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New genus and species of microtrombidiid mite (Actinotrichida: Trombidioidea, 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 *Spininitrombium* Fain and Jocqué, 1996. This is the first record of Trombidioidea (excl. Trombiculidae s.l.) in Costa Rica.

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

ZOOBANK — [6A08EB21-CB39-45C2-99B0-8DFEB3113389](https://zoobank.org/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 (Małol 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 (Małol 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 Erythraeidae: 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 (Małol 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 Trombidioidea (excl. Trombiculidae s.l.) in Costa Rica.

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, heterogeneous 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, μm) 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-BAE4-4E6D-BD45-1C8354E2B10D](https://doi.org/10.26434/chem:8AAF24E7-BAE4-4E6D-BD45-1C8354E2B10D)

Diagnosis — Larva. Subcapitular setae (hypostomalae) short and robust, reniform. Scutum pentagonal in outline (when flattened). Eyes incorporated into scutum. Coxal setae 1a, 1b, 2b and 3b simple, setulated. Tarsi I-III terminated with two

claws and empodium. Smilum, scopa and lophotrix absent. Postlarval instars: not known.

Type species: *Araneothrombium dimalogunovi* n. sp.

Araneothrombium dimalogunovi n. sp.

Zoobank: [789BDBAE-1F67-4A53-AA2F-5E0ABFEB5A96](https://doi.org/10.26434/chem:789BDBAE-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 antero-ventrally. 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 (c_2 , e_1) 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, scopa 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 adoral setae (*or*) (9 – 10, $n = 2$). Subcapitular setae (tritorstral setae, hypostomalae, *bs*), short (5 – 7 long $\times$ 12 – 13 wide, $n = 3$) and robust, reniform, rounded at terminations,

TABLE 1: Leg measurements of *Araneothrombium dimalogunovi* n. sp.; H - holotype, P - paratype.

	Holotype F3441.152	Paratype F3441.153	Paratype F3441.154	Paratype H7794/1	Paratype H7794/3	range
Cx I	34	35	37	37	34	34–37
Tr I	28	27	29	28	30	27–30
Fe I	43	43	44	43	45	43–45
Ge I	16	18	18	16	14	14–18
Ti I	35	37	36	34	36	34–37
Ta I	72	73	70	74	74	70–74
leg I	228	233	233	232	233	228–233
Cx II	35	35	35	35	34	34–35
Tr II	28	29	30	27	30	27–30
Fe II	40	42	40	42	44	40–44
Ge II	15	16	16	13	15	13–16
Ti II	33	34	35	34	34	33–35
Ta II	65	64	68	69	68	64–69
leg II	215	220	224	220	225	215–225
Cx III	35	33	35	34	34	33–35
Tr III	30	29	31	28	30	28–31
Fe III	37	40	39	41	39	37–41
Ge III	20	20	20	21	19	19–21
Ti III	39	39	40	40	40	39–40
Ta III	68	69	70	69	70	68–70
leg III	229	229	235	232	233	229–235
IP	672	682	692	685	692	672–692

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-BNNNNN $\omega\zeta$. 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, *ca* 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 postero-laterally 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 c_1 (= SL). Lateral margins of scutellum with well-defined concavities. Setae c_1 (56 – 58, n = 3) located posteriorly on scutellum, covered with short setules. Bases of c_1 surrounded with weakly sclerotized pools, levelled with posterior margin of the sclerite. Distance between c_1 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 (c_2 , e_1) longer (DS_{max} = 44 – 51, n = 3) than remaining ones (DS_{min} = 17 – 22, n = 3). Bases of c_2 , e_1 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 sclerotized. Coxal plates punctate. Coxa I with seta 1a placed in anterior position, *ca* half-length the sclerite; 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 setae. Anal opening without sclerites.

Legs (Figure 3) — Segmentation formula: 6-6-6. Leg chaetotaxy. Leg I: Tr (1n) – Fe (6n) – Ge (4n, 2 σ , 1 κ) – Ti (6n, 2 φ , 1 κ) – Ta (17 – 18n, 2 ζ , 1 ω , 1 ϵ). Leg II: Tr (1n) – Fe (5n) – Ge (2n, 1 σ , 1 κ) – Ti (5n, 2 φ) – Ta (14n, 1 ζ , 1 ω , 1 ϵ). Leg III: Tr (1n) – Fe (4n) – Ge (2n, 1 σ) – Ti (5n) – Ta (13n). Normal setae 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. Posterior (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 *Araneothrombium* refers to the host affiliation of the newly described type species. The species is dedicated to Dr. Dmitri ("Dima") V. Logunov, araneologist, Curator 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 posterior part of cephalothorax, close to the pedicel (Figures 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.) described to date, only the monotypic *Surasmaris* Southcott, 1995 of Smarididae and *Araneothrombium* n. gen. of the Microtrombidiidae are known exclusively from Costa Rica, thus both may represent the endemic fauna.

The subfamily affiliation of *Araneothrombium* n. gen. is ambiguous. The genus shares several characters 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 Eutrombidiinae. Of those, *Alhamitrombium* Mayoral and Barranco, 2005, *Beronium* Southcott, 1986,

FIGURE 3: *Araneothrombium dimalogunovi* 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.

Characters	<i>Spininitrombium kenyense</i> Fain and Jocqué, 1996	<i>Verdunella lockleii</i> (Welbourn and Young, 1988)	<i>Araneothrombium dimalogunovi</i> n. gen. et n. sp.
position of setae c_1 (= SL) on scutellum	anterior	anterior	posterior
posterior margin of scutellum	convex	convex	convex, with concavity along postero-lateral line, on both sides of symmetry axis
fD	[?] (2)4-4-2-2-4 = (2) + 16	(2)4-6-4-4-4 = (2) + 22	(2)4-2-4-4-4 = (2) + 18
fV	[?] 2-4-2	2-2	2u-2-4
seta 1a on coxa I	simple, nude	simple, setulated*	simple, setulated
seta 1b on coxa I	stout, bifid	stout, bifid	simple, setulated
seta 2b on coxa II	stout, bifid	stout, bifid	simple, setulated
seta 3b on coxa III	stout, bifid	stout, bifid	simple, setulated
tarsus I termination	one claw and empodium	two claws and empodium	two claws and empodium
tarsus II termination	one claw and empodium	two claws and empodium	two claws and empodium
tarsus III termination	two claws and empodium, outer claw modified	two claws and empodium, inner claw reduced in length	two claws and empodium, inner claw reduced in length
solenidion on tarsus I	at proximal margin of the segment	shifted from the proximal margin of a segment	at proximal margin of the segment
famulus on tarsus II	distally to solenidion	proximally to solenidion	proximally to solenidion
f_{ζ}	2-1-0	2-0-0	2-1-0
host	<i>Metaleptyphantes perexiguus</i> (Araneae, Linyphiidae)	<i>Ceraticelus emertoni</i> (Araneae: Linyphiidae), <i>Oxyopes salticus</i> (Araneae: Oxyopidae)	Araneidae (Araneae), juv.
distribution	Africa (Kenya)	North America (USA: Mississippi)	Central America (Costa Rica)

*inferred from SEM micrograph (Figure 8 in Welbourn and Young 1988)

Hexathrombium Cooreman, 1944, *Hoplothrombium* Ewing, 1925, *Kepongia* Southcott, 1993, *Milliotrombidium* Shiba, 1976, *Phnompetrombium* Haitlinger, 2002, *Spininitrombium* Fain and Jocqué, 1996 and *Verdunella* Southcott, 1993 are known exclusively from larvae. Southcott (1993) distinguished three tribes within the Eutrombidiinae: Eutrombidiini (with *Eutrombidium*, *Verdunella*), Hexathrombiini (with *Hexathrombium*, *Hoplothrombium* and *Beronium*) and Milliotrombidiini (with *Milliotrombidium* and *Kepongia*). The criteria set by Southcott (1993) for larvae, adopted by subsequent authors with few modifications (Mayoral and Barranco 2005), allowed to place *Alhamitrombium* in Hexathrombiini. *Spinini-*

trombium was assigned to Eutrombidiini (Fain and Jocqué 1996), whereas a new tribe Phnompetrombiini was erected for *Phnompetrombium* (Haitlinger 2002). The newly described genus *Araneothrombium* n. gen. shares several characters with *Spininitrombium* and *Verdunella* (eyes incorporated in scutum, host spectrum), however it differs from them primarily in the absence of bilobed setae on leg coxae (for other differences see Table 2). The latter character (*i.e.* the absence of modified setae) has not been hitherto observed in the Eutrombidiinae, and - as present in the remaining Microtrombidiidae - may support the hypothesis on the polyphyletic origin not only of the earlier distinguished Eutrombidi-

idae 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 c_1 (= 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 (Małol 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.

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