td>two claws and empodium</td>
<td>two claws and empodium</td>
</tr>
<tr>
<td>tarsus III termination</td>
<td>two claws and empodium,</td>
<td>two claws and empodium, inner claw reduced in length</td>
<td>two claws and empodium, inner claw reduced in length</td>
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<td></td>
<td>outer claw modified</td>
<td></td>
<td></td>
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<tr>
<td>solenidion on tarsus I</td>
<td>at proximal margin of the segment</td>
<td>shifted from the proximal margin of a segment</td>
<td>at proximal margin of the segment</td>
</tr>
<tr>
<td>famulus on tarsus II</td>
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<td>proximally to solenidion</td>
<td>proximally to solenidion</td>
</tr>
<tr>
<td>fζ</td>
<td>2-1-0</td>
<td>2-1-0</td>
<td></td>
</tr>
<tr>
<td>distribution</td>
<td>Africa (Kenya)</td>
<td>North America (USA: Mississippi)</td>
<td>Central America (Costa Rica)</td>
</tr>
</tbody>
</table>

*inferred from SEM micrograph (Figure 8 in Welbourn and Young 1988)
idiae but also of the Eutrombidiinae. However, until the status of the latter subfamily in the sense of its boundaries and composition is resolved, we tentatively place the newly described genus in the Eutrombidiinae.

While several differences between *Spinnitrombium kenyense* Fain and Jocqué, 1996, *Verdunella lockleii* (Welbourn and Young, 1988) and *Araneothrombium dimalogunovi* n. gen. et n. sp., for example, the shape of scutellum, the position of setae c₁ (=SL), but also the termination of tarsi, in all probability are expressions of intra-generic variation, the presence of normal, setulose setae on coxae, not reported for any of the eutrombidiine genera, constitutes the main reason for the erection of the new genus. All three genera have been hitherto known as monotypic. The actual status and relationships between the taxa in question should be solved with the help of molecular data.

The helmet-like (in three dimensional aspect) scutum, similar in *Verdunella, Spinnitrombium* and *Araneothrombium* n. gen., is the reason for the distortion which occurred while flattening the specimen during mounting. The adaptive value of scutum shape may consist in protection of idiosoma against damage during parasitism in the narrow space between the host’s cephalothorax and abdomen. A similar role can be attributed to the strongly sclerotized anterior margin of scutellum, not observed in the other members of terrestrial Parasitengona.

The hosts of *Spinnitrombium, Verdunella* and *Araneothrombium* are probably limited to spiders. The seven larvae of *Araneothrombium dimalogunovi* n. gen. et n. sp. attached to the host fit the load range of 1 – 19 parasitengone mites per spider (MaKol and Felska 2011). The knowledge of associations between terrestrial Parasitengona mites and spiders suggests some host specificity. This, however, should be treated with caution, due to unresolved questions about intra-specific variation in parasitengones.

ACKNOWLEDGEMENTS

Our sincere thanks go to Dmitri V. Logunov for collecting the spider with larvae that served for this study. We are grateful to Amanda Bamford (University of Manchester, UK) for providing us with the photo of live host with larvae (Figure 4) and to Dariusz Łupicki for his assistance in processing the original camera lucida drawings. We are also indebted to the three anonymous Reviewers for their valuable suggestions.

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