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Taxonomy of *Perissosega* Krombein (Hymenoptera: Chrysididae, Amiseginae), with description of a new species from Japan

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Abstract

Perissosega sulcata **sp. nov.** is newly described on the basis of the two females collected from Iriomote Island, the Ryukyus, Japan. A new combination is proposed for *Calosega flavipes* (Kimsey, 1995), **comb. nov.** from *Perissosega* Krombein, 1983. The diagnostic characters of *Calosega* Terayama, 1999 and *Perissosega* are revised.

Key words. *Calosega*; parasitoid wasp; walking stick

Introduction

Perissosega Krombein, 1983 is a compact-bodied amisegine genus (Hymenoptera: Chrysididae, Amiseginae) with two species described from the Oriental region (Krombein, 1983; Kimsey, 1995). The genus has fully developed wings in both sexes and the dark streak of Rs_2v vein is arising abruptly from the 2r-rs_2v (Kimsey & Bohart (1991)). Among winged-female genera of the Oriental-Palaearctic Amiseginae, this condition of Rs_2v is characteristic to *Perissosega* and *Atoposega* Krombein, 1957 (Kimsey & Bohart, 1991; Kimsey, 2014). Other diagnostic features of the two genera involve the absence of the posterior oblique sulcus of the mesopleuron and presence of the developed posterior propodeal projection on the metapectal-propodeal complex. As *Atoposega*, the ground color of the body is red and black; the metanotum is differently sculptured from the mesoscutellum, and the metasoma is usually more or less finely scratched (Kimsey & Bohart, 1991; Kimsey, 2014). On the other hand, the body color of *Perissosega venablei* Krombein, 1983, the type species of the genus described from Sri Lanka, is largely black; the median metanotal enclosure is densely punctured as mesoscutellum; and the metasoma is sculptured by large and densely located punctures (Krombein, 1983; Kimsey & Bohart, 1991). The second species of the genus, *P. flavipes* Kimsey, 1995 was described from Thailand (Kimsey, 1995). In the original description, the remarkable characteristics as *Perissosega* were mentioned: the presence of omaulus and posterior oblique sulcus; the absence of metacoxal carina. Apart from the Rs_2v, the above characteristics are rather similar to *Isegama* Krombein, 1983 and *Calosega* Terayama, 1999.

During the investigation of the Amiseginae, I found females very close to *P. venablei* from Iriomote Island, the Ryukyus, Japan. This finding provided a new insight into the definition of the genus.

Materials & methods

Specimens from Iriomote Island, the Ryukyus, Japan were obtained by net-sweeping or yellow pan trap. They are deposited in Entomological Laboratory, Faculty of Agriculture, Kyushu University, Fukuoka, Japan (ELKU). The holotype and paratypes of *Perissosega venablei* Krombein, 1983 were studied. They are deposited in the National Museum of Natural History, Washington D.C., U.S.A. (USNM).

Images of the holotype of *Perissosega flavipes* Kimsey, 1995 were also examined. These were obtained from the digital collections of Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario,

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Canada (CNC). Images of the types in the ELKU were taken using a Canon EOS RP digital camera mounted on an Olympus SZX10 microscope. Those in USNM were taken using a Canon EOS Kiss X5 digital camera mounted on a Leica S8 APO microscope.

Terms follow those of Kimsey & Bohart (1991), Kawada *et al.* (2015) and Lanes *et al.* (2020). For fore wing venation, following abbreviations were used: Cu-a_2v, cubito-anal cross vein; Rs_2v, radial sector vein (= distal dark streak of Rs by Kimsey & Bohart (1991)); Rs&M_2v, radial sector & median vein (= M by Kimsey & Bohart (1991)); $R1_2$v, radial 1 vein; 2r-rs_2v, second radial cross vein (= tubular part of Rs by Kimsey & Bohart (1991)). In the description part, following abbreviations were used: OL, inner distance between anterior and lateral ocelli; OOL, inner distance between a lateral ocellus and eye; POL, inner distance between lateral ocelli; OPL, shortest distance between a lateral ocellus and occipital carina; MOD, maximum diameter of median ocellus; PD, puncture diameter; F1–F8, flagellomeres 1 to 8; T1–T2, metasomal tergites 1 to 2.

Results

Genus *Calosega* Terayama, 1999

Calosega Terayama, 1999: 101. Type species: *Calosega kamiteta* Terayama, 1999: 102.

Diagnosis. Scapal basin shallow and cross-ridged, dorsal margin not carinate; posterior margin of vertex almost straight; occipital carina complete; malar sulcus developed; flagellum compact, intermediate flagellomeres shorter (♀) or at most slightly longer (♂) than wide; pronotum thick, about as long as or slightly longer than mesoscutum along mid-line, with posteromedial and lateral pits; mesoscutum with notauli complete; short track of parapsidal signum present, sometimes indicated as small depression; mesopleuron with omaulus and posterior oblique sulcus (= scrobal sulcus by Kimsey & Bohart (1991)), sometimes weakly differentiated from other surface sculptures; metanotum as long as mesoscutellum; median enclosure of metanotum present, sculptured as mesoscutum; metapectal-propodeal complex with spine-like posterior propodeal projection (female) or posterolateral corner angulate (male); both sexes fully winged; narrow $R1_2$v indicated or not differentiated from pterostigma; distal part of pterostigma + $R1_2$v 0.8 × 2r-rs_2v; 2r-rs_2v almost straight or weakly curving; dark streak of Rs_2v almost straight or weakly curving; Rs&M_2v arising at Cu-a_2v; tarsal claw with submedian tooth; metacoxa with dorsal carina; metasoma sculptured by small and sparsely located punctures.

General characteristics of *Calosega* are similar to those of *Isegama* and *Cladobethylus* Kieffer, 1922. However, *Isegama* has a median pronotal groove (not pit-like), and a rounded posterolateral corner of metapectal-propodeal complex (the posteromedian pit is present, and the metapectal-propodeal complex is angulate or spinose in *Calosega*); and *Cladobethylus* has an impunctate welt on vertex (welt absent).

Host. Unknown.

Distribution. Known from Palaearctic Japan (Honshu), Oriental Japan (Ryukyus) (Terayama, 1999; Terayama & Suda, 2014; Katayama, 2021) and Thailand (Kimsey, 1995).

Remarks. Two species *Calosega kamiteta* Terayama, 1999, *C. flavipes* (Kimsey, 1995) are known. *Calosega kamiteta* was rarely found in temperate area (Honshu, Japan) (Terayama & Suda, 2014; Katayama, 2021), but the center of abundance of the genus is considered to be in subtropics.

Calosega flavipes (Kimsey, 1995) comb. nov.

(Figs 1–4)

Perissosega flavipes Kimsey, 1995: 594. Holotype ♀; type locality: Thailand, Khao Yai Natl. Park (CNC).

Holotype ♀, "THAILAND: 180km N.E. Bangkok, Khao Yai N.P., 780m, 11-18-IV-1990, M.T., Moist Semi Evergreen Forest, B. V. Brown", "HOLOTYPE, *Perissosega flavipes* Kimsey", "HOLOTYPE *Perissosega flavipes* Kimsey, CNC No. 22205", "CNC, 957622" (CNC, photos examined).

Remarks. 2r-rs_2v is almost straight and the dark streak of Rs_2v is also almost straight, but the connection is strongly arced (Fig. 1). It appears similar to those of *Perissosega* and other related genera. However, as indicated

by Kimsey (1995), other important characters do not match the diagnosis of *Perissosega* (Krombein, 1983; Kimsey & Bohart 1991). The absence of a smooth strip on vertex (Fig. 3), the well-developed and not-excavated vertex, the presence of a complete omaulus and posterior oblique sulcus (Fig. 2), and also the presence of a dorsal carina on metacoxa (Fig. 4) are common with *Isegama* among the genera known in the Indo-China region. However, the presence of postero-medial pit on pronotum and the developed posterior propodeal tooth places this species in the genus *Calosega*.

The general habitus, and the smaller and sparsely located punctures of the body are similar to *Calosega kamiteta* Terayama, 1999; however, *C. flavipes* is distinguished from *C. kamiteta* by the wider flagellum, F2 2.0 × wider than long (F2 1.5 × wider than long) and the unique condition of Rs_2v (Rs_2v is normal in *C. kamiteta*, the 2r-rs_2v and dark streak of Rs_2v is weakly curving, the connection does not from a strong arc).

FIGURES 1–4. *Calosega flavipes* (Kimsey), holotype ♀. 1. Dorsal habitus; 2, lateral habitus; 3, head and mesosoma; 4, metacoxa. Arrow indicates the dorsal carina. (Photos by S. Gagnon).

Genus *Perissosega* Krombein, 1983

Perissosega Krombein, 1983: 26. Type species: *Perissosega venablei* Krombein, 1983: 27.

Diagnosis. Scapal basin cross-ridged, sometimes dorsal margin surrounded by strong carina; occipital carina variable, but incomplete; malar sulcus developed; posterior margin of vertex weakly excavated; flagellum compact, intermediate flagellomeres shorter than (♀) or as long as (♂) wide; pronotum thick, about as long as mesoscutum along mid-line, with posteromedial pit and pit before lateral lobe; mesoscutum with notauli and short track of parapsidal signum; mesopleuron without omaulus and posterior oblique sulcus; metanotum more than half as long as mesoscutellum; median enclosure of metanotum present, sculptured as mesoscutum; metapectal-propodeal complex with posterior propodeal projection; both sexes fully winged; $R1_2v$ not discriminated from pterostigma; distal part of pterostigma + $R1_2v$ 0.4–0.7 × 2r-rs_2v; 2r-rs_2v weakly curving; dark streak of Rs_2v extended at abrupt angle from 2r-rs_2v; Rs&M_2v variable, usually arising before Cu-a_2v; tarsal claw with submedian tooth; metacoxa with dorsal carina; metasoma more or less densely punctate by large punctures.

Perissosega is probably most closely related to *Atoposega*. This genus is distinguished from *Atoposega* by following characteristics: the body is largely black (the ground color of the body is red and black in *Atoposega*); the metanotum is punctate as mesoscutellum (differently sculptured from the mesoscutellum); and the metasoma is sculptured by large and densely located punctures (usually more or less finely scratched) (Krombein, 1983; Kimsey & Bohart, 1991; Kimsey, 2014).

Host. Unknown.

Distribution. Oriental genus known from Sri Lanka (Krombein, 1983) and Japan, **new record**.
Remarks. Two species, *P. venablei* and *P. sulcata* **sp. nov.** are known.

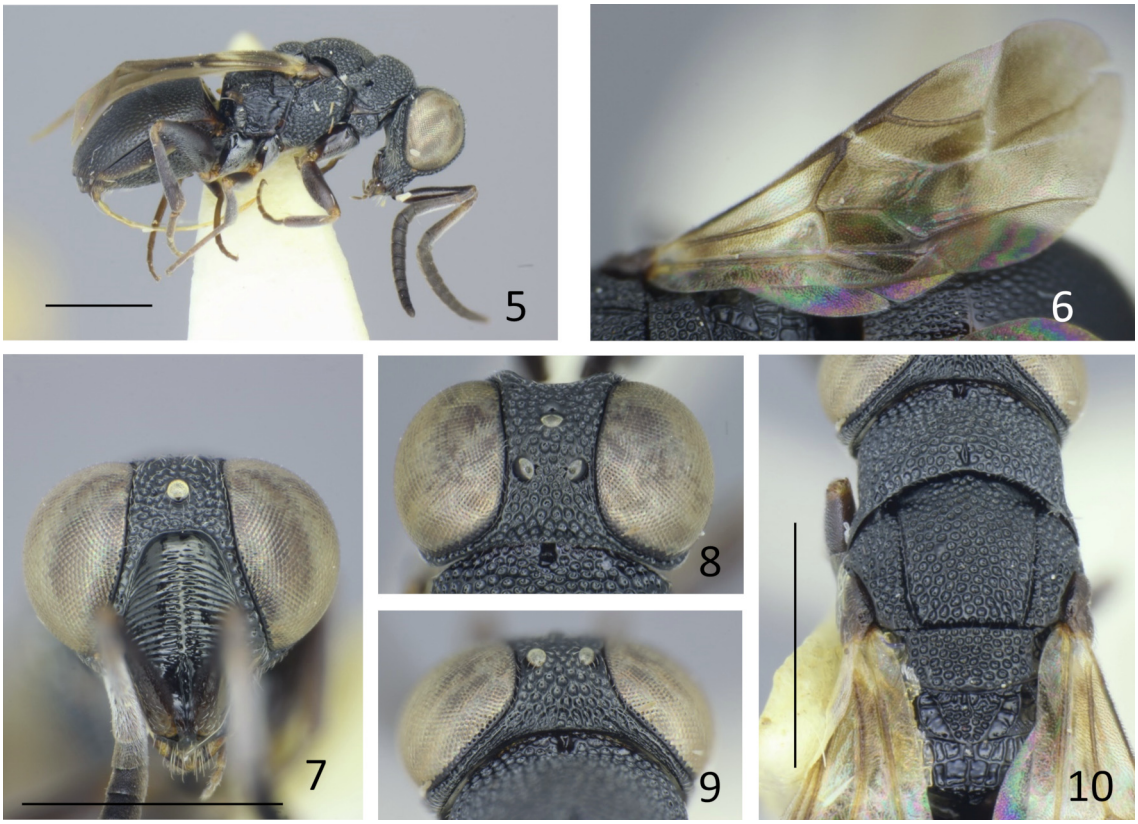
Perissosega venablei Krombein, 1983
(Figs 5–10)

Perissosega venablei Krombein, 1983: 27. Holotype ♀; type locality: Sri Lanka, Southern Prov., Galle District, Kanneliya section, Sinharaja Jungle (USNM).

Diagnosis. Body 2.9–3.5 mm in female, 3.6–2.9 mm in male; black with dark brown mandibles, antennae and legs, articulation of legs paler; wings strongly infuscate with two clear bands, legs sometimes brown; head punctate, almost contiguous; scapal basin with dorsal margin surrounded by strong carina (Fig. 7); occipital carina posterior to ocellar region absent or effaced (Fig. 9), laterally always complete, extending ventral to hypostoma; ocellar triangle narrow, POL 0.8 × OL (Fig. 8); mesosoma (Fig. 10) punctate, punctures almost contiguous; mesopleuron with punctures, dorsally denser, almost punctate-reticulate (Fig. 5); median enclosure of metanotum 0.75 × mesoscutellum; metapectal-propodeal complex bearing spine-like posterior propodeal projection; distal part of pterostigma + $R1_2v$ 0.7 × 2r-rs_2v (Fig. 6); 2r-rs_2v weakly curving; Rs&M_2v arising before (holotype) or almost at (one paratype ♀) Cu-a_2v; metasoma punctate, punctures shallow, somewhat larger and denser than those on mesosoma; median polished line more or less present on T2 (♀) or absent (♂).

About the recognition of *P. venablei* from the closely allied species, see the diagnosis of *P. sulcata* **sp. nov.**

Specimens examined. Holotype ♀, "SRI LANKA: Gal. Dist., Kanneliya Jungle", "14-VII-1978, K. V. Krombein, P. B. Karunaratne", "HOLOTYPE, PERISSOSEGA VENABLEI ♀, Karl V. Krombein", "Type No. 100444, U.S.N.M."(USNM). **Paratypes** 1♀, Sri Lanka, Mat. Dist., Kibissa, 0.5 miwest, Sigiriya, Jungle, 3. VI. 1978, K. V. Krombein, P. B. Karunaratne leg. (USNM); 1♂ (allotype), Sri Lanka, Rat. Dist., Gilimale, Induruwa, Jungle, 2. II. 1979, Malaise trap, K.V. Krombein, P. B. Karunaratne, T. Wijesinhe, S. Siriwardane, T. Gunawardane leg. (USNM).



FIGURES 5–10. *Perissosega venablei* Krombein, holotype ♀. 5. Lateral habitus; 6. forewing; 7, head, frontal view; 8, head, dorsal view; 9, vertex; 10, mesosoma. Scale bar = 1.0 mm.

***Perissosega sulcata*, new species (Figs 11–17)**

Diagnosis. Body 2.1–2.3 mm; black, legs partly testaceous; fore wing strongly infuscate around 2r-rs_2v; head punctate, punctures almost contiguous on vertex; scapal basin with dorsal margin not carinate; occipital carina present only posterior to ocellar region; ocelli forming regular triangle; mesosoma densely punctate; dorsal part of mesopleuron densely punctate and rugose; posterolateral corner of metapectal-propodeal complex angulate, forming a blunt posterior propodeal projection; distal part of pterostigma + $R1_2$v 0.4 × 2r-rs_2v; 2r-rs_2v weakly curving; Rs&M_2v arising almost at Cu-a_2v; metasoma densely punctate, punctures shallow, somewhat smaller and sparser than those on mesosoma; median polished line present from T1 to T2. Male unknown.

FIGURE 11. *Perissosega sulcata* **sp. nov.**, holotype ♀, lateral habitus. Scale bar = 1.0 mm.

This new species is distinguished from *P. venablei* by the shallow scapal basin without a strong dorsal carina (scapal basin is deep and the dorsal margin is surrounded by a strong transverse carina in *P. venablei*); the incomplete occipital carina only present posterior to ocellar region (laterally complete, only absent or effaced posterior to ocellar region); the blunt posterior propodeal projection on the metapectal-propodeal complex (a long spine-like projection is present); the median smooth line on T1 (smooth line absent on T1).

Description. Holotype female. Body length 2.05 mm. Head (Figs 12, 14, 15) punctate except scapal basin, 1.6 × as wide as long in dorsal view, as wide as deep in frontal view; punctures 0.3–0.6 × MOD, 0.2–0.5 × PD apart with smooth interspaces, denser and contiguous on vertex; scapal basin (Fig. 14) shallow, cross-ridged with smooth median line; strong carina absent around dorsal margin; frons dorsally converging, shortest distance between eyes 0.33 × head width; MS 0.36 × maximum length of eye; lateral ocelli almost touching eye, OL 1.0, OPL 2.1, POL 1.0, OOL 0.1, MOD 0.6; occipital carina present only posterior to ocellar triangle; posterior margin of vertex excavated. Mandible cylindrical. Eye setose. Antenna compact, F2–F8 wider than long; length (width) of F1–F4 following ratio: 6.0 (2.0): 1.5 (2.5): 2.0 (3.0): 2.0 (3.0).

Mesosoma (Fig. 16) covered with short decumbent setae. Pronotum punctate with smooth interspaces; punctures somewhat longitudinally contiguous, as large as those on frons, 0.3–1.0 × PD apart, sparser posteriorly; medial longitudinal line reaching 0.8 × length of pronotum; median length of pronotum 0.62 × longer than wide. Mesoscutum

as long as pronotum, punctate with smooth interspaces; punctures smaller and denser on median part, larger and sparser on lateral part. Mesoscutellum 0.6 × mesoscutum, sculptured as median part of mesoscutum. Mesopleuron punctate with smooth interspaces; punctures 0.5 MOD, 0.2–0.6 × PD apart; dorsal part densely punctate and rugose. Metanotum with median triangular enclosure, median length 0.54 × mesoscutellum, densely punctate. Metapectal-propodeal complex rugose, with blunt posterior propodeal projection; dorsal surface slightly shorter than propodeal declivity, with median longitudinal carina; propodeal declivity weakly rugose, with median, sublateral and lateral carina. Fore wing tinged with brown, around 2r-rs$_2$v more strongly infuscate (Fig. 13).

Metasoma (Fig. 14) punctate with smooth interspaces, surface covered with short decumbent setae; punctures on T1 somewhat longitudinally contiguous, ca. 0.3 × MOD, 0.2–1.0 × PD apart, denser posteriorly, punctures on T2 as large as T1, anteriorly denser, posteriorly sparser; median smooth line with one fine groove present on T1 and T2.

Color. Body black except mandible, antenna and tegula dark brown, joints of legs, protibia and tarsi testaceous, other part of legs dark brown, basal part of metasoma brownish.

Specimens examined. Holotype ♀, "JPN: Okinawa Pref., Iriomote-jima Isl., Haiminaka, yellow pan trap, 24.2897N, 123.8775E, 20m alt., 28-VIII-2020, T. Mita leg." (ELKU). **Paratype** 1♀, same island as holotype, but Komi, Airagawa, 24.3261N, 123.8914E, 15. V. 2014, H. Handa leg. (ELKU).

Host. Unknown.

Etymology. The specific epithet sulcata, a Latin adjective, meaning bearing a groove. The species name refers to the median groove on metasoma.

Remarks. The paratype female shows the following variation: body length 2.25 mm; punctures on metasoma slightly denser.

FIGURES 12–17. *Perissosega sulcata* **sp. nov.**, paratype ♀. 12, Head, dorsal view; 13, forewing; 14, head, frontal view; 15, head, lateral view; 16, mesosoma; 17, metasoma. Scale bars = 0.5 mm.

Discussion

The fauna of Amiseginae in the Oriental region is still poorly understood. The finding of *Perissosega* in Far East and, conversely, *Calosega* in Indochina, suggest that amisegine genera may be more widespread than our previous knowledge.

General habitus of *Perissosega sulcata*, **sp. nov.** is apparently slender compared to *P. venablei*. However, the body proportion of Amiseginae should be affected by the shape of host egg (Mita, 2021). This intraspecific difference can make it difficult to identify a species in some cases, but it can also help determine the host.

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