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A new species of the genus *Lasioseius* (Acari: Blattisociidae) inhabiting litter of secondary rainforest in Sumatra, Indonesia

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**Original research**

**ABSTRACT**

A new species of blattisociid mites *Lasioseius orangrimbae* n. sp., that belongs to the *floridensis*-group, is described based on females and males from litter and soil samples of secondary rainforest in Sumatra, Indonesia.

**Keywords** Gamasida; Oriental region; tropical lowland rainforest

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**Introduction**

Currently, the mite family Blattisociidae (Mesostigmata: Ascoidea) comprises 14 globally distributed genera with *Lasioseius* Berlese 1916 as the most diverse and rich genus. *Lasioseius* includes a total of 206 described species that have been found in different habitats such as soil, grass, moss and litter, but also associated with insects and on plants (Moraes et al. 2016). Some species have been widely studied as potential biological control agents (Moraes et al. 2015).

Up to date, nine species from five genera of Blattisociidae have been reported for Indonesia i.e., *Blattisocius denticruss* (Berlese, 1918) from Ambon Island, *Cheiroseius alstoni* (Evans and Hyatt 1960) from Bogor, *Cheiroseius parapodicus* (Berlese, 1916), *Hoploseius cometa* (Berlese, 1910), *Lasioseius sublaevis* Berlese, 1916, and *Platyseius mollicomus* (Berlese, 1916) from Java, *Lasioseius alter* Vitzthum, 1925, *Lasioseius frontalis* Evans and Sheals, 1959 and *Lasioseius polydesmophilus* Evans and Sheals, 1959 from Sumatra. Only *C. alstoni* and *L. alter* have been collected from soil in decaying vegetation and rotting vegetable debris respectively. All the other species have been found associated with insects.

The main goal of this paper is to describe one new species of the genus *Lasioseius* (*Lasioseius*) based on adult specimens (female and male) collected from litter of secondary rainforest in Bukit Duabelas National Park, Jambi Province, Sumatra, Indonesia.
Materials and methods

This study forms part of a large project investigating arthropods of Indonesia, within the framework of the interdisciplinary project “Ecological and socioeconomic functions of tropical lowland rainforest transformation systems (Sumatra, Indonesia)” – EFForTS. For more details on the study region and the experimental design see Drescher et al. (2016).

Mites were extracted from soil samples of 16 x 16 cm taken from the core plots of the project with a spade in the Bukit Duabelas National Park, Jambi Province, Sumatra (for exact localities and habitats see “Material examined” section). Litter and topsoil to a depth of 5 cm were extracted separately using the high gradient canister method described by Kempson et al. (1963). All specimens were collected in November 2013 by B. Klarner. Mites were initially stored in 70% ethanol, then cleared in 55% lactic acid, in some cases gnathosoma was dissected from idiosoma, and slide preparations were done with Hoyer’s medium.

Photographs and measurements were made using a Nikon Eclipse Ci microscope equipped with phase contrast and connected to a digital camera (Nikon, High-definition Color Camera Head DS-Fi2) controlled by (Nikon, Camera Control Sight DS-L3). Most images were taken in stacks with the focal depth controlled manually. Selected images were combined using Zerene Stacker Version 1.04. In some cases, images captured from different regions of the body were combined using the ‘photomerge’ function in Adobe Photoshop, version 2015 (16.0 or 20150529.r.88; Adobe Systems Inc., San Jose, USA). Digital drawings were prepared with Adobe Illustrator, version CC 2015 (19.0.0), based on mite photographs.

All measurements are given in micrometers (μm) and included in the descriptions as a range (minimum–maximum). Lengths of shields were measured along their midlines; the level in which widths were measured are indicated in brackets. Leg measurements were taken from the proximal margin of the coxa, along of the midline of each segment, to the tip of the claw. Notations of body structures and idiosomal chaetotaxy generally follow Lindquist and Evans (1965). Leg chaetotaxy follows Evans (1963) and Evans and Till (1965). Notations for pore-like structures (gland pores and poroids/lyrifissures) follow the system of Athias-Henriot (1971) for ventral idiosoma and peritrematal shield, and Athias-Henriot (1975) for the dorsal idiosoma.

The holotype (female) and one paratype (male) are deposited in LIPI (Indonesian Institute of Science), Cibinong, Indonesia; the other paratypes in SMNG (Senckenberg Museum), Görlitz, Germany and OSAL (Ohio State Acarology Collection), Columbus, USA.

Results

Systematics

The genus Lasioseius includes two subgenera Lasioseius (Lasioseius) Berlese, 1916 and Lasioseius (Endopodalius) Christian and Karg, 2006 (Moraza and Linquist 2011). The subgenus Lasioseius (Lasioseius) includes the following four currently recognized species-groups: the phytoseioides-group (Lindquist, 1964) with twenty species, the porulosus-group (Walter and Lindquist, 1997) with seven species, the floridensis-group (Mineiro et al., 2009) with four species, and the cassidini-group with four species (Moraza and Lindquist, 2018).

Based on the key to the world genera and subgenera of Blattisociidae (Moraza and Linquist 2011) and on the diagnosis provided by Moraza and Lindquist (2018) for the species-groups, the species described here forms part of the subgenus Lasioseius (Lasioseius) and the floridensis-group by the combination of the following characters: females with most of the dorsal shield setae tricarinate and moderately long, many of them nearly as long as longitudinal intervals between their bases; posthumeral seta r4 short and simple, similar to r2, and at most half as long as neighboring tricarinate seta s4; tarsus II with one midlateral seta pl2 elongated and reaching nearly to base of pretarsus; leg IV with no tarsal setae longer than tibial segment; podonotal region of female dorsal shield with 21 pairs of setae, including r4 but excluding
r5; and sternal shield with an anteromedial patch of reticula. The floridensis-group currently includes L. floridensis Berlese 1916, L. queenslandicus (Womersley, 1956), L. sugawarai (Ehara, 1964), and L. latinoamericanus Mineiro et al., 2009.

**Blattisocilidae**

**Lasioseius Berlese**


**Lasioseius orangrimbae** n. sp. Quintero-Gutiérrez and Sandmann

Zoobank: B3F5F066-ABEB-4C0E-9B19-8AE00F85DF4E

Lasioseius orangrimbae n. sp. Quintero-Gutiérrez and Sandmann

[Figures 1–9, 10a](#)

**Diagnosis**

**Female** — Dorsal shield with reticulate surface, bearing 36 pairs of setae that are relatively long and tricarinate, except z1, s1, r2, t4, JV5 which are smooth and aciculate, Z3–Z5, S4 and S5 tricarinate and with serrate margin. Soft integument bearing only seven relatively short pairs of setae r5, r6, R2–6; seta R1 and UR series absents. Ventral shields with all setae aciculate and smooth, sternal shield mostly smooth, central region slightly punctate, sparse lateral striations, and with two parallel anteromedian lines between st1 and st2; st1 in the sternal shield. Genital shield punctate (difficult to discern) with posterior margin truncate; four transversely aligned and elongated platelets between genital and ventrianal shield. Ventrianal shield strongly reticulate, bearing six pairs of preanal setae ZV2–ZV3, JV1–JV3, JV4 10–11; posterior margin slightly narrow at level of JV4. Only three pairs of setae ZV1, ZV4 and JV5 on opisthogastic integument, JV5 at least twice longer than ZV1 and ZV4. Two pairs of semi-rounded metapodal elements. Spermadeca with a short major duct leading to a weakly sclerotized shallowly funnel-shaped calyx as long as wide from which a long and thin minor duct arise. Tarsus II with pl2 macrosetae.

**Male** — Dorsal shield with 38 pairs of setae including r5–6 (r6 inserted sometimes on unsclerotized lateral cuticle), unsclerotized lateral cuticle with the setae R–UR series absents. Sternogenital shield with five setae st1–st5, ventrianal shield bearing six pairs of setae with six pairs of preanal setae, seta JV5 longer than other preanal setae; ZV5 in soft opisthogastic

**Description**

**Female** (Figures 1–6, 10a) (n = 5)

**Idiosomal dorsum** — (Figure 1). **Dorsal shield** 340–363 long, 219–239 wide (at level of seta S1), covering partially the idiosoma, strongly reticulate, except between the bases of Z5 and Z4 being slightly reticulate and with some granulations, reticulations less distinct centrally due to dense internal muscle insertions, lateral margins of soft integument exposed. Dorsal shield bearing 36 pairs of setae of similar length and shape; most setae relatively long and tricarinate, except pairs z1, s1, r2, t4, r4, J5 which are smooth and aciculate; pairs of setae Z3–Z5, S4 and S5 tricarinate with serrate margin. Unsclerotized lateral cuticle bearing only seven pairs of relatively short setae of similar length r5, r6, R2–6, and a pair of lirifissures (RP) between R3 and R4; R1 and UR series absents. Length of setae: j1 20–21, j2 18–19, j3–j4 25–26, j5 22–23, j6 23–24, z1 7–9, z2 20–21, z3 30, z4 27, z5 22, z6 22–23, s1 11–12, s2 7–9, s3 27–28, s4–s6 29–30, r2 7–8, r3 28–29, r4 7–8, r5 9–10, r6 7, J1 23–24, J2–J4 24–25, J5 11–12, Z1 28–29, Z2 29–30, Z3 36, Z4 46–47, Z5 41–42, S1–S3 25–27, R2–R3 9–10, R4–R6 11–12. Dorsal shield with 22 pairs of pore-like structures, including six pairs of gland openings (gd1–2, gd4, gd6, gd7 and gd9) and 16 pairs of poroids.

**Idiosomal venter** — (Figures 2, 3a–d). All setae aciculate and smooth. **Tritosternum** with columnar base and pair of completely free pilose laciniae. Pre-sternal region little sclerotized, punctate and transversely striate (Figures 3a). **Sternal shield** 253–260 long, 170–174 wide (at level of st2) mostly smooth, central region slightly punctate, difficult to discern (Figures
Figure 1 Lasioseius orangrimbae n. sp., adult female: Dorsal idiosoma. Note absence of setae R1 and UR series.
Figure 2  *Lasioseius orangrimbae* n. sp., adult female: Ventral idiosoma.
Figure 3  *Lasioseius orangrimbae* n. sp., adult female: a – Pre-sternal region and sternal shield showing the punctuated area, arrow showing the narrow anteromedian strip; b – Genital shield with punctuations; c, d – Metapodal platelets, variant forms.

3a), with sparse lateral striations and with two parallel anteromedian lines between *st1* and *st2* (Figures 3a, see arrow), bearing three pairs of setae *st1*–*st3* (15–16) and two pairs of slit-like poroids *iv1–2*, oblique. Posterior portion of endopodal plate represented by a triradiate fragment between coxae III–IV. Metasternal plates roundish, with *st4* (16) and a pair of lyrifissures (*iv3*). **Genital shield** 72–75 long, 55–58 wide (at level of *st5*), evenly punctated, but difficult to discern (Figure 3b); posterior margin truncate, shield bearing one pair of setae *st5* (15–16), slit-like poroids *iv5* on unsclerotized cuticle and posterolaterad of *st5*; in front of the posterior margin four transversely aligned elongate platelets. **Exopodal shield** narrow, between coxa I–IV long and fused posteriorly (at level to the coxa IV) with the peritremal–parapodal shields. **Peritrematal shield** smooth, anteriorly fused with dorsal shield at level of the setae *s1*, fused posteriorly with the exopodal–parapodal shields; bearing pairs of poroids *id3*, *gd3*, *id7*, *gdp* and
Figure 4 Lasioseius orangrimbae n. sp., adult female: a – Subcapitulum; b – Chelicera (antiaxial view); c – Gnathotectum.

*Ventral shield* wider 312–316 (at level of ZV3) than long 194–204, posterior margin slightly narrow at level of JV4; strongly reticulate and punctate anterior to the postanal setae; shield with six pairs of setae ZV2 15–16, ZV3 7, JV1 11–12, JV2 15–16, JV3 12–13 and JV4 10–11 additionally to the circumanal setae (postanal seta slightly longer 21–22 than para-anal setae 15–16). Further, with one pair of marginal pores (gv3) posterolateral of para-anal setae and two pairs of poroids (ivo). *Soft opisthogastric cuticle* bearing only three pairs of setae, JV5 20–21 twice longer than JV1 and JV4 10–11, with two pairs of semi-rounded metapodal platelets (met) well developed (Figures 3c–d).

Gnathosoma — (Figures 4a–c). Subcapitulum (Figure 4a) corniculi well sclerotized, elongated and horn-like. Internal malae lanceolate, densely fimbriated, with apices slightly beyond of the corniculi. Deutosternum with eight transverse rows of denticles with first row (most distal), from second to seventh rows with 10-15 denticles, the first seven lines are connected by the lateral subparallel deutosternal lines, eighth line (most proximal) extending beyond lateral deutosternal lines and with 20–23 denticles; with smooth lines laterad of delineating deutosternal lines at region between fifth and sixth transverse lines; subcapitular setae smooth and aciculate, h1 and h3 32 longer than h2 23 and pc 29. Chelicerae (Figure 4b). Fixed digit with 13 small teeth plus one distal hook-like tooth, and a setiform *pilus dentilis*; dorsal and antiaxial lyrifissures as well as dorsal setae distinct; mobile digit with three large teeth and one large distal tooth. Gnathotectum (Figure. 4c) with three anterior projections, two serrate lateral projections and one acuminate middle process longer than the lateral ones (not serrate).


Chaetotaxy/setation—Coxae: I: 0, 0/1, 0/1, 0; II: 0, 0/1, 0/1, 0; III: 0, 0/1, 0/1, 0; IV: 0, 0/2, 0/1, 0; trochanters: I: 1, 0/1, 1/2, 1; II: 1, 0/1, 0/2, 2; III: 1, 1/1, 0/2, 0; IV: 1, 1/1, 0/2, 0; femora:
Figure 5 *Lasioseius orangrimbae* n. sp., adult female: a–d – legs I–IV, respectively.
Figure 6 *Lasioseius orangrimbae* n. sp., adult female: spermathecal apparatus.

I: 2, 3/1, 2/2, 2; II: 2, 3/1, 2/2, 1; III: 1, 2/1, 1/0, 1; IV: 1, 2/1, 1/0, 1; genua: I: 2, 3/2, 3/1, 2; II: 2, 3/1, 2/1, 2; III: 2, 2/1, 2/1, 1; IV: 2, 1/1, 3/0, 1; tibia: I: 2, 3/2, 3/1, 2; II: 2, 2/1, 2/1, 2; III: 2, 1/1, 2/1, 1; IV: 2, 1/1, 3/1, 2; tarsi I: not counted, II: 18; III: 18; IV: 18. All legs I–IV with pretarsi, including a pair of claws and a pulvillus with median lobe rounded. Legs with all setae aciculate and smooth. Legs I–IV with most of the dorsal setae in femur–tibia slightly thicker than ventral setae. The most of setae in the tarsi I–IV moderately longer and/or stout than other segments. Tarsi II–IV with seta *md* 3.2 times longer than *mv*. Leg II with *al* setae in femur–tibia shorter than *pl* setae (*al1* in femur II is long). Tarsus II with *pl2* macrosetae (5.2 times longer than *al2*) (Figure 10a) and *pd2* moderately longer than *ad2*. Legs III–IV with *pl* setae in femur–tibia shorter than *pl* setae. Tarsus IV with *al2* slightly longer than *pl2*.

**Spermathecal apparatus** — (Figure 6). With a short major duct leading to a weakly sclerotized shallowly funnel-shaped calyx as long as wide from which a long 33 and thin minor duct arises with terminus duct indiscernible in specimens at hand.

**Male** (Figures 7–9) (*n* = 3)

**Idiosomal dorsum** — (Figures 7a–b). **Dorsal shield** 268–275 long, 178–180 wide at level of setae *S1*, chaetotaxy as in female but bearing two more pairs of setae (*r5–6*, Figure 7a) for a total 38 pairs of setae (*r6* inserted on unsclerotized lateral cuticle in one of the three males, Figure 7b), other setae from *R*-series absent; dorsal setae slightly shorter than in female. Poroidotaxy, adenotaxy and ornamentation identical to that of female.

**Idiosomal venter** — (Figure 8). Similar to female except the following: **Sternigenital shield** 130–134 long, 58–61 wide at level between *s2*; bearing five pairs of simple setae (*st1–5*).

**Ventralian shield** with six pairs of setae (*JV1–3, JV5, ZV1–2*), excluding three circum-anal setae, *JV5* longer than other preanal setae; *ZV5* in soft opisthogastric integument.

**Gnathosoma** — (Figures 9a–b). As in female except the following: **Chelicerae** (Figure 9a); fixed digit with 12 small teeth plus one distally hook-like tooth and a setiform *pilus dentilus*; dorsal and antiaxial lyrifissures and dorsal setae distinct; mobile digit with a single tooth slightly directed forward and distally hook-like; with a slightly curved spermadactyl.

**Gnathotectum** (Figure 9b) anteromedian region of epistome convex, with variably denticulate extensions.

Type material and depository
Indonesia, Sumatra, holotype and all paratypes from Bukit Duabelas National Park, litter from secondary rainforest, research site BF1a, S 01°59′42.5″, E 102°45′08.1″, 83 m a.s.l. 
**Holotype:** • 1♀, deposited at LIPI (OSAL 00124869); **Paratypes:** • 2♀ deposited at SMNG (OSAL 00124865 SMNG 2020 / 61895/1, OSAL 00124867 SMNG 2020 / 61895/3). • 2♀ deposited at OSAL, (OSAL 00124868, 00124870). • 1♂ deposited at LIPI, (OSAL 00124864). • 1♂ deposited at SMNG (OSAL 00124866 SMNG 2020 / 61895/2). • 1♂ deposited at OSAL (OSAL 00124863). All specimens were collected in November 2013 by B. Klarner. Additional photos of the species (ECOTAX_ID: 424404) are deposited in Ecotaxonomy database at www.ecotaxonomy.org.

**Etymology**
The epithet *orangrimbae* refers to forest-dwelling people “Orang Rimba” living in the sampling region.

**Remarks**
Figure 8  *Lasioseius orangrimbae* n. sp., adult male: Ventral idiosoma.
**Discussion**

Five species of *Lasioseius* have been previously described from Sumatra *L. sublaevis L. alter, L. frontalis, L. polydesmophilus* and *L. angustus*. For *L. sublaevis* it is not possible to compare or establish the subgenus or species group because the description is very short. Additionally, Christian and Karg (2006) did not include this species in their study. *Lasioseius alter, L. frontalis, and L. polydesmophilus* are not closely related to *L. orangrimbae* n. sp., because they belong to the subgenus *Lasioseius (Endopodalius)* Christian and Karg, 2006. Finally, *L. angustus* was described based only on males and also seems to belong to the subgenus *Lasioseius (Endopodalius)*.

When examining our specimens with the key to the species of *Lasioseius* provided by Christian and Karg (2006) we ended in a similar way as reported in Britto et al. (2011). These authors reported that when they determined their specimens of *L. floridensis* with this key, it led them to the subgenus *Crinidens*, then to key 6 for their *ometes-complex having five pairs*
of setae on the ventrianal shield. In our case ending in the subgenus *Crinidens* for having most dorsal setae tricarinate, then to the *Lasioseius-ometisimilis*-complex key 5 for having 6 setae on the ventrianal shield, and at the end to the uplet 21-22 to the species *L. laciniatus* Christian and Karg, 2006, and *L. tricuspidis* Christian and Karg, 2006 for having the following characters:

- a normal number of dorsal setae (not reduced), two pairs of metapodal plates, margins of the tectum with three clear “branches” with medial “branch” as long as the lateral ones which have serrations, most of the dorsal setae tricarinate and dorsal setae not as long to reach the base of the next setae, sternal seta *st1* on the sternal shield, ventrianal shield slightly wider than longer, post anal seta not long. However, the tectum shape in *L. laciniatus* and *L. tricuspidis* do not resemble the one of *L. orangrimbae n. sp.*, in *L. orangrimbae n. sp.* the lateral processes of the tectum are serrate with the middle process longer than the lateral ones, whereas in *L. laciniatus* the lateral processes of the tectum are serrate with the middle one shorter than the lateral ones, and in *L. tricuspidis* the lateral processes are three-pronged with the middle one little longer than the lateral ones. Additionally, *L. orangrimbae* has a well-developed anteromedial patch in the sternal shield, which is absent in *L. laciniatus* and *L. tricuspidis*.

Finally, we would like to emphasize that *L. orangrimbae n. sp.*, fits well the characters stated in Moraza and Lindquist (2018: 68, entry 4) for the *floridensis*-group “Dorsal shield with post-humeral seta *r4* short, simple, similar to *r2*, and not more than half as long as tricarinate seta *s4* neighboring it medially; most dorsal setae tricarinate and moderately long, nearly as long as longitudinal intervals between their bases; anterior pair of sternal setae on weakly sclerotized preternal area, just before anterior margin of sternal shield; sternal shield with anteromedial patch of reticula; tarsus II with one midlateral seta *pl2* elongated and reaching nearly to base of pretarsus”, except the character “anterior pair of sternal setae on weakly sclerotized preternal area”. However, when we compared our specimens with the key to the species of *Lasioseius* in Christian and Karg (2006), we noticed that some species in the subgenus *Lasioseius (Crinidens)* sensu Christian and Karg, 2006 especially the species in the part of the key 5 (*Lasioseius-ometisimilis*-complex) number 11(14) that states “The first pair of sternal setae localized anteriorly to the shield” may fall in the *floridensis*-group because they all fit the characters of the group but some of them do not have the “sternal shield with
anteromedial patch of reticula”, and it is not clear if all species of Lasioseius-ometisimilis-complex also have “tarsus II with one midlateral seta pl2 elongated and reaching nearly to base of pretarsus”. Examining holotype images of L. laciniatus and L. tricuspidis in VIRMISCO (Decker et al. 2018), we noticed that L. laciniatus and L. tricuspidis have the macroseta pl2 in tarsus II (Figures 10b–c). Therefore, it is not clear why the floridensis- group does not include species of the subgenus Lasioseius (Crinidens) sensu Christian and Karg (2006), or where those species would fall under the species-group key presented in Moraza and Lindquist (2018).

All the previous suggests that the subgenus Lasioseius (Crinidens) sensu Christian and Karg (2006) needs to be revised considering if certain species may belong to the floridensis-group, or if with a slight shift of characters the floridensis-group may be split or expanded to include other species.

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