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New Genera and Species of Oriental Orthotyline Plant Bugs (Heteroptera: Miridae: Orthotylinae: Orthotylini)

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Abstract. Two new genera and three new species are proposed for unique orthotyline plant bugs (Orthotylinae: Orthotylini) from the Oriental Region. Two new species representing respective new genera, *Exorthotylus miagao* (from Visayas, Philippines) and *Sarikamiris narakius* (central Thailand), are described. In addition, a new species of *Pseudoloxops* Kirkaldy, *P. manjusri*, is described from Kathmandu, Nepal. The detailed structures of each taxa are shown with SEM images.

Key words. New genera, new species, Orthotylini, Oriental Region, SEM documentation.

Introduction

The present work documents unique new taxa of the plant bug tribe Orthotylini (Miridae: Orthotylinae) from the Oriental Region. As mentioned by several recent efforts (e.g. Balukjian 2013; Eyles 2005; Hazali 2013; Yasunaga & Duwal 2017), a number of undescribed taxa are still present in the southern hemisphere and Old World tropics. The majority of the orthotyline taxa are currently known to occur in the Holarctic Region (Aukema 2018; Schuh 1995; 2002–2013).

In the tropical Oriental Region west of the Wallacea, the orthotyline fauna (excluding taxa of *Zanchius*-group, cf. Cassis & Schuh 2012) does not seem rich, currently represented only by seven genera, namely *Adfalconisca* Carvalho, 1983 [its subfamilial placement needs verification], *Cyrtorhinus* Fieber, 1858, *Mecomma* Fieber, 1858, *Melanotrichus* Reuter, 1875, *Orthotylus* Fieber, 1858, *Pseudoloxopidea* Yasunaga, 1999 and *Pseudoloxops* Kirkaldy, 1905. More than 50 species have been documented from the Indian subcontinent (including the Himalayas) and the warm temperate and subtropical climate zones in China, Japan and Taiwan (Distant 1904, 1911; Liu & Zheng 2014; Yasunaga 1999; Yasunaga *et al.* 2001; Yasunaga & Shishido 2020). Nonetheless, further investigation is encouraged to clarify the whole Oriental fauna.

In this paper, two new genera, *Exorthotylus* and *Sarikamiris*, are proposed to accommodate *E. miagao* (from Visayas, Philippines) and *S. narakius* (Nakhon Nayok, Thailand), respectively. A new species, *Pseudoloxops manjusri*, is described from Kathmandu Valley, Nepal and the systematic position of each treated genus is also discussed. SEM images are provided for all new species.

Materials and methods

The specimens examined in this study were collected by the authors and will be deposited in the following institutions or collections:

AMNH: American Museum of Natural History, New York, USA;
CNC: Canadian National Collection of Insects, Ottawa, Ontario, Canada;
DOAT: Entomology & Zoology Group, Plant Protection Research & Development Office, Department of Agriculture, Bangkok, Thailand;

Received 29 March 2022, accepted 30 August 2022

NMTU: Natural History Museum, Tribhuvan University, Kathmandu, Nepal;
TYCN: T. Yasunaga collection, Nagasaki, Japan.

Matrix code labels, which uniquely identify each specimen and are referred to as 'unique specimen identifier' (USI), are attached to the holotypes and some representative specimens. The USI codes [e.g., AMNH_PBI 00123456] comprise an institution and project code (AMNH_PBI) and a unique number (00123456). These data were digitized on the Arthropod Easy Capture (formerly the Planetary Biodiversity Inventory) database maintained by the American Museum of Natural History, New York, USA (http://research.amnh.org/pbi/) and are also searchable (by species name) on 'Heteroptera Species Pages'.

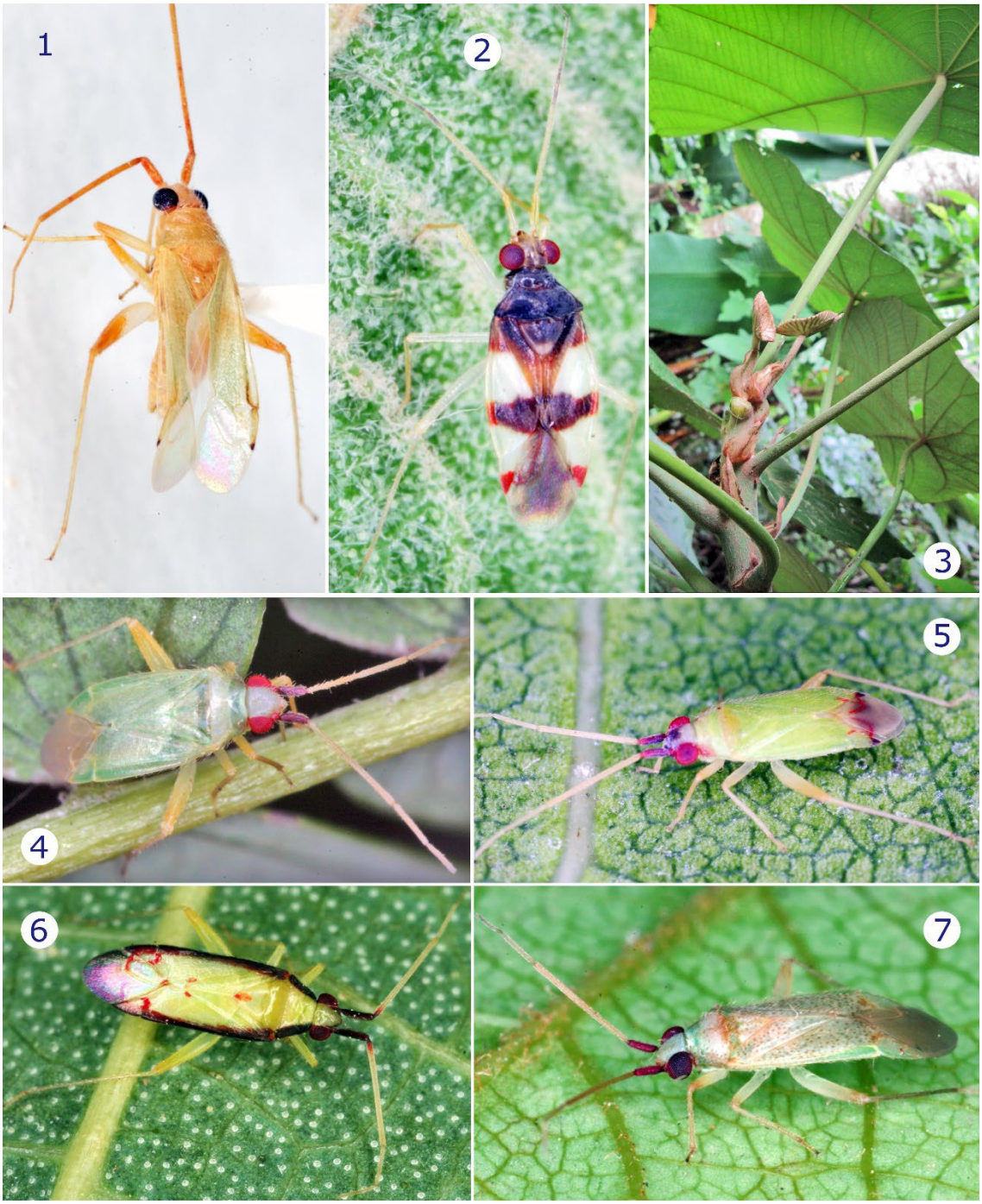
Measurements were made with an ocular micrometer and are given in millimeters; for some of the SEM images, scale bars are shown in micrometers (μm). In the synonymic lists, only selected references are cited for known taxon, as comprehensive catalogs are now available online (Schuh 2002–2013; Aukema, 2018). Terminology of the genitalia principally follows Davis (1955), Schwartz (2011), Yasunaga (1999) and Yasunaga & Duwal (2017, 2021). The following abbreviations are used in the text and figures — Male genitalia (two letters): GP – secondary gonopore; HP – hypophysis (solitary or paired apical spine(s) of parameres); LP – left paramere; PT – phallotheca; RP – right paramere; SB – sensory lobe; SD – seminal duct; SP – spicule. Female genitalia (three letters): DLP – dorsal labiate plate; DOS – dorsal structure; IRL – interramal lobe; IRS – interramal sclerite; SCR – sclerotized ring; VLP – ventral labiate plate.
Scanning electron micrographs were taken with Hitachi Tabletop Microscope® TM3030; Nikon Eclipse-Ci upright microscope with a phase-contrast unit was used to observe and photograph the genitalic structures. For SEM documentation of the male and female genitalic structures, the delicate minute organs were dipped and washed in 60–70% ethyl alcohol after dissection under Olympus SZX-12 binocular stereoscopic microscope, placed on filter paper until dry, carefully attached to cards (ca. 5 x 15 mm) using water soluble wood glue, and finally placed in the TM3030 Tabletop SEM chamber for observation on a Fujitsu Laptop PC (without vapor deposition of metals).

Taxonomy

Exorthotylus gen. nov.

ZooBank taxon LSID:
zoobank.org:act:056DA855-545A-4B7A-97D0-43FF101932C4

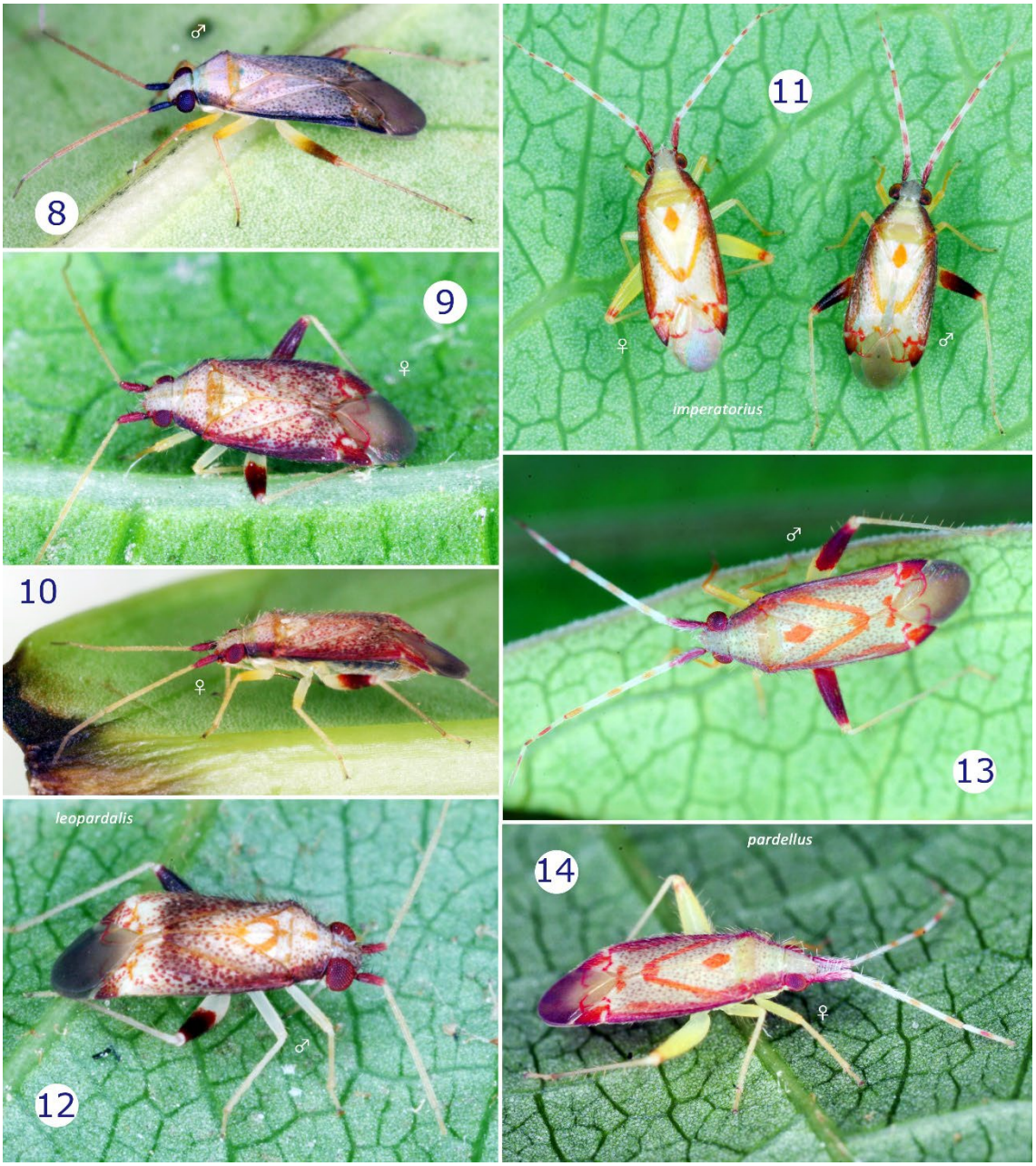
Type species: *Exorthotylus miagao* new species.
Diagnosis. Externally most similar to a certain member (with uniformly pale green basic coloration, cf. Figs 4–7) of *Pseudoloxops* Fieber (see diagnosis below), but the present new genus is distinct in having the following combination of characters: Body almost immaculate, small, parallel-sided; basic coloration pale yellowish green (Figs 1, 15–16); dorsum generally shining; head rounded in front; antenna and legs comparatively long; labium shorter than basal width of pronotum; pronotum narrow, with lateral margin not much oblique; pygophore elongate, tapered towards apex (Fig. 21); right paramere bifurcate, T- or Y-shaped; left paramere stout, with hooked hypophysis (Figs 21–22); vesica (endosoma) only with a single, slender spicule (Fig. 23); sclerotized ring on female genital chamber reduced (Figs 30, 50); interramal sclerite inflated and spinulate ventrally (Figs 29, 54); and interramal lobe elongate, densely covered with comb-like scaly microstructures (*sensu* Yasunaga & Duwal, 2021; Figs 52–54).
Description. Macropterous, elongate, parallel-sided, small-sized (3.5–3.9 mm in total length, 1.0–1.3 mm in maximum width), not sexually dimorphic; dorsal surface generally pale yellow-green, shining, with uniformly distributed, pale, simple, semierect setae (Figs 1, 15, 16). **Head:** Vertical, flattened and weakly rounded anteriorly, with rather densely distributed, simple, upright or semierect setae; eyes large, slightly removed from anterior margin of pronotum. **Antenna:** Slightly shorter than body, generally stout; segment I longer than width of vertex (interocular space); segment II long, almost linear, much longer than width of body (across hemelytra); segments III and IV filiform. **Labium:** Shorter than basal width of pronotum, not surpassing apex of mesocoxa. **Thorax:** Pronotum relatively polished, smooth, narrow, with flattened disk and not much oblique lateral margin; mesoscutum widely exposed, slightly arched; scutellum flat; metathoracic scent efferent system as in Fig. 46, semi-circular, with flat, ear-like peritreme. **Forewing:** Hemelytra generally shining, with



FIGURES 1–7. Habitus images and habitat (3) of Oriental orthotyline plant bugs. 1, *Exorthotylus miagao*, male; 2, *Sarikamiris narakius*, male; 3, same, habitat (*Macaranga grandifolia* abaxial leaves); 4, *Pseudoloxops ayutthaya* Yasunaga & Yamada, female; 5, *P. hibiscus* Yasunaga & Duwal, female; 6, *P. lateralis* (Poppius), male; 7, *P. pericarti* Yasunaga & Yamada, male.

uniformly distributed, simple, semierect setae; membrane with posteriorly rounded, narrow veins. **Legs***:* Relatively long; metatibia more than twice as long as basal pronotal width; tibial spines pale brown, rather sparsely distributed; meta-tarsomere II as long as III; pulvilli weak; parempodia broad, wider than claw (Fig. 48).

Male genitalia: As in Figs 21–23, 49; pygophore elongate, tapered towards apex, with minute spines apically (Figs 21, 49). Parameres



FIGURES 8–14. Habitus images of *Pseudoloxops* spp. 8–10, *P. manjusri* (8, holotype, AMNH_PBI 00380590); 11, *P. imperatorius* (Distant); 12, *P. leopardalis* Yasunaga & Duwal, holotype (00380545); 13, 14, *P. pardellus* Yasunaga & Duwal.

relatively large; right paramere bifurcate, T- or Y-shaped, with apically notched hypophysis (Fig. 22); left paramere stout, with hooked hypophysis (Figs 21–22). Phallotheca widened, with a pointed spine at apex (Fig. 23); vesica (endosoma) only with a single, slender spicule that is sharpened apically; secondary gonopore elongate, triangular.

Female genitalia: As in Figs 28–31, 50–54; genital chamber with reduced sclerotized ring (Figs 30, 50); interramal sclerite ventrally inflated and distinctly spinulate (Figs 29, 54); interramal lobe elongate, densely covered with comb-like scaly microstructures (Figs 52–54).

Etymology. Named for similarity in external appearance to the genus *Orthotylus* Fieber, combined with a prefix ex- (out of), as *Orthotylus*

has a remote relationship to the present new genus; gender masculine.

Discussion. Although the present new genus is at first sight similar to the large Holarctic genus *Orthotylus* Fieber, 1858, a relationship between these two genera is only superficial (cf. Figs 73–75). The genuine *Orthotylus* members are known predominantly from temperate and cold temperate climate zones (Schuh 2002–2013; Aukema 2018).

Judging from similarity in the male and female genitalic structures, *Exorthotylus* is assumed to be most closely related to *Pseudoloxops*. The former can be distinguished from the latter by the characters suggested in diagnosis section above. Nonetheless, the current membership of *Pseudoloxops* seems to include several lineages (cf. Yasunaga & Duwal 2017; Yasunaga & Takai 2017) and requires further generic level reclassification (see below discussion of *Pseudoloxops*).

Exorthotylus miagao sp. nov.

(Figs 1, 15−16, 21−23, 28–31, 43–54)

ZooBank taxon LSID:
zoobank.org:act:F96F6B48-852F-4045-A0FE-D642E8499798

Type material. Holotype: Male, **PHILIPPINES:** Visayas, Panay Island, Miagao, 10.64, 122.20, on a fabaceous broadleaf tree (Mimosoideae), 31 May 1994, T. Yasunaga (DOAT) (AMNH_PBI 00380589). **Paratypes**: **PHILIPPINES:** same data as for holotype, 2♂4♀ (TYCN); same data except for date 1 Jun 1994, 1♂4♀ (TYCN).

Diagnosis. Recognized by its almost uniformly pale yellow-green general coloration, with slightly reddish antenna and apical parts of femora, and narrowly darkened apex of cuneus (Figs 1, 15–16), in addition to the characters mentioned in generic diagnosis.

Description. Body generally pale yellow-green, often faded to brownish in dry-preserved specimens, with antennal segments I and II, and apical part of each femur more or less tinged with red; dorsal vestiture pale, uniformly distributed. Antenna brown; segments I and II partly pale red; segments III and IV about half as thick as II. Labium shiny yellowish brown; apical half of segment IV darkened. Pronotum uniformly pale, not much widened posteriorly; mesoscutum and scutellum shiny; thoracic pleura including scent efferent system uniformly pale. Hemelytron weakly shagreened; apex of cuneus darkened; membrane pale smoky brown, semitransparent, with pale veins. All coxae and legs pale brown; apical part of each femur (apical half of metafemur in particular, cf. Fig. 1) more or less suffused with red. Abdomen shiny pale brown, with lateral margin sometimes narrowly reddish. Other features including male and female genitalia as mentioned in generic description.

Measurements. Male (n=2): Total body length 3.57–3.66; width of head across compound eyes 0.73−0.77; width of vertex (interocular space) 0.30−0.32; lengths of antennal segments I−IV 0.40−0.44, 1.60−1.73, 0.60−0.66, 0.55−0.58; total length of labium 0.85−0.89; basal width of pronotum 0.93−1.02; maximum width across hemelytra 1.09−1.17; and lengths of metafemur, tibia and tarsus 1.35−1.40, 2.08−2.10, 0.36−0.39. Female (n=3): Total body length 3.72–3.83; width of head across compound eyes 0.72−0.74; width of vertex 0.34−0.36; lengths of antennal segments I−IV 0.45−0.47, 1.69−1.76, 0.70−0.75, 0.49−0.57; total length of labium 0.91−0.95; basal width of pronotum 0.99−1.04; maximum width across hemelytra 1.20−1.26; and lengths of metafemur, tibia and tarsus 1.50−1.53, 2.05−2.09, 0.34−0.39.

Etymology. Named for the type locality, Miagao, Panay Island; a noun in apposition.

Distribution. Philippines (Visayas: Panay Island).

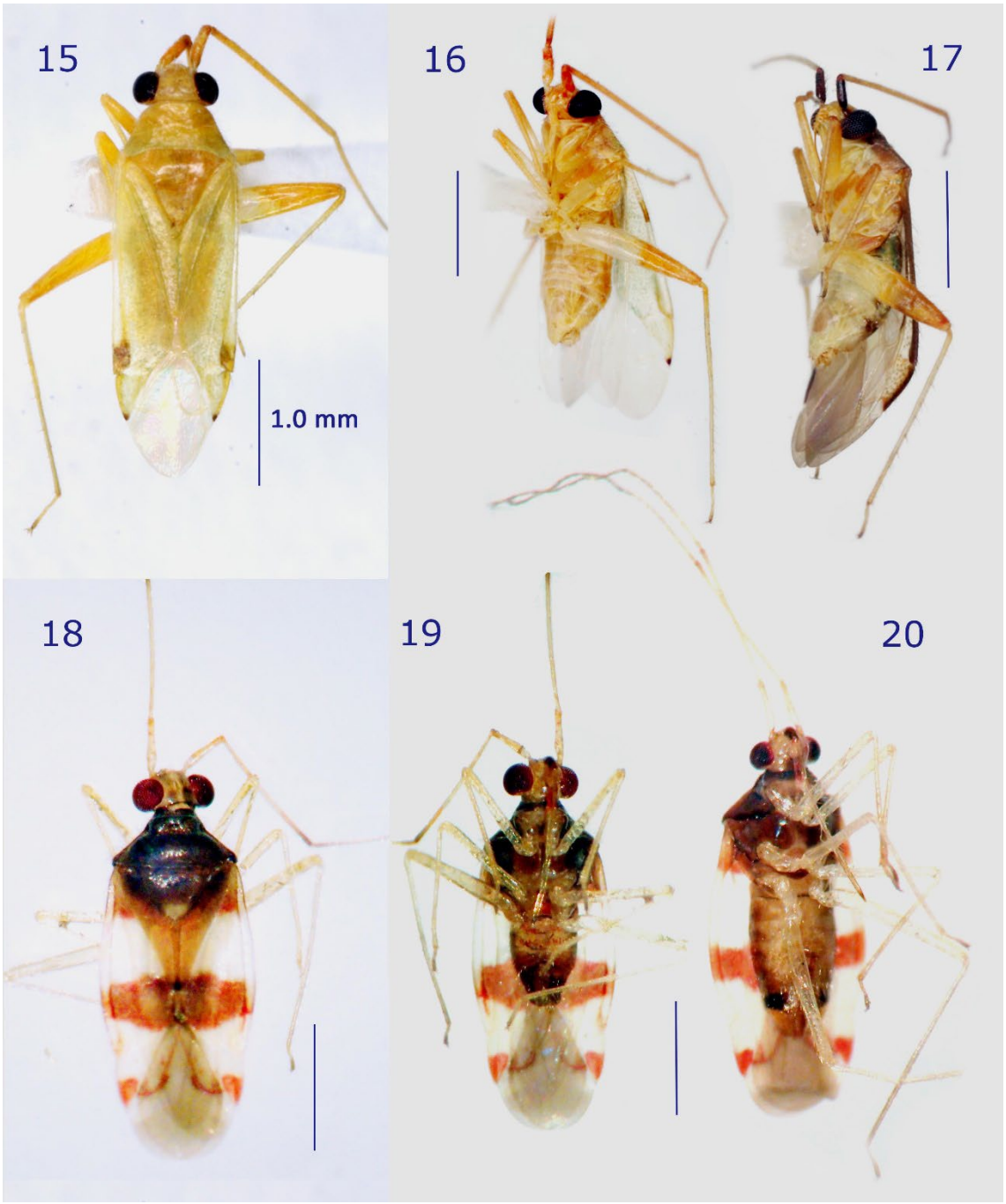
Biology. All known specimens were collected from leaves and branches of a Mimosoideae trees (Fabaceae); however, no other biological information is currently available.

Pseudoloxops Kirkaldy, 1905

Loxops Fieber, 1858: 314 (new genus), type species: *Capsus coccineus* Meyer-Dür, 1843, monotypic (preoccupied by *Loxops* Cabanis, 1847, a honeycreeper genus, Aves: Passeriformes: Fringillidae).

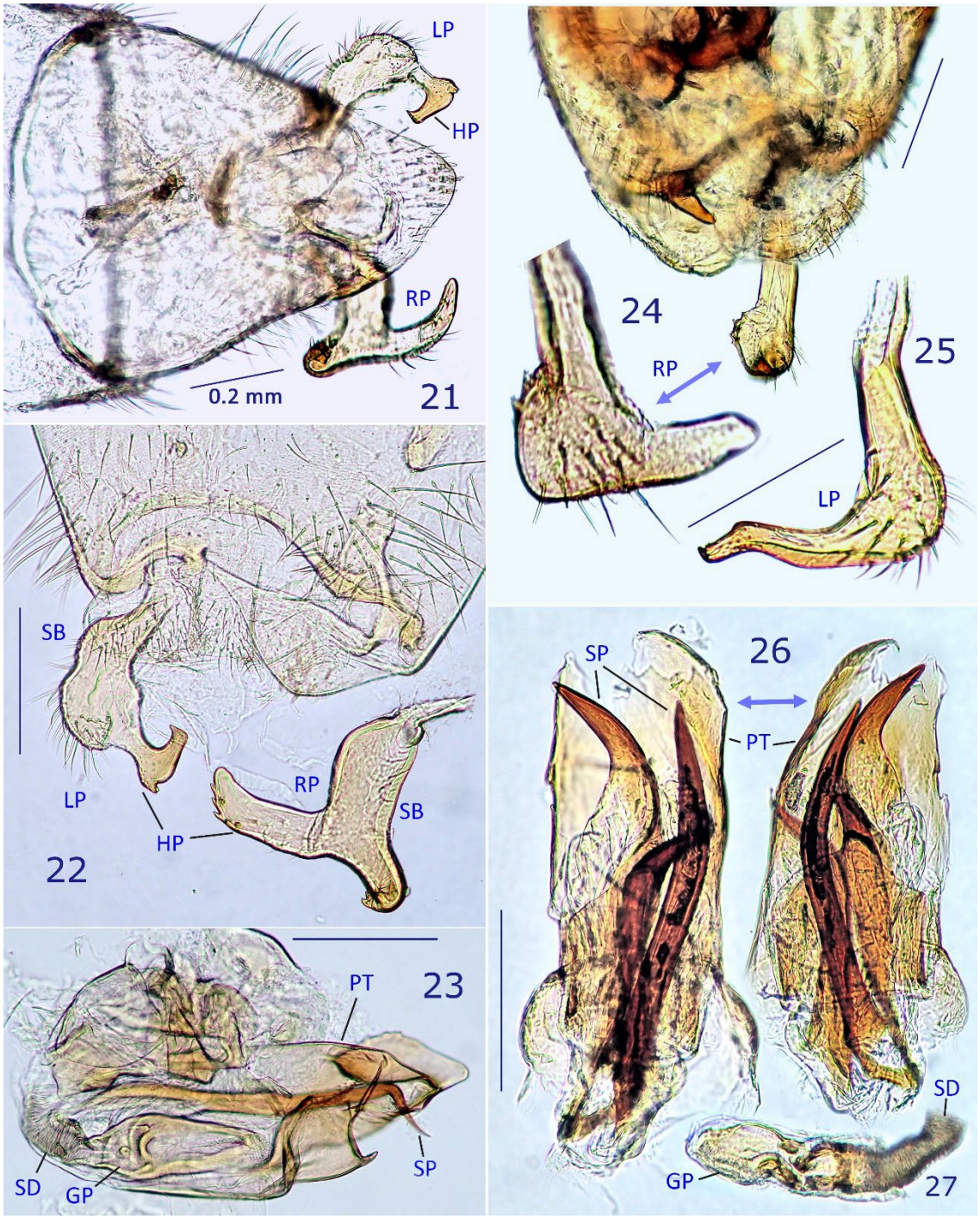
Pseudoloxops Kirkaldy, 1905: 268 (n. name for *Loxops* Fieber); Yasunaga, 1997: 11 (diag.); Yasunaga, 1999: 179 (diag.); Yasunaga *et al.*, 2001 (diag.); Schuh, 2002–2013 (online catalog); Liu & Zheng, 2014: 196 (diag.); Yasunaga & Duwal, 2017: 282 (faunal list); Aukema, 2018 (online catalog).

Discussion. *Pseudoloxops* was proposed for *P. coccineus* (Meyer-Dür, 1843); the species was originally described from Switzerland and is



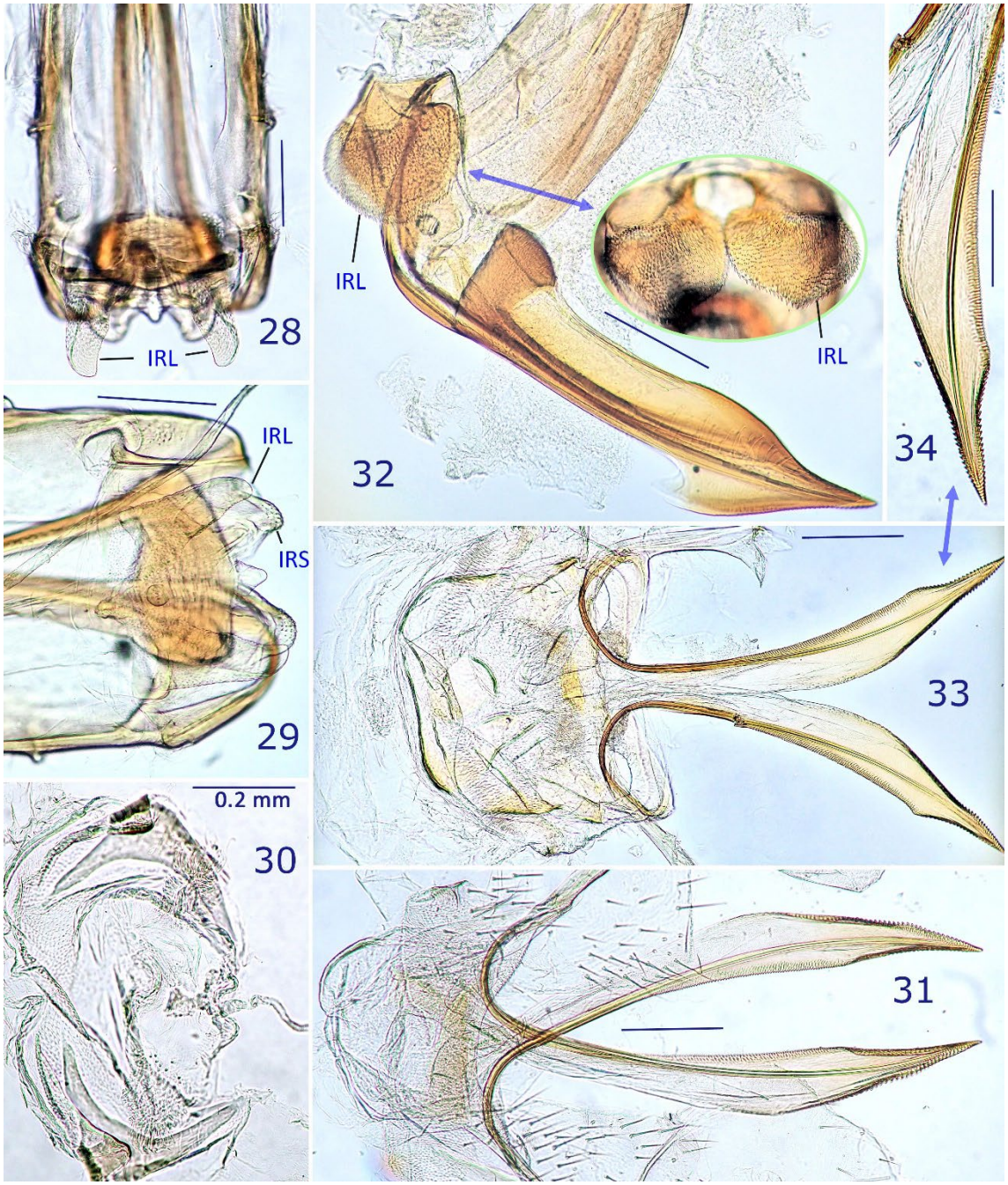
FIGURES 15–20. Habitus images of Oriental orthotylines, dry-preserved specimens. 15, 16, *Exorthotylus miagao*, male; 17, *Pseudoloxops manjusri*, male; 18, 19, *Sarikamiris narakius*, male; 20, same, female. 15 and 18, dorsal view; 16, 17, left lateral view; 19, 20, ventral view. Scale bars 0.1 mm.

now known widely from Europe and N. Africa (Schuh 2002–2013) as well as eastern North America (introduced populations, cf. Wheeler & Henry, 1992). More than 50 species have hitherto been described from the Old World, and the majority of congeners are known from the Indo-Pacific regions, where the genus is considered to have radiated extensively, as a number of undescribed species were confirmed (Balukjian 2013; Hazali 2013; Yasunaga & Duwal 2017). In the Oriental Region including subtropical



FIGURES 21–27. Male genitalia of *Exorthotylus miagao* (21–23) and *Pseudoloxops manjusri* (24–27). 21, Apex of pygophore with parameres, ventral view; 22, same, dorsal view; 23 and 26, vesica (endosoma); 24, apex of pygophore with right paramere, left lateral view; 25, left paramere; 27, secondary gonopore and apical seminal duct. Scale bars 0.2 mm.

climate zones of East and South Asia, *Pseudoloxops* is represented by 22 species (Knigh, 1937; Yasunaga 1999; Yasunaga & Yamada 2009; Liu & Zheng 2014; Yasunaga & Duwal 2017; Yasunaga & Takai 2017). Currently, only three members of the genus, *Pseudoloxops coccineus*, *P. miyamotoi* Yasunaga, 1997 and *P. miyatakei* Miyamoto, 1969 are associated with temperate deciduous forests (cf. Yasunaga *et al*. 2001). A unique new species is herein described



FIGURES 28–34. Female genitalia of *Exorthotylus miagao* (28–31) and *Pseudoloxops manjusri* (32–34). 28, Posterior wall of bursae, dorsal view; 29, same, anterior view; 30, genital chamber, dorsal view; 31, 33, 34, ovipositor (gonapophysis) I; 32, posterior wall and adjacent structures including gonapophysis II, left lateral view. Scale bars 0.2 mm.

from the warm temperate climate zone of Nepal, southern slope of the Himalayas.

Many congeners exhibit two-tone, brilliant yellow-scarlet (sometimes yellow-pink or orange) pattern, and identification of each species is usually performed by the external characters alone. However, the monophyly of *Pseudoloxops* is yet to be elucidated, because of presence of excessive interspecific morphological variation, particularly in the male and female genitalia. For example, the *Pseudoloxops* members in Japan, Taiwan and Thailand are presumed to

comprise at least three subdivisions, based on the diverse genitalic structures (cf. Yasunaga & Duwal 2017; Yasunaga & Takai 2017). Further comprehensive revision is encouraged to correctly redefine monophyletic groups.

***Pseudoloxops manjusri* sp. nov.**
(Figs 8−10, 17, 24–27, 32–34, 55–66)
ZooBank taxon LSID:
zoobank.org:act:DBECD2E1-0AD4-4E3A-B4D8-59BB26BDAF17

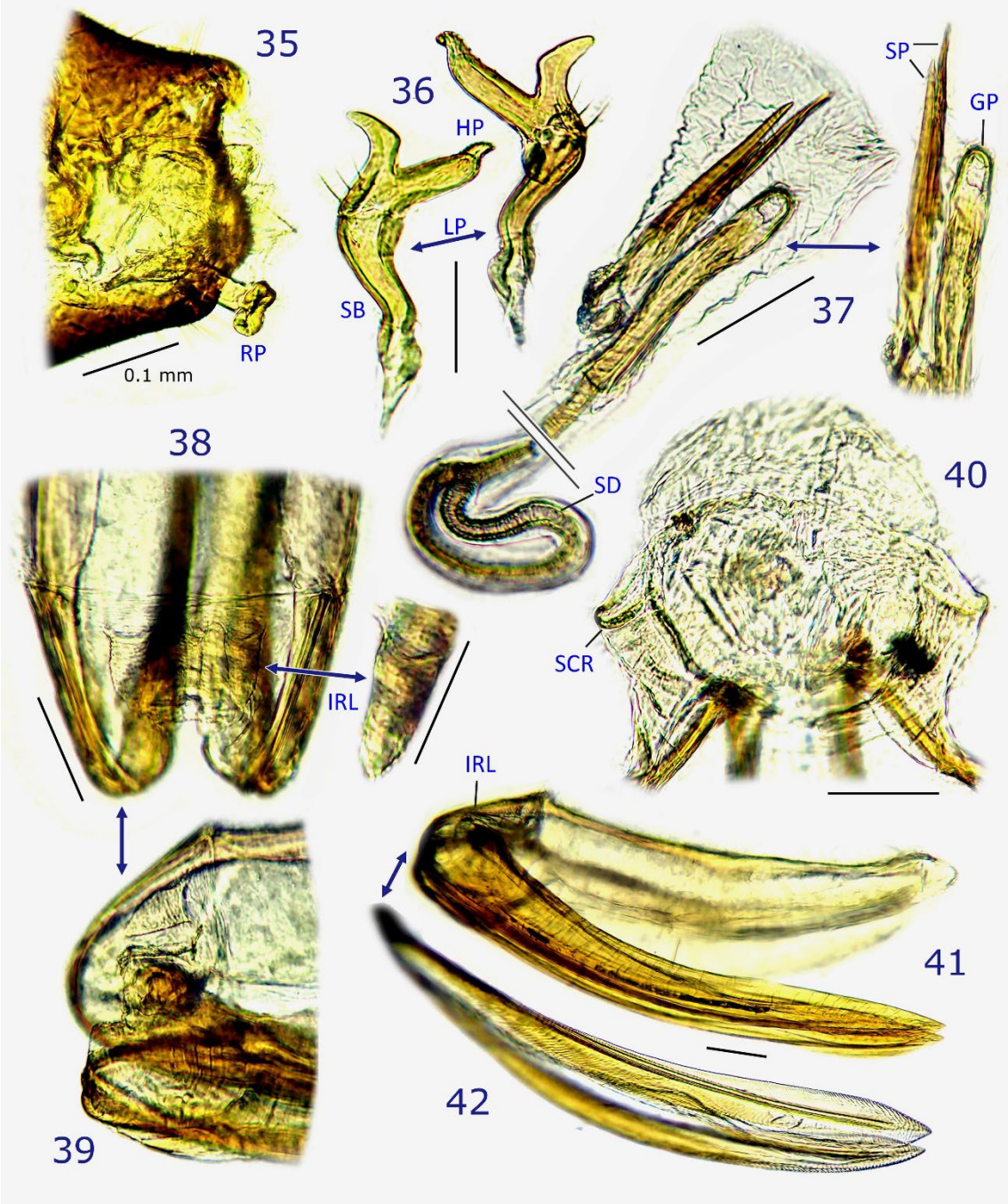
Type material. Holotype: Male, **NEPAL:** Kathmandu, Gongabu-Samakhusi, 27.731175, 85.313253, UV lighting, 21 Jul 2005, T. Yasunaga (AMNH_PBI 00380590) (NMTU). **Paratypes**: **NEPAL:** same data as for holotype, except for date, 20 Jun 2005, 1♀; 27 Jun 2005, 3♀; 30 Jun 2005, 1♀ (AMNH, TYCN); Bhaktapur, Kamerotar, 27.67, 85.39, 4 Oct 2005, R. K. Duwal, 1♂ (CNC).

Diagnosis. Recognized readily by its sexually dimorphic color pattern and unique genitalic structures (e.g. well-developed, stout spiculi on male vesica; remarkably enlarged female interramal lobes). The male of this new species is at first sight similar to *P. lateralis* (Poppius) (Fig. 6), but *P. manjusri* has the whitish or creamy brown dorsum and spotted pattern. The female of *P. manjusri* resembles *P. leopardalis* Yasunaga & Duwal (Fig. 12), from which the present new species can be readily distinguished by the whitish scutellum lacking circular orange macula, and dense reddish pattern on the posterior corium and anterior cuneus. Judging from the similar shape of parameres and heavily sclerotized vesica (endosoma), *P. manjusri* is assumed to be most closely related to *P. leopardalis* (cf. Yasunaga & Duwal 2017).

Description. Male. Body elongate, subparallel-sided; dorsum widely whitish brown, weakly tinged with red, somewhat matte, with narrowly darkened lateral margins across pronotum, exocorium (embolium) and cuneus (Fig. 8); dark small spots present on pronotum, scutellum and hemelytron; dorsal vestiture pale, semierect to upright, almost uniformly distributed. Head whitish brown, rather rounded in front, with a faint, pale orange stripe mesally; eye dark brown. Antenna pale brown; segment I dark brown; segment II slightly longer than width across hemelytra. Labium shiny pale brown, reaching but not exceeding apex of mesocoxa, slightly longer than basal width of pronotum; apical part of segment IV darkened. Pronotum laterally with narrow, dark brown margin and mesally with a faint, pale orange stripe; dark spots on disk faint, sparsely distributed; mesoscutum shiny pale orange brown; scutellum flat, with uniformly distributed, brown, small spots; pleura widely pale brown, weakly shining; propleuron pale reddish brown dorsally (Fig. 17); metathoracic scent efferent system relatively narrow, with small peritreme (Fig. 58). Hemelytron widely whitish brown, with uniformly distributed, brown, small spots; exocorium and lateral margin of cuneus dark brown; anterior margin of cuneus narrowly suffused with red; membrane smoky brown, with partly reddish veins. Coxae and legs pale brown, except for basal part of metacoxa tinged with red; apical part of each femur yellowish in fresh specimens; apical half of metafemur tinged with red; meta-tarsomere II about as long as III (Fig. 59); pretarsal structure as in Fig. 60. Abdomen pale brown, with reddish brown stripes laterally (Fig. 17). Genitalia: As in Figs 24–27, 61; pygophore with a noticeable spine at base of left paramere (Fig. 24); left paramere C-shaped, with narrow sensory lobe and small, apically hooked hypophysis (Fig. 25); vesica (endosoma) heavily sclerotized, with three stout spiculi (Fig. 26).

Female: Basic structures similar to those of males. Body ovoid, slightly elongate, similar in basic coloration but dark brown parts (including stripes and spots) in male becoming red-scarlet as in Figs 9–10; dorsal spots densely distributed on corium. Head and pronotum with a faint, red stripe; eye reddish brown. Cuneus widely sanguineous, anteriorly speckled with creamy brown spots (Fig. 9). **Genitalia:** As in Figs 32–34, 62–66; posterior wall with remarkably developed, enlarged interramal lobes that are covered with sharp micro-spines (Figs 32, 64–66); sclerotized ring reduced, indistinct (Figs 33, 62); ovipositors (gonapophyses I and II) broad (Figs 32–34, 63).

Measurements. Male (n=2): Total body length 3.28–3.43; width of head across compound eyes 0.66−0.69; width of vertex (interocular space) 0.25−0.27; lengths of antennal segments I−IV 0.30−0.32, 1.36−1.49, 0.45−0.50, 0.33−0.42; total length of labium 1.05−1.11; basal width of pronotum 0.87−1.01; maximum width across hemelytra 1.18−1.26; and lengths of metafemur, tibia and tarsus 1.20−1.23, 1.68−1.74, 0.30−0.32. Female (n=3): Total body length 3.33–3.46; width of head across compound eyes 0.63−0.65;



FIGURES 35–42. Male (35–37) and female (38–42) genitalia of *Sarikamiris narakius*. 35, Apical part of pygophore with right paramere, in ventral view; 36, left paramere; 37, vesica (endosoma); 38, posterior wall, anterior view; 39, same, left dorsolateral view; 40, genital chamber, dorsal view; 41, ovipositor (gonapophysis) II; 42, ovipositor (gonapophysis) I. Scale bars 0.1 mm.

width of vertex 0.31−0.34; lengths of antennal segments I−IV 0.33−0.35, 1.26−1.37, 0.52−0.56, 0.34−0.36; total length of labium 1.05−1.08; basal width of pronotum 1.02−1.04; maximum width across hemelytra 1.32−1.35; and lengths of metafemur, tibia and tarsus 1.20−1.22, 1.75−1.77, 0.33−0.35.

Etymology. Named for a bodhisattva, Manjusri (or Manjushri in Sanskrit), symbolizing wisdom in Buddhism and believed (as a myth) to have made pilgrimage to the Kathmandu Valley, the

type locality of this new species; a noun in apposition.

Distribution. Nepal (Kathmandu Valley).

Biology. Unknown; all available individuals were collected by UV-lighting at night. Collection records suggest that this new species has a bivoltine life cycle.

***Sarikamiris* gen. nov.**

ZooBank taxon LSID:
zoobank.org:act:B9D075DF-8F51-42BA-B2E4-95C0C5FD1E09

Type species: *Sarikamiris narakius* new species.

Diagnosis. Distinguished from other genera of the subfamily Orthotylinae primarily by the following unique characters: Ovoid, flat body shape (Figs 2, 18–20); large eyes contiguous to cog-like anterior margin of pronotum (Figs 2, 18); generally long antenna with extremely elongate segment IV (cf. Fig. 20); rows of deep punctures on pronotum and propleuron (Fig. 68); notched margins of scutellum (Fig. 68); relatively enlarged, Y-shaped left paramere (Fig. 36); two slender, straight endosomal spiculi without indentation (Fig. 37); discoid, almost membranous female genital chamber (Fig. 40); and small, elongate interramal lobe on posterior wall (Fig. 39).

Externally most similar to New Guinean genera, *Jimia* and *Neoloxops*, proposed by Carvalho (1987). However, the present new genus can be distinguished from them by the following diagnostic characters: Head somewhat porrect, with produced clypeus; generally longer antenna; very long antennal segment IV that is longer than basal width of pronotum; pronotum distinctly narrowed or constricted at calli, with rows of deep punctures demarcating border of calli and disk (Figs 67–68); Y-shaped left paramere (Fig. 36); bifurcate, C-shaped hypophysis of right paramere (Fig. 35); and larger endosoma with two distinct spiculi (Fig. 37).

Description. Macropterous, oval, flat, small-sized (2.7–3.1 mm in total length, 1.0–1.3 mm in maximum width); dorsal surface shining, smooth, with sparsely distributed, simple, upright setae (Figs 2, 68). **Head:** Somewhat porrect anteriorly, with sparsely distributed, simple, upright setae; eyes large (particularly in male), contiguous to anterior margin of pronotum; clypeus produced (Fig. 67). **Antenna:** Longer than body, generally slender and linear (Fig. 20); segment I constricted basally, tapered towards apex; each of segment II and IV longer than basal width of pronotum; segments III and IV filiform, elongate; segment IV about as long as or longer than II. **Labium:** Long, generally slender, slightly exceeding apex of metacoxa (Figs 19–20); apex of segment I reaching thorax. **Thorax:** Pronotum polished, impunctate, constricted at calli, with inflated disk, arranging rows of deep punctures along posterior margin of calli, with antero-dorsal margin cog-like; lateral margin of scutellum irregularly notched; propleuron deeply wrinkled, with a row of deep punctures at anterior 1/3 part; pleura with distinct scent efferent system with subtriangular, evaporative areas and slit-like, narrow accessory evaporatorium (sensu Yasunaga & Duwal 2019). **Forewing:** Hemelytra shining, impunctate, flat, with rounded lateral margin; membrane with posteriorly rounded, rather narrow areolar cells (Fig. 2). **Legs:** Relatively long, slender; metafemur subequal in length to antennal segment IV; metatibia with several rows of minute serrations (Fig. 69); tarsomere III longer than I or II (Figs 70–71); pretarsal structure as in Fig.72; pulvilli weak; parempodia broadened, rather flat, apically convergent or overlapped, curled inward. **Abdomen:** Much shorter and narrower than wings, bullet-shaped distally (Figs 19–20).

Male genitalia: As in Figs 35–37, 69; Pygophore simple in form, with somewhat truncated apex, not indented (Figs 35, 69); right paramere with C-shaped, curled hypophysis; left paramere Y-shaped, with a flat protuberance at apical sensory lobe and minutely notched hypophysis (Fig. 36); vesica (endosoma) with developed membranous lobe and two straight, smooth spiculi (Fig. 37); secondary gonopore as in typical Orthotylini, narrow-rimmed, situated at distal end of primary lobe.

Female genitalia: As in Figs 38–42; posterior wall simple, with elongate, narrow interramal lobes (Figs 38–39); genital chamber symmetric, discoid, almost membranous, with incomplete, U-shaped, narrow-rimmed sclerotized rings (Fig. 40); ovipositors (gonapophyses I and II) rather rounded and not sword-like apically (Figs 41–42).

Etymology. Named for the type locality, Sarika in Nakhon Nayok Province, Thailand, combined with the mirid generic name *Miris* F.; gender masculine.

Discussion. The present new genus is well-defined by the above diagnostic characters. Nonetheless, some unique features are not commonly

found in any other orthotylines (e.g., ovoid, flat body shape; long, slender antenna with extremely elongate segment IV; cog-like anterior margin of pronotum; rows of deep punctures on pronotum and propleuron; and notched margins of scutellum).

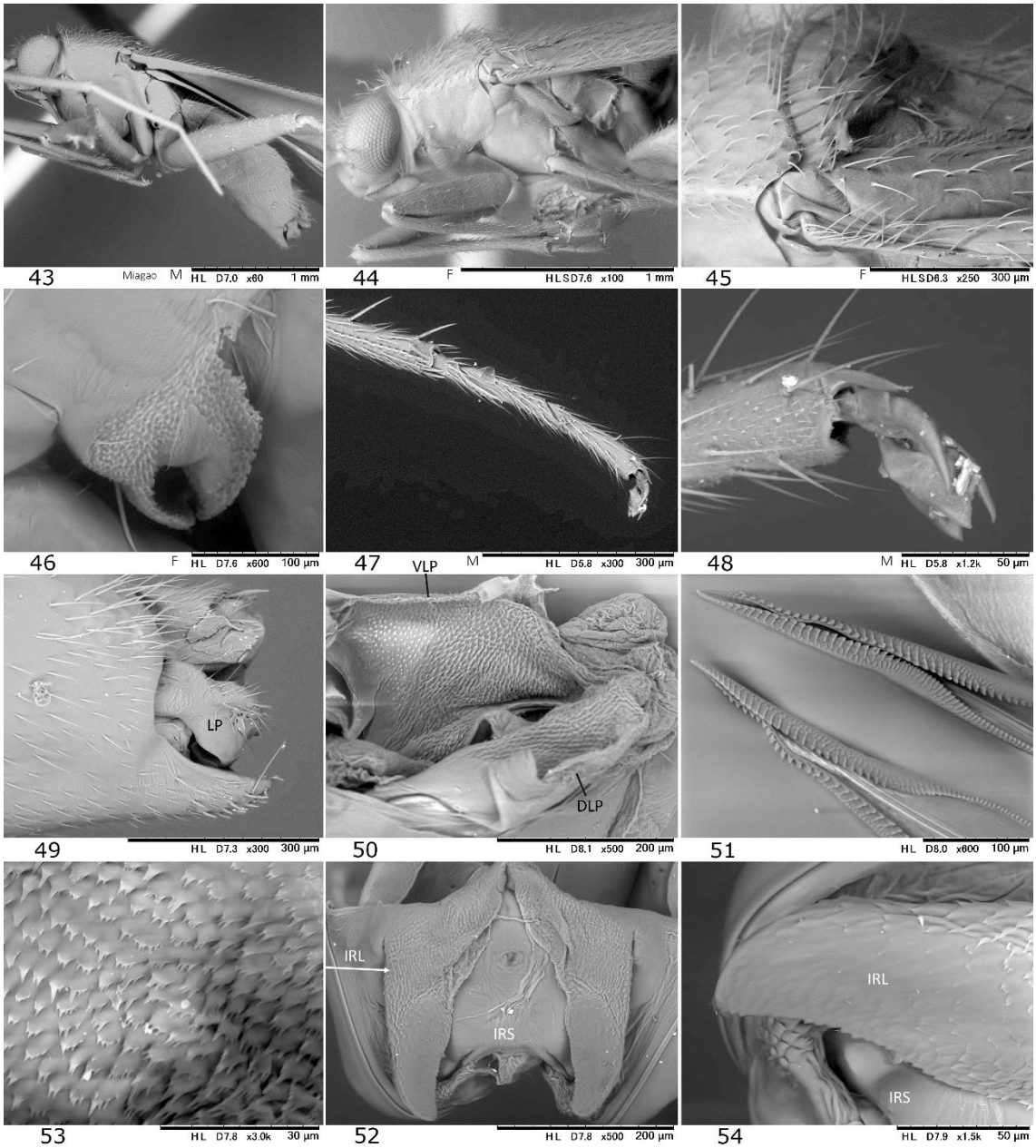
Carvalho (1987) described *Jimia bimaculata* and *Neoloxops rubrosignatus* from Papua New Guinea as new genera and new species; he placed these taxa in the Orthotylini. Based on the original descriptions and illustrations, *Jimia* and *Neoloxops* are most similar in external appearance to *Sarikamiris* as they share the following characters: similarly ovoid, flat body form; small size; whitish basic coloration with dark or reddish stripes on dorsum; large eyes contiguous to anterior margin of pronotum; long, filiform antennal segments III and IV; and notched margin of scutellum. But *Sarikamiris* is unequivocally separated from these New Guinean genera by the characters mentioned in above generic diagnosis.

Liu & Zheng (2014) recognized eight genera of the Orthotylinae in the southern (warm temperate) continental China, adjacent to the Indochina. Nevertheless, none of known Chinese genera exhibits affinity and shares apomorphy with *Sarikamiris*. Therefore, we currently posit that *Sarikamiris*, along with *Jimia* and *Neoloxops*, may represent a tropical element restricted to the Oriental-Australian regions across the Wallacea (for concept of this zoogeographical realm, see Ali & Heaney 2021).

It seems inappropriate to classify several thermophilic (subtropical or tropical) elements into Orthotylini, as these taxa equally do not have some of most distinctive characters for the tribe (e.g., reduced pronotal collar; enlarged parameres (cf. Figs 75, 79); notched or serrate endosomal sclerites; well-sclerotized interramal lobes on posterior wall). It is our opinion that at least *Sarikamiris* is currently assumed to have closer relationship to the *Pseudoloxops*-group rather than the typical orthotylines or *Zanchius*-group, judging from the following characters shared by our new genus and species currently placed in *Pseudoloxops*: flattened dorsal body form, with narrow, short abdomen (Figs 19–20); enlarged eyes (particularly in male, cf. Fig. 19); shiny, less-punctate pronotum and hemelytron with simple, silky, upright vestiture (Figs 2, 68); long, slender antennae and legs; rather delicate forewing often with clear reddish pattern; pygophore narrowed apically, with small-sized parameres (Figs 35–36); small endosoma with two spiculi that are not serrate (Fig. 37); and weakly sclerotized female genital chamber (Fig. 40). In addition, we observed the type species of *Sarikamiris* inhabiting abaxial leaves of *Macaranga* trees at the type locality; the habitat preference (as well as the motion of live adults) is similar to those of some *Zanchius* species (see biology below).

Incidentally, the external appearance of *Sarikamiris* is reminiscent of a certain species of Eccritotarsini (Bryocorinae) (e.g., species of *Michailocoris* Štys) rather than an orthotyline, and we at first thought this new taxon was an eccritotarsine mirid (cf. Figs 85–87). Namyatova *et al.* (2016) suggested some apomorphies that may support the monophyly of the Eccritotarsini, such as metathoracic gland evaporative area reduced to a narrow falciform area (Fig. 85); bothrium deeply recessed and tuberculate; large pulvilli with pulvillar combs at pretarsus (Figs 86–87); pseudopulvilli absent; right paramere equal to or larger than left paramere; and vestibulum large and asymmetrical. Stonedahl (1988) also listed additional synapomorphies: asymmetrical parempodia; reduced metathoracic scent efferent system with a reduced ostiolar canal; and male genitalia with strongly developed endosomal sclerite and small distal membranous region (see also Yasunaga & Ishikawa 2016). These apomorphic characters inferred for the Eccritotarsini are not possessed by *Sarikamiris*, which has the following characters different clearly from those of any eccritotarsine mirid: large eyes and anteriorly projected clypeus (Fig. 67); uniformly slender (not partly broadened) tarsus with fleshy, apically convergent parempodia and small pulvilli (Figs 72–73); presence of distinct scent efferent system and slit-like, narrow accessory evaporatorium sensu Yasunaga & Duwal (2019) (Fig. 69); simple form of pygophore without distal indentation (Fig. 35); developed left paramere (Fig. 36); narrow-rimmed secondary gonopore situated at apex of endosomal primary lobe (Fig. 37); symmetrical, discoid female genital chamber (Fig. 40); and elongate, narrow interramal lobes (Fig. 38).

As mentioned above, Carvalho (1983) described *Adfalconisca javanica* from Java as new taxa in the Orthotylini. However, this Indonesian mirid in all likelihood belongs to the Eccritotarsini (presumably most similar to *Ernestinus*, cf. Fig. 85; see also Yasunaga & Ishikawa 2016), based on the uniformly punctate dorsum and

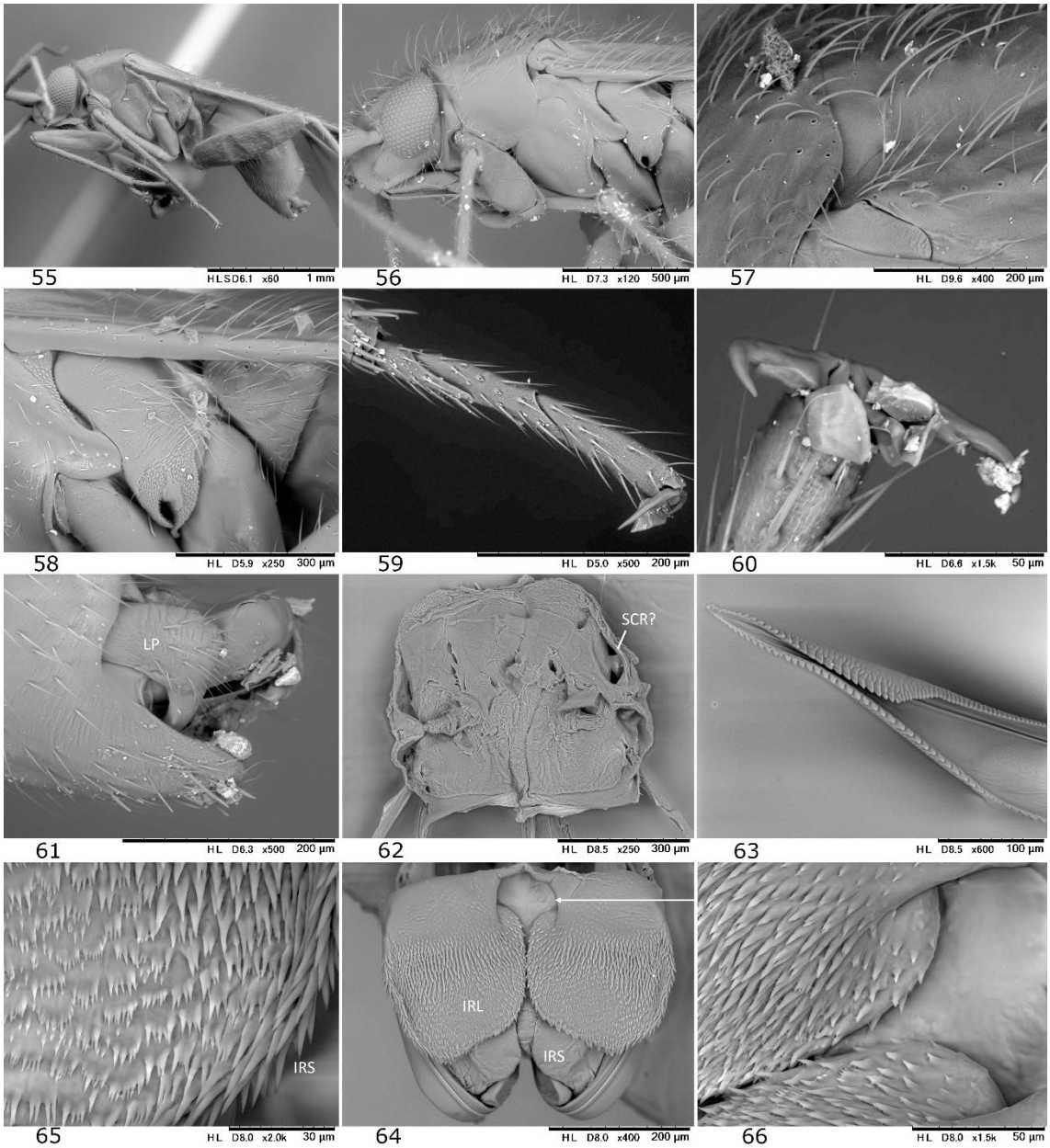


FIGURES 43–54. Scanning electron micrographs of *Exorthotylus miagao*. 43, Left lateral habitus; 44, ditto, anterior body; 45, dorsal surface of pronotum, scutellum and anterior hemelytron; 46, metathoracic scent efferent system; 47, metatarsus; 48, same, pretarsal structure; 49, pygophore, left lateral view; 50, genital chamber, dorsal view; 51, ovipositor (gonapophysis) I; 52, posterior wall; 53, 54, interramal lobe.

shape of the male genitalia shown in the original description and illustrations by Carvalho (1983). Such clearly punctate pronotum is not possessed by any known taxa in Orthotylini.

***Sarikamiris narakius* sp. nov.**
(Figs 2−3, 18−20, 35−42, 67–72, 84)
ZooBank taxon LSID:
zoobank.org:act:B687B596-E1DA-4558-A1F4-AF234CE5B3BA

Type material. Holotype: Male, **THAILAND:** Nakhon Nayok Prov., Sarika near Sarika Waterfall, 14.3040, 101.2588, from Macaranga leaves, 17–18 Jun 2009, T. Yasunaga and K. Yamada (DOAT) (AMNH_PBI 00380588). **Paratypes**.

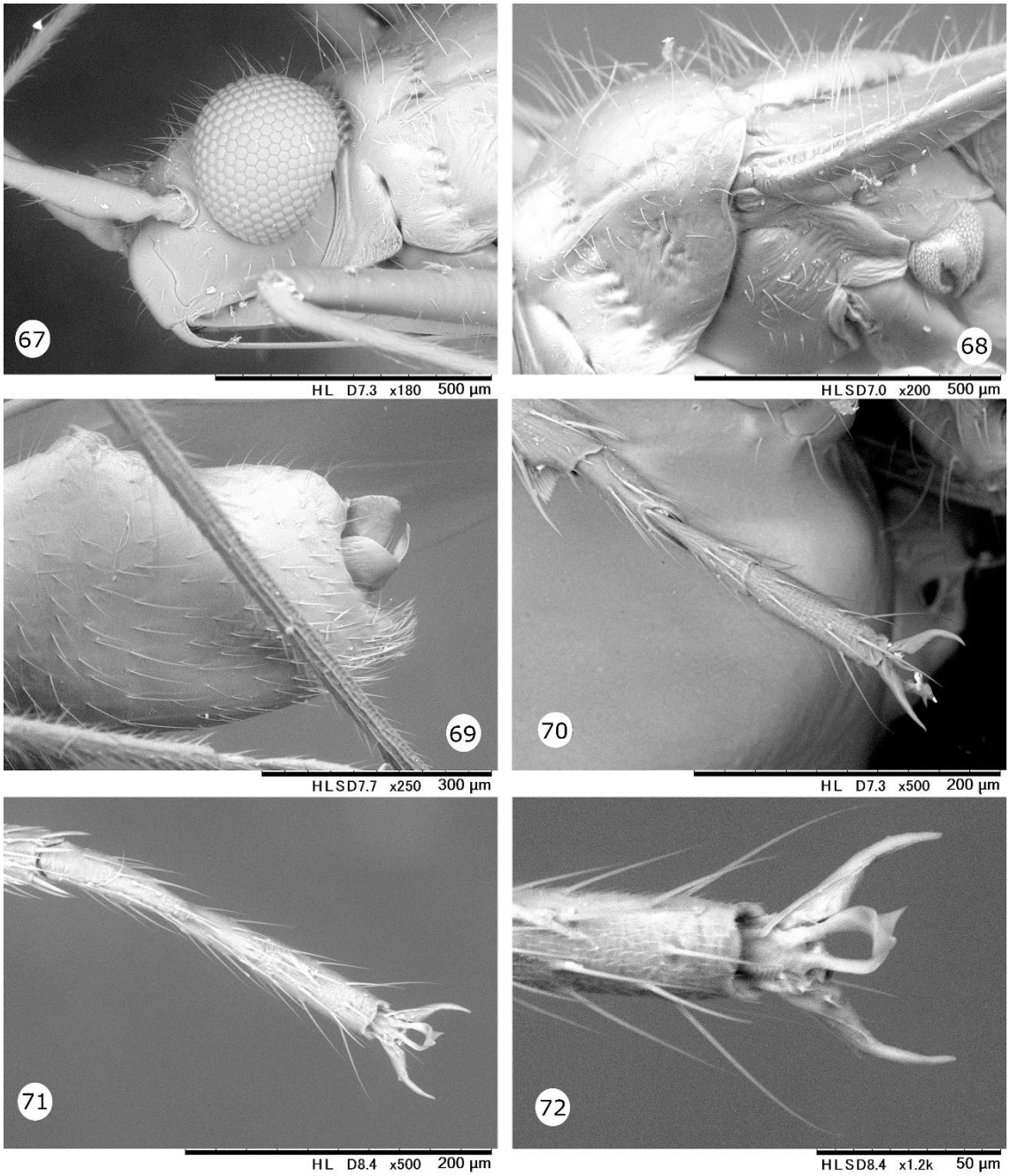


FIGURES 55–66. Scanning electron micrographs of *Pseudoloxops manjusri*. 55, Left lateral habitus; 56, ditto, anterior body; 57, dorsal surface of pronotum, scutellum and anterior hemelytron; 58, anterior thorax with scent efferent system; 59, metatarsus; 60, same, pretarsal structure; 61, pygophore, left lateral view; 62, genital chamber, dorsal view; 63, apex of ovipositor (gonapophysis) I; 64, posterior wall; 65, 66, interramal lobe.

THAILAND, same data as for holotype, 1♂1♀ (TYCN).

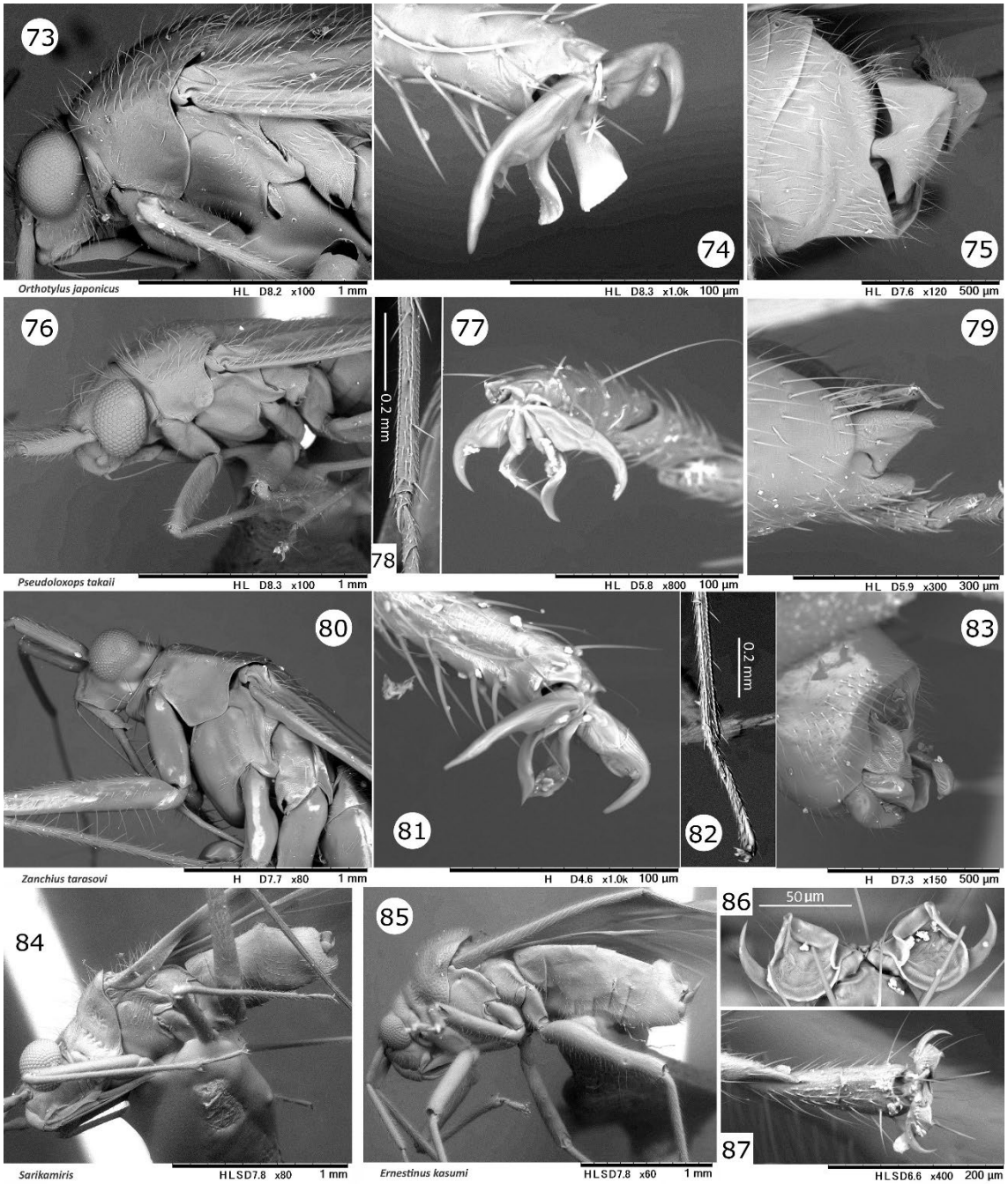
Diagnosis. Recognized readily by its conspicuous white-red pattern on dorsum (Figs 2, 18), ovoid shape reminiscent of a certain eccritotarsine taxon, and long antenna that is much longer body. Most similar in small size, general shape and colour pattern to *Neoloxops rubrosignatus* Carvalho, 1987 (known from Papua New Guinea); this new species can be readily distinguished by the characters mentioned in above generic discussion.

Description. Basic coloration shiny fuscous; dorsal surface shining, with a single type of pale vestiture; pure white parts of antennae, hemelytron and legs (Fig. 2) faded to pale yellow-brown in dry-preserved specimen (Figs 18–20). Head



FIGURES 67–72. Scanning electron micrographs of *Sarikamiris narakius*, holotype male. 67, Head, left lateral view; 68, thorax, left lateral view; 69, genital segment (with metatibia); 70, protarsus; 71, metatarsus; 72, same, pretarsal structure.

grayish brown, partly matte; vertex with a narrow, somewhat elongate depression medially, in dorsal view almost equal in width to an eye (male)/ 1.8 times as wide as an eye (female). Antenna white when alive; segment I tinged with yellow; apex of segment II, and whole segments III and IV dark brown. Labium pale reddish brown; apex of segment IV infuscate. Pronotum shiny chocolate brown, with a longitudinal, mesal depression between calli; pleura shiny fuscous; scent efferent system grayish yellow; mesoscutum fuscous, narrowly exposed; scutellum reddish dark brown, with creamy yellow apical 1/3, impunctate, produced at middle. Hemelytra pure white (faded to yellowish in dry-



FIGURES 73–87. Scanning electron micrographs of *Orthotylus japonicus* Yasunaga (73–75), *Pseudoloxops takaii* Yasunaga (76–79), *Zanchius tarasovi* Kerzhner (80–83), *Sarikamiris narakius*, holotype male (84) and *Ernestinus kasumi* Yasunaga & Ishikawa (85–87) (Bryocorinae: Eccritotarsini). 73, 76, 80, 84, Left lateral view of body; 74, 77, 81, 86, 87, pretarsal structure (metaleg); 78, 82, apical part of metatibia; 75, 79, 83, male genital segment.

preserved specimen), shining, with two sanguineous, noticeable bands (one across anterior exocorium, corium, clavus and scutellum, and the other across middle exocorium and corium); clavus wholly reddish, with orange posterior part; apical 1/3 of cuneus rouge; membrane pale smoky brown, with broadly semitransparent posterior margin and with sanguineous veins. Coxae and legs whitish brown; femora pure white when alive; pro- and mesotibiae tinged with yellow; all tarsi pale brown, except for each tarsomere III slightly darkened. Abdomen shiny

chocolate brown; ventral median part (sternites II–VIII) yellowish in both sexes (Figs 19–20). Other features including male and female genitalia as mentioned in generic description.

Measurements. Male (n=2): Total body length 2.74–2.90; width of head across compound eyes 0.60−0.62; width of vertex (interocular space) 0.21−0.23; lengths of antennal segments I−IV 0.42−0.44, 1.05−1.16, 0.67−0.72, 1.09−1.20; total length of labium 1.21−1.23; mesal length of pronotum 0.45−0.47; basal width of pronotum 0.90−0.92; maximum width across hemelytra 1.06−1.08; and lengths of metafemur, tibia and tarsus 1.17−1.20, 1.65−1.74, 0.24−0.26. Female (n=1): Total body length 3.09; width of head across compound eyes 0.57; width of vertex 0.27; lengths of antennal segments I−IV 0.44, 1.17, 0.83, 1.17; total length of labium 1.38; mesal length of pronotum 0.48; basal width of pronotum 0.99; maximum width across hemelytra 1.29; and lengths of metafemur, tibia and tarsus 1.22, 1.65, 0.24.

Etymology. From a Thai word, 'Narak' (= pretty, cute), referring to the noticeable white-red color pattern of this new species; Latinized as an adjective.

Distribution. Thailand (Nakhon Nayok).

Biology. The present new species was observed to have inhabited abaxial leaves of *Macaranga* sp. (identical to *M. grandifolia*, Euphorbiaceae; Fig. 3) along a mountain stream along deep forest in Nakhon Nayok Province, central Thailand, with several other plant bug species, *Zanchius* spp. (currently Orthotylini) and *Pilophorus saovapruki* Yasunaga, Yamada & Artchawakom, 2014 (Phylinae: Pilophorini), and an unidentified, small leafhoppers (Auchenorrhincha: Cicadellidae: Typhlocybinae). In Indochina and Japanese Ryukyu islands, *Zanchius* species were frequently found to inhabit the abaxial leaves of *Macaranga* spp., *Mallotus* spp. (Euphorbiaceae) or teak, *Tectona grandis* L.f. (Lamiaceae), where homopteran leafhoppers and/or whiteflies usually co-occurred. Some species of *Zanchius* and *Pilophorus* are presumed to prey on these homopterans (Yasunaga 1999; Yasunaga *et al.* 2001, 2014, 2021; Yasunaga and Yamada pers. obs.). However, the exact breeding host plant of *Sarikamiris narakius* is yet to be confirmed.

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