

RESEARCH PAPER

Review of the plant bug genus *Prolygus* and related mirine taxa from eastern Asia (Hemiptera: Heteroptera: Miridae)

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Abstract. The mirine plant bug genus *Prolygus* Carvalho, 1987 (Hemiptera: Heteroptera: Miridae: Mirinae: Mirini) and superficially reminiscent taxa in eastern Asia (mainly in Japan, P. R. China and Taiwan) are reviewed. Four species in the region are now assigned to *Prolygus*. Three new genera, *Anthophilolygus* gen. nov., *Miyamotolygus* gen. nov. and *Poppiolygus* gen. nov., are proposed to accommodate *Prolygus bakeri* (Poppius, 1915), *Neolygus rufilorum* (Lu & Zheng, 2004) and *Lygus bengalicus* Reuter, 1885, respectively. Ten new combinations and three new synonymies are established: *Apolygopsis eoa* (Poppius, 1915) comb. nov. [transferred from *Apolygus* China, 1941]; *A. fuhoshoensis* (Poppius, 1915) comb. nov. [*Apolygus*]; *A. nigra* (Poppius, 1915) comb. nov. [*Prolygus*]; *Anthophilolygus bakeri* (Poppius, 1915) comb. nov. [*Prolygus*] = *P. tainanensis* (Poppius, 1915) syn. nov.; *Micromimetes rubrotinctus* (Carvalho, 1956) comb. nov. [*Lygus sensu lato*]; *Miyamotolygus bui* (Lu & Zheng, 2004) comb. nov. [*Neolygus* Knight, 1917]; *M. pictus* (Lu & Zheng, 2004) comb. nov. [*Neolygus*]; *M. rufilorum* (Lu & Zheng, 2004) comb. nov. [*Neolygus*]; *Poppiolygus bengalicus* (Reuter, 1885) comb. nov. [*Lygus sensu lato*] = *Prolygus kirkaldyi* (Poppius, 1915) syn. nov.; *Prolygus disciger* (Poppius, 1915) comb. nov. [*Neolygus*]; *P. palauensis* (Carvalho, 1956) comb. nov. [*Lygus sensu lato*]; *P. nigriclavus* (Poppius, 1915) = *Neolygus nigroscutellaris* (Lu & Zheng, 2004) syn. nov. Two additional new species, *Anthophilolygus alaneylesi* sp. nov. (central Thailand) and *Micromimetes sunweni* sp. nov. (Lanyu Island, Taiwan), are also described. The lectotype is designated for *Lygus bengalicus* Reuter. *Lygus sacchari* Matsumura, 1910 is regarded as *nomen dubium*.

Key words. Hemiptera, Heteroptera, Miridae, *Prolygus*, new genus, new species, new combination, new synonymy, lectotype designation, eastern Asia, Oriental Region, Palaearctic Region

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Introduction

For 200 years many mirine plant bugs were described or placed in the inadequately defined genus *Lygus* Hahn, 1833 *sensu lato* (cf. POPPIUS 1914, CARVALHO 1956, SCHWARTZ & FOOTITT 1998); currently quite a few species remain in *Lygus* as *incertae sedis* (SCHUH 2013). For Asian taxa, recent workers have verified the proper identities of some of these taxa (e.g., SCHWARTZ & KERZHNER 1997,

LU & ZHENG 1998, YASUNAGA et al. 2002, SCHWARTZ & CHÉROT 2005). However, further investigation is required to define concepts for genera and species remaining in *Lygus sensu lato*. The present paper continues our serial attempt to clarify the taxa assigned to the *Lygus*-complex and comprehensively review the genus *Prolygus* Carvalho, 1987 and related taxa mainly in eastern Asia as well as the adjacent regions of Indo-Pacific.



Prolygus was proposed by CARVALHO (1987) with *Lygus* [*sensu lato*] *papuanus* Poppius, 1915 as the type species. CARVALHO (1987) described eleven new species and transferred five additional species of *Lygus* [*sensu lato*] to *Prolygus*; all of those taxa were known only from Papua New Guinea. Subsequently, SCHWARTZ & KERZHNER (1997) placed four Taiwanese species in *Prolygus*, including two (*L. kirkaldyi* Poppius, 1915 and *L. nigriclavus* Poppius, 1915) that MIYAMOTO (1975) had regarded as members of *Dagbertus* Distant, 1904. As a result, twenty-one species were assigned to *Prolygus*. Nonetheless, the placement of quite a few species in *Prolygus* require critical assessment to verify their exact status.

Five species are currently known from eastern Asia (warm temperate and subtropical climate zones in Japan, P. R. China and Taiwan): *Prolygus bakeri* (Poppius, 1915), *P. kirkaldyi*, *P. niger* (Poppius, 1915), *P. nigriclavus* and *P. tainanensis* (Poppius, 1915); only *P. bakeri* and *P. kirkaldyi* are documented from SW Japan (YASUNAGA 2001, YASUNAGA & TAKAI 2014), and ZHENG et al. (2004) reported *P. kirkaldyi* from SE continental China. However, our investigation of these reveal that: (1) *Prolygus kirkaldyi* and *P. tainanensis* are conspecific with *Lygus bengalicus* Reuter, 1885 and *Prolygus bakeri*, respectively; (2) current generic combinations are problematic for *Apolygus eous* (Poppius, 1915), *A. fuhoshensis* (Poppius, 1915), *Neolygus bui* (Lu & Zheng, 2004), *N. disciger* (Poppius, 1915), *N. nigriscutellaris* (Lu & Zheng, 2004), *N. pictus* (Lu & Zheng, 2004), *N. rufilorum* (Lu & Zheng, 2004), *Prolygus bakeri*, *P. bengalicus* [= *P. kirkaldyi*] and *P. niger*; (3) *Prolygus alboscuteellatus* Carvalho, 1987 and *P. papuanus* are probably distributed in the Oriental Region; and (4) two species remaining in *Lygus* [*sensu lato*], *L. palauensis* and *L. rubrotinctus* described by CARVALHO (1956) from Micronesia (in the broad sense), are now confirmed as a member of *Prolygus* or *Micromimetes* Eyles, 1999, respectively.

This work is thus organized to unequivocally redefine taxonomically ambiguous taxa remaining after previous works (YASUNAGA et al. 2002, ZHENG et al. 2004, SCHWARTZ & CHÉROT 2005), with propositions of ten new combinations and three new synonymies. The poorly defined genus *Prolygus* is rediagnosed and discussed, on the basis of closer evaluation of morphological characters and zoogeographical distribution. New distributional records are also incorporated within the species treatments of seven described species. Three new genera, *Anthophilolygus*, *Miyamotohygus* and *Poppiolygus*, are proposed for the species that cannot be accommodated in any known genus. Two new species, *Anthophilolygus alaneylesi* sp. nov. and *Micromimetes sunweni* sp. nov. are also described. The lectotype is designated for *Miyamotohygus bengalicus*. *Lygus sacchari* Matsumura, 1910, without a type series, is regarded as *nomen dubium*.

Materials and methods

The depositories of material [or images] examined are abbreviated in the text as follows:

AMNH American Museum of Natural History, New York, USA;
BMNH The Natural History Museum, London, United Kingdom;

CNC Canadian National Collection of Insects, Ottawa, Ontario, Canada;
DEIC Senckenberg Deutsches Entomologisches Institute, Münchenberg, Germany;
DOAT Insect Collection, Entomology & Zoology Group, Plant Protection Research and Development Office, Department of Agriculture, Bangkok, Thailand;
HNHM Hungarian Natural History Museum, Budapest, Hungary;
KUEC Kyushu University, Entomological Collection, Fukuoka, Japan;
MZHF Zoological Museum, University of Helsinki, Helsinki, Finland;
NIAES Division of Informatics and Inventory, Institute of Agro-Environmental Sciences (NARO), Tsukuba, Japan;
NMNS National Museum of Natural Science, Taichung, Taiwan;
NMTU Natural History Museum, Tribhuvan University, Kathmandu, Nepal;
NSMT National Science Museum, Tokyo, Japan;
SNUK Seoul National University, Seoul, Korea;
TYCN Tomohide Yasunaga Collection, Nagasaki, Japan;
USNM United States National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA;
ZMUC Zoological Museum, University of Copenhagen, Copenhagen, Denmark.

Matrix code labels are attached to the type specimens and some additional representative specimens, which uniquely identify each specimen, and are referred to as 'unique specimen identifiers' (USIs). The USI codes [e.g., AMNH_PBI 0012345] comprise an institution and project code (AMNH_PBI) and a unique number (0012345). 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 on the 'Heteroptera Species Pages' (<http://research.amnh.org/pbi/heteropterasespeciespage/>). Images of the type series for species described from Taiwan are provided by NMNS on a website 'Integrated insect types database of Taiwanese species' (<http://twinsecttype.nmns.edu.tw/>); several images used in this paper were used under agreement by the museum). Scanning electron micrographs were taken with Hitachi Tabletop Microscope® TM3030.

All measurements are given in millimeters in the text; for most of SEM images, scale bars are shown in micrometer (µm). The synonymic lists for known taxa provide selected references, as comprehensive catalogs are now available (AUKEMA et al. 2013; KERZHNER & JOSIFOV 1999; SCHUH 1995; SCHUH 2013). Terminology of the genitalia mainly follows SCHWARTZ & FOOTITT (1998), YASUNAGA (1991), YASUNAGA et al. (2002), and YASUNAGA & SCHWARTZ (2007).

For known species, new distributional records are indicated in the text. Some terms are used in this paper, to indicate the male genitalic structures (particularly lobes and sclerites on the endosoma). The following abbreviations are used in the text and figures — *Pygophore and parameres*: HP – hypophysis (solitary or paired apical spine(s) of parameres); PS – pygophoral spine (at base of left paramere); SB – sensory lobe. *Endosoma and adjacent structures*: GP – secondary gonopore; PL – primary lobe or lobal sclerite; PT – phallosome; SD – seminal duct; SL – second lobe or lobal sclerite; SP – spicule; TL – third lobe or lobal sclerite. *Female genitalia*: DLP – dorsal labiate plate; DOS – dorsal structure; IRL – interramal lobe; IRS – interramal sclerite; SCR – sclerotized ring; VLP – ventral labiate plate.

Taxonomy

Prolygus Carvalho, 1987

Prolygus Carvalho, 1987: 137 (original description), type species by original designation: *Lygus papuanus* Poppius, 1914: 353.

Prolygus: SCHUH (1995): 941 (catalog); KERZHNER & JOSIFOV (1999): 172 (catalog); YASUNAGA (2001): 260 (diagnosis); ZHENG et al. (2004): 560 (diagnosis, key to Chinese spp.).

Diagnosis. *Prolygus* is distinguished from other similar taxa of the *Lygus* complex by the following combination of characters: Body elongate oval, small to medium in size (3.0–4.5 mm); antenna uniformly linear, 0.66–0.75× as long as body; clavus at least basally with two or three rows of keeled lines parallel to claval vein (cf. Figs 1–4, 12, 16, 18, 49, 50–52); cuneus pale, sometimes median part darkened but not infuscate at apex; male with left paramere L- or C-shaped, with a flat, median projection at apex of hypophysis; right paramere long, not much shorter than left one (its total length usually greater than that of left paramere sensory lobe), with apical part of sensory lobe often inflated; endosoma composed of three lobes, usually with two lobal sclerites (PL and SL); secondary gonopore thick-rimmed, small; phallosome slender, smooth; female with: sclerotized ring elongate ovoid, thick-rimmed, more or less narrowed medially; posterior wall with spinulate lateral and interramal lobes.

Biology. Little is known about the biology. Specimens of most species were collected using UV light traps. Several Asian species were found on inflorescences of broadleaf trees or shrubs.

Distribution. Known from the Oriental Region and across Wallacea east to New Guinea and several Pacific islands or atolls; at least three species occur in the eastern Palearctic Region (SW Japan and Taiwan).

Discussion. *Prolygus* was established by CARVALHO (1987) to accommodate sixteen New Guinean species. However, he included many species with irrelevant or questionable affinities which made the generic definition inadequate. Thirteen of the sixteen species (ca. 81%) placed in *Prolygus* by CARVALHO (1987) have, in our opinion, uncertain generic placements based on their original descriptions or subsequent redescriptions and illustrations: *Prolygus albocuneatus* Carvalho, 1987, *P. biscutellatus* Carvalho, 1987, *P. erimensis* (Poppius, 1914), *P. femoralis* (Poppius, 1914), *P. finisterrensis* Carvalho, 1987, *P. kandanus* Carvalho, 1987, *P. kebarensis* Carvalho, 1987, *P. maai* Carvalho, 1987, *P. nakanaiensis* Carvalho, 1987, *P. punctialbus* Carvalho, 1987, *P. quatei* Carvalho, 1987, *P. stali* (Poppius, 1914), and *P. watutensis* Carvalho, 1987. Definitive treatments for these taxa are beyond the scope of our current study. It would require additional material and further investigations of *Lygus*-complex and related taxa on a world-scale.

Prolygus can now be defined by the characters mentioned in above diagnosis. Based on the possession of these characters, placements of a dozen species in *Prolygus* are now contradictive. Accordingly, we regard six species as genuine members of *Prolygus*, but more than a few unidentified congeners are evidently present in the Indo-Pacific Region.

Prolygus alboscuteletatus Carvalho, 1987

(Figs 43–44)

Prolygus alboscuteletatus Carvalho, 1987: 140 (original description).

Material examined. **INDONESIA:** SUMATRA: Brastagi, North of Toba Lake, 3.18, 98.50, 1,400 m, UV light trap, 8 Dec 1989, T. Yasunaga, 1 ♀ (AMNH_PBI 00380625) (TYCN). **PHILIPPINES:** NEGROS ISLAND: Camp Lookout, Dumaguete, 22 May 1961, Schneirla & Reyes, 1 ♂ (00110770) (AMNH).

Distribution. Indonesia (Sumatra) (new record), Papua New Guinea (CARVALHO 1987), Philippines (Negros) (new record).

Comments. A female specimen (Fig. 43) from N. Sumatra and a male (Fig. 44) from Negros Island could belong to this taxon, which is now assumed to be a close relative of *P. nigriclavus*, based on similarities in basic color pattern (yellow-brown dorsum, yellow pronotum sometimes with dark, posterior fascia and more or less darkened clavus), elongate median process at apex of left paramere hypophysis, and presence of a single lobal-sclerite on the endosoma. But the scutellum of *P. alboscuteletatus* sometimes has a large, black, triangular mark in the middle, differing from that illustrated by CARVALHO (1987).

Prolygus disciger (Poppius, 1915) comb. nov.

(Figs 1–2, 12–15, 24–32, 45–46)

Lygus disciger Poppius, 1915: 35 (original description).

Lygus disciger: POPPIUS (1914): 339 (key); SCHUH (1995): 811 (catalog).

Lygocoris (*Neolygus*) *disciger*: SCHWARTZ & KERZHNER (1997): 252 (new combination); LU & ZHENG (1998b): 187 (diagnosis, type designation); KERZHNER & JOSIFOV (1999): 114 (catalog).

Neolygus disciger: ZHENG et al. (2004): 396 (new combination, re-description, key).

Prolygus sp.: YASUNAGA (2001): 260, Fig. 302 (diagnosis).

Type material examined. PARALECTOTYPE: ♂, TAIWAN: Fuhosho, Formosa [currently Nantou County], 7 Sep, H. Sauter (DEIC, without USIs, image examined).

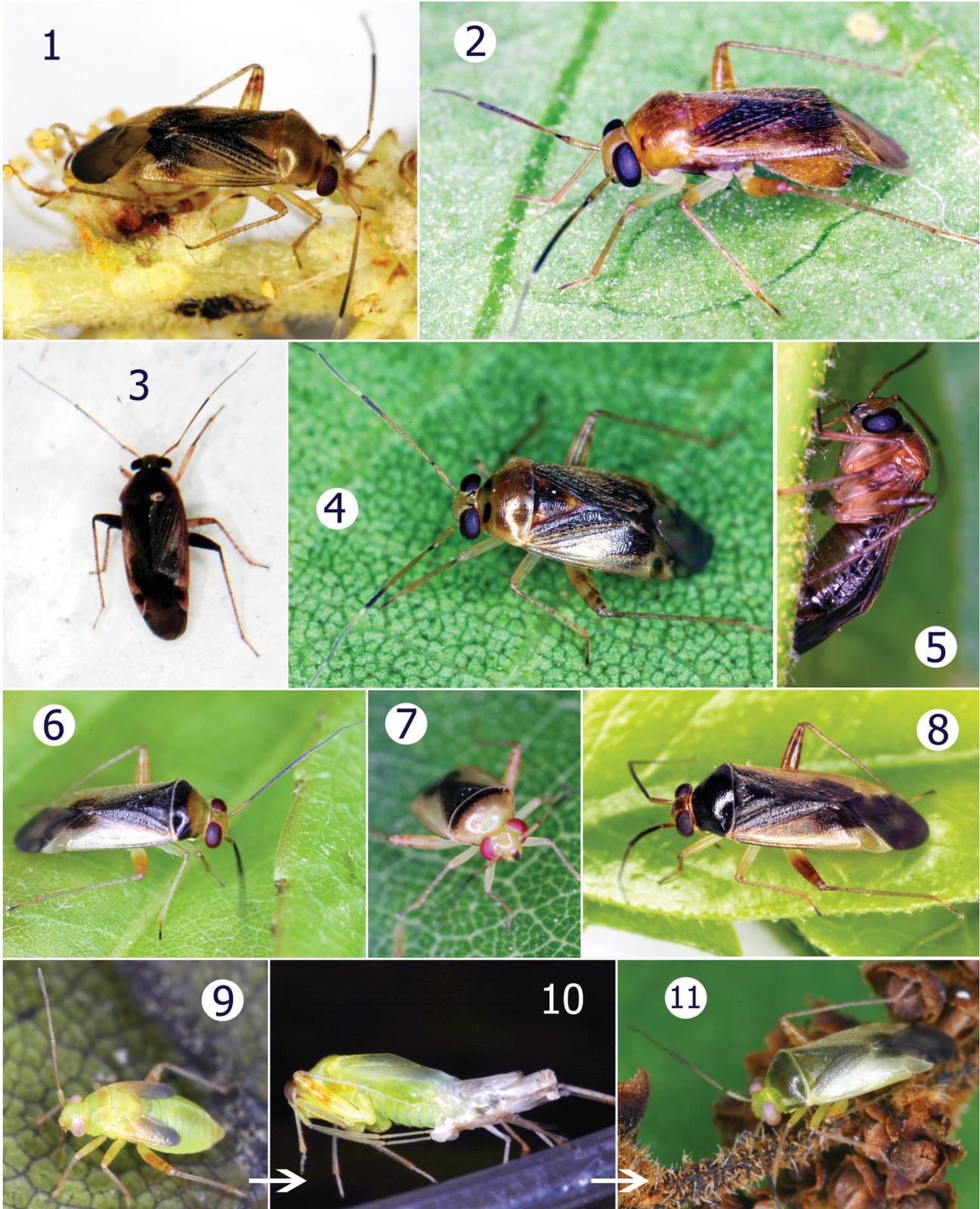
Additional material examined. **JAPAN:** KYUSHU: Nagasaki Pref., Nagasaki City, Konoura-Ohgiyama, 32.88, 129.72, UV light trap, T. Nozaki, 1 ♂ (AMNH_PBI 00380503) (AMHN). **RYUKYUS:** Iriomote Island, Shirahama, 24.3645 123.7544, on flower of *Pittosporum tobira*, 6 Mar 1999, T. Yasunaga, 1 ♀ (AMNH_PBI 00380504). **TAIWAN:** HUALIEN: Hsiulin, Hualuhsi, Malaise trap, 22 Nov – 10 Dec 2009, W. T. Yang & K. W. Huang, 1 ♂ (NMNS). **NANTOU:** Mt. Nanren-shan, 22.8417, 120.8358, 13 Mar 2012, Peng & Lan, 1 ♂ (NMNS). **PINGTUNG:** Mutan, 22.17477, 120.83560, flowers of *Castanopsis indica*, 18 Mar 2017, T. Yasunaga et al., 2 ♂♂ (TYCN) (1 ♂ with USIs, AMNH_PBI 00380613). **TAITUNG:** Taimali, Chinlun, UV light trap, 7–8 Dec 2009, W. T. Yang & K. W. Huang, 2 ♂♂ (NMNS). **THAILAND:** CHAIYAPHUM: Chulabhomdam, 16.5346, 101.6421, UV light trap, 16 Apr 2013, T. Yasunaga, 1 ♂ (AMNH_PBI 00380505).

Measurements (Japanese specimens; in mm). ♂ / ♀: Total length of body 3.65 / 3.63; head width including eyes 0.91 / 0.83; vertex width 0.29 / 0.30; lengths of antennal segments I–IV 0.54, 1.62, 0.90, 0.60 / 0.45, 1.35, 0.75, 0.45; labial length 1.47 / 1.35; mesal length of pronotum including collar 0.75 / 0.69; basal width of pronotum 1.20 / 1.20; maximum width across hemelytron 1.40 / 1.44; and lengths of metafemur, tibia and tarsus 1.50, 2.22, 0.56 / 1.35, 1.95, 0.45.

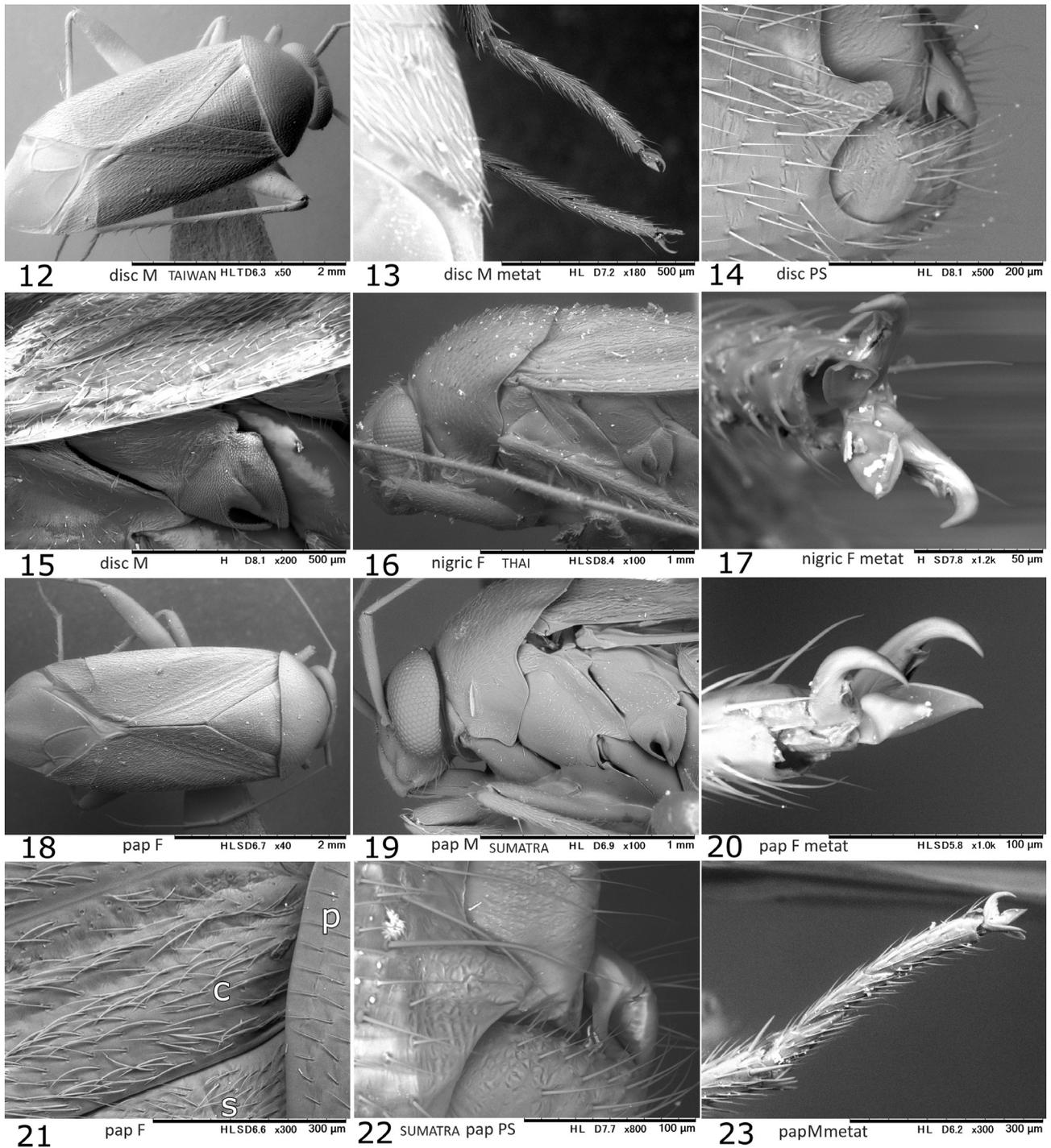
Differential diagnosis. Recognized by pale castaneous to reddish general colouration (Figs 1–2, 45–46); pale basal part of antennal segment II, except for darkened

extreme base; more or less darkened pronotum calli; often darkened inner parts of clavus and corium; distinct, triangular pygophoral spine (Figs 14, 24; PS); C-shaped left paramere with an elongate median process and small ventral process on hypophysis (Figs 24–26); flattened,

apically inflated right paramere (Fig. 27); presence of two distinct lobal-sclerites (PL, SL), a basal spicule (SP), and a spinulate (TL) sclerite on endosoma (Figs 28–30); rather narrow interrampal lobe (Fig. 31); and thick-rimmed, elongate ovoid sclerotized ring (Fig. 32). This species



Figs 1–11. Habitus images of genuine *Prolygus* species, live individuals. 1–2 – *P. disciger* (Poppius, 1915) (1 – ♂, Pingtung, Taiwan; 2 – ♂, Chaiyaphum, Thailand), 3–5 – *P. papuanus* (Poppius, 1915) (3 – ♀, attracted to FL light in Brastagi, N. Sumatra; 4–5 – ♂, Kathmandu, Nepal), 6–11 – *P. nigriclavus* (Poppius, 1915) (6 – ♂, Kathmandu; 7 – ♀, Nakhon Ratchasima, Thailand; 8 – ♂, darkened individual, Nantou, Taiwan; 9–11 – reared ♂ emerging, Rasuwa, Nepal).



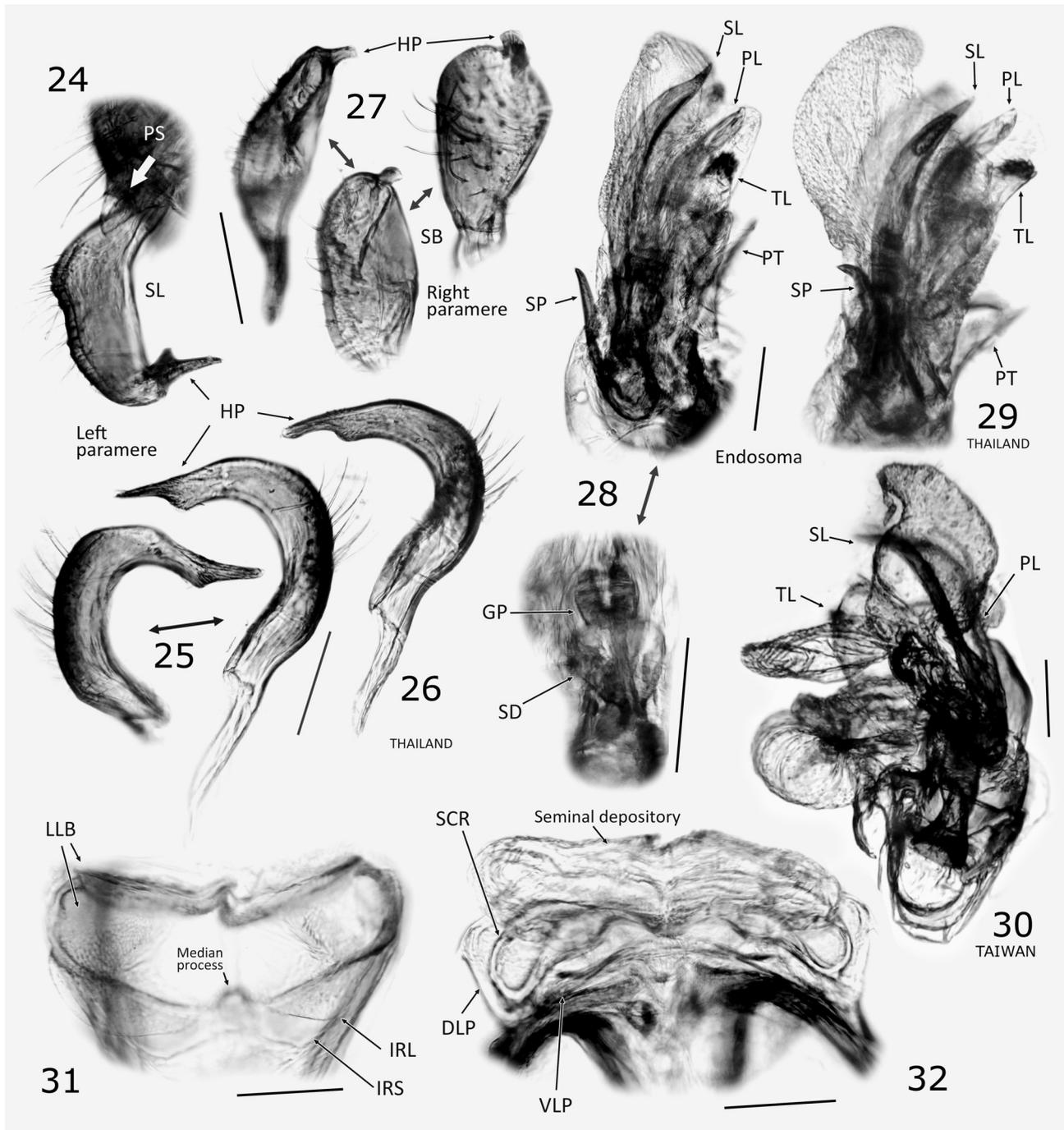
Figs 12–23. Scanning electron micrographs for genuine *Prolygus* species. 12–15 – *P. disciger* (Poppius, 1915), ♂: 12 – dorsal surface, 13 – cuneus and metatarsi, 14 – apical part of pygophore, left lateral view, 15 – scent efferent system; 16–17 – *P. nigriclavus* (Poppius, 1915), ♀: 16 – head and thorax, left lateral view, 17 – pretarsus (hind leg); 18–23 – *P. papuanus* (Poppius, 1915): 18 – ♀, dorsal surface, 19 – ♂, head and thorax, left lateral view; 20 – ♀, pretarsus (hind leg); 21 – ♀, dorsal vestiture (c: corium, p: pronotum, s: scutellum), 22 – ♂, apex of pygophore, left lateral view, 23 – ♂, metatarsus.

is most closely related to *P. papuanus*, from which *P. disciger* can be distinguished by generally reddish body (in live or freshly preserved specimens); faint or weak paired spots on pronotal calli; uniformly creamy yellow coxae; shorter, more bulbous right paramere with blunt-tipped hypophysis; left paramere with a elongate apical process; endosoma with a basal spicule (Fig. 29, SP); and narrower, subtriangular interramal lobe (Fig. 30).

Biology. A female adult was collected by sweep-netting

flowers of *Pittosporum tobira* (Thunb.) W.T. Aiton (Pittosporaceae) that is distributed widely in warm climate zones of SW Japan; a few adults were found on *Castanopsis indica* (Roxb. ex Lindl.) A.DC. (Fagaceae) in Taiwan (Fig. 1). Similar to *P. nigriclavus*, this species prefers to inhabit (and feed on) inflorescence of broadleaf trees.

Distribution. Japan (Kyushu: Nagasaki, Ryukyus: Iriomote Island) (YASUNAGA et al. 2001; new record from Nagasaki), P. R. China (Guangdong, Yunnan) (LU & ZHENG

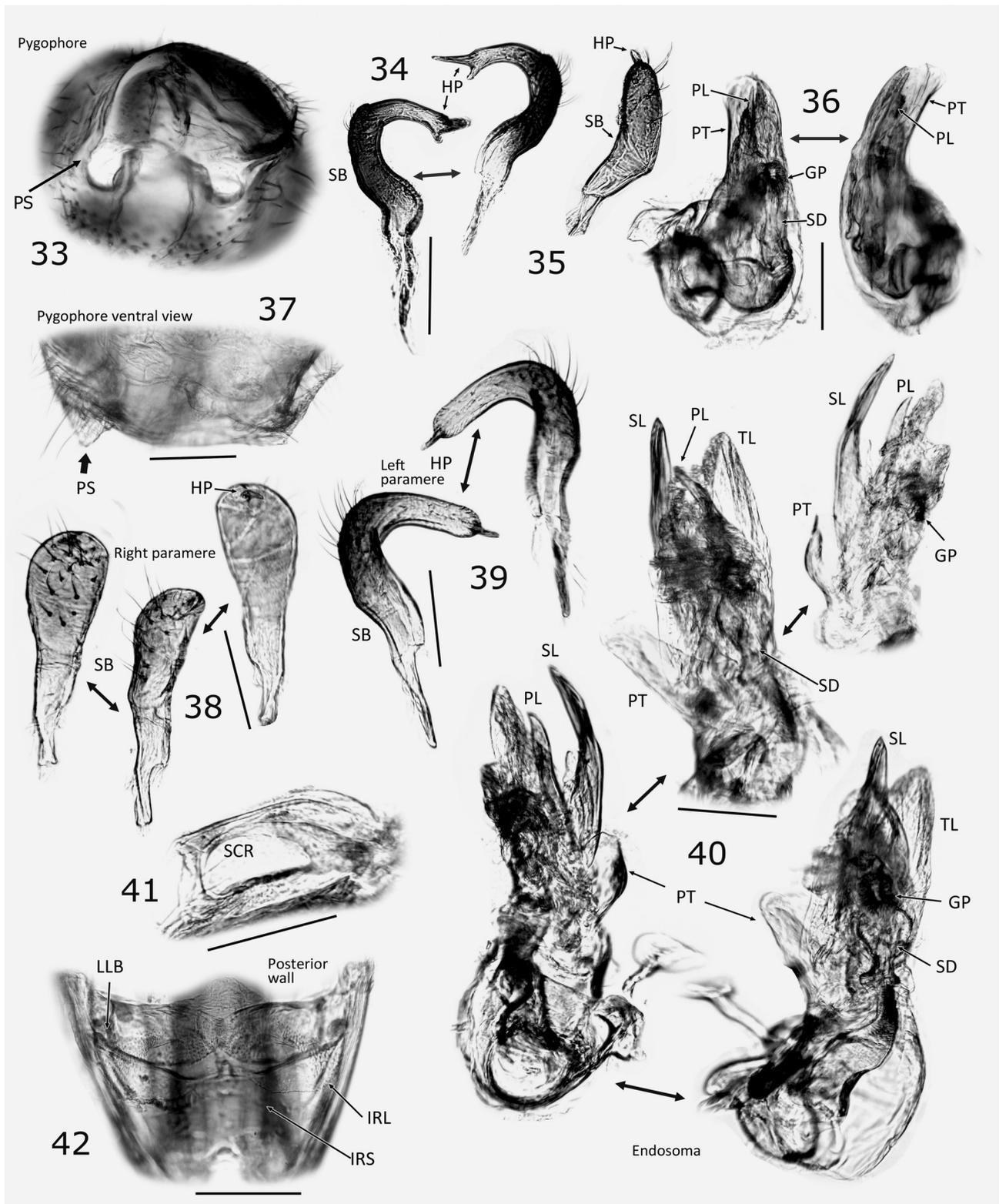


Figs 24–32. Male (24–30) and female (31–32) genitalia of *Prolygus disciger* (Poppius, 1915). 24 – pygophoral spine and left paramere; 25–26 – left paramere; 27 – right paramere; 28–30 – endosoma; 31 – posterior wall; 32 – bursa copulatrix. Scale bars 0.2 mm.

1998b), Thailand (Chaiyaphum) (new record), Taiwan (Hualien, Nantou, Pingtung, Taitung) (POPPIUS 1915 and additional records). In Taiwan this mirid occurs widely in mountain areas to coastal zones.

Comments. Based on the elongate body form, distinctly sutured (or keeled) clavus and presence of pygophoral spine (PS, cf. Fig. 24), this taxon is doubtlessly placed in *Prolygus*. LU & ZHENG (1998b) and ZHENG et al. (2004) provided a redescription, including the male genitalia, of this species placed in the genus *Neolygus*. The male

genitalic structures illustrated by LU & ZHENG (1998b) are similar to those possessed by *P. papuanus* rather than *Neolygus* members. The following particular features that diagnose *Neolygus* are not found in *P. disciger*: left paramere with apical portion of sensory lobe strongly protuberant and shaft without subapical process; endosoma including a loop *sensu* CLAYTON (1982), and a wide spicule. Among a pair of syntypes present, LU & ZHENG (1998b) designated a female (deposited in MZHF, without antenna and left forewing) as the lectotype instead of the



Figs 33–42. Male (33–40) and female (41–42) genitalia of *Prolygus* spp. 33–36 – *P. nigriclavus* (Poppius, 1915): 33 – apex of pygophore, caudal view; 34 – left paramere; 35 – right paramere; 36 – endosoma; 37–42 – *P. papuanus* (Poppius, 1914): 37 – apex of pygophore, dorsal view; 38 – right paramere; 39 – left paramere; 40 – endosoma; 41 – bursa copulatrix; 42 – posterior wall. Scale bars 0.2 mm.

male (in DEIC). Because the redescription (including the male genitalia) by LU & ZHENG (1998b) was based on non-type specimens from continental China, we have some doubt whether all of those continental specimens are conspecific with the male paralectotype from Taiwan.

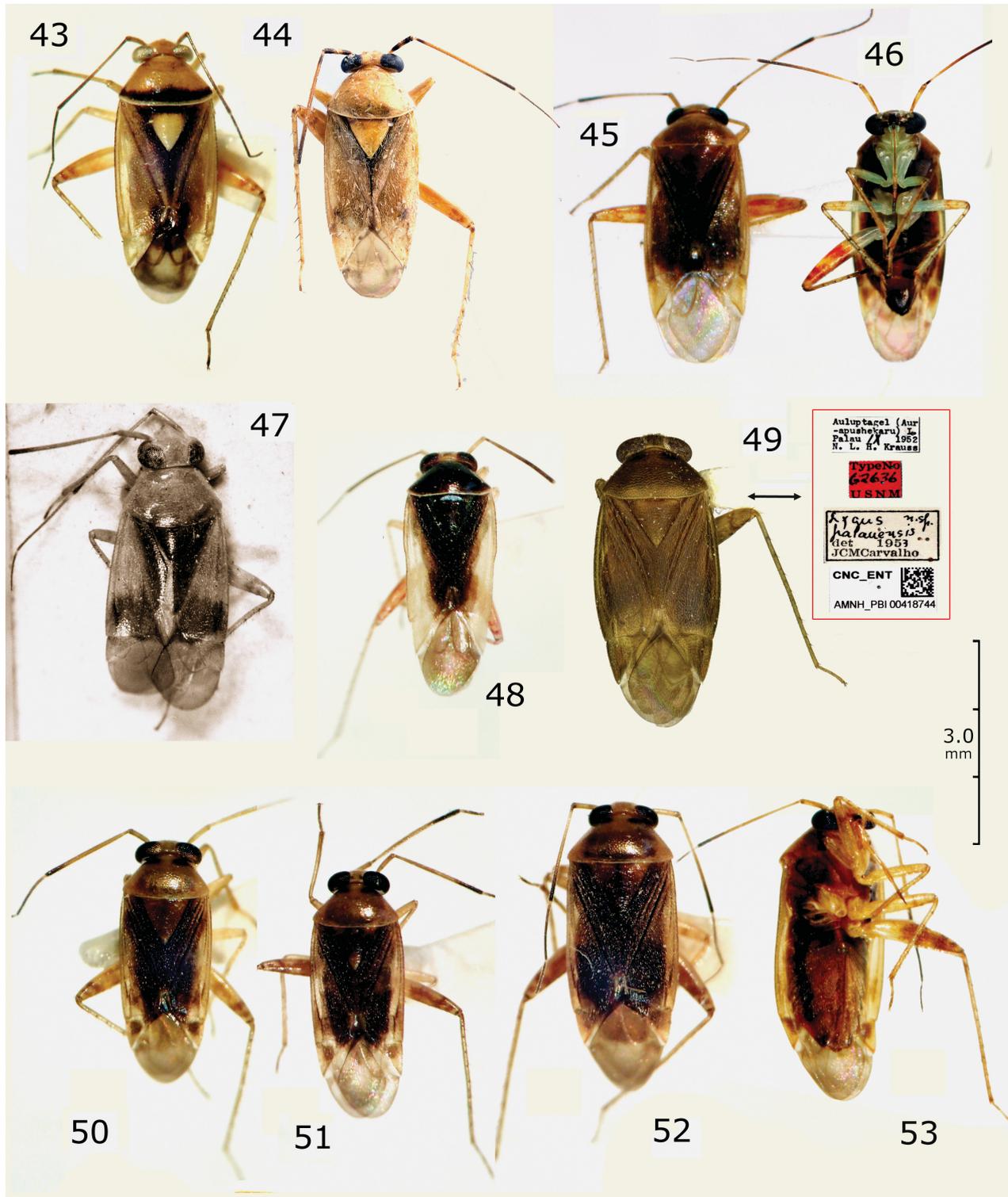
One male specimen collected in Thailand most probably fits this species, but the shape of its endosomal sclerites is slightly different from Japanese and Taiwanese specimens, probably representing tiny but recognizable geographical variation.

***Prolygus loriae* (Poppius, 1914)**

(Fig. 47)

Prolygus loriae Poppius, 1914: 352 (original description).*Prolygus loriae*: CARVALHO (1987): 145 (new combination, redescription).**Distribution.** Papua New Guinea (CARVALHO 1987).**Comments.** Carvalho's redescription and illustrations (CARVALHO 1987) suggest that this species is doubtlessly a

member of *Prolygus* and in all likelihood appears to be a sister taxon of *P. papuanus*; each species has two distinct, elongate lobal sclerites on the endosoma. Based on an image of the holotype male taken by the second author in 1986 (Fig. 47, ZMUF), *P. loriae* is distinct in having the pale, rather polished dorsum with largely darkened scutellum and posterior half of corium.



Figs 43–53. Habitus images of genuine *Prolygus* spp, dry-preserved specimens in dorsal and ventral (46, 53) view. 43–44 – *P. alboscutellatus* Carvalho, 1987: 43 – ♀ (N. Sumatra); 44 – ♂ (Negros, Philippines). 45–46 – *P. disciger* (Poppius, 1915): 45 – ♀ (Iriomote Island, Japan), 46 – ♂ (Pingtung, Taiwan); 47 – *P. loriae* (Poppius, 1914), holotype, ♂ (ZMUF); 48 – *P. nigriclavus* (Poppius, 1915) (N. Sumatra); 49 – *P. palauensis* (Carvalho, 1956), holotype, ♂ (USNM); 50–53 – *P. papuanus* (Poppius, 1914): 50 – ♂ (Perak, Malaya), 51 – ♂ (N. Sumatra), 52–53 – ♀ (N. Sumatra).

***Prolygus nigriclavus* (Poppius, 1915)**

(Figs 6–11, 16–17, 33–36, 48, 68)

Lygus nigriclavus Poppius, 1915: 35 (original description).*Lygus nigriclavus*: POPPIUS (1914): 340 (key).*Dagbertus nigriclavus*: MIYAMOTO (1975): 133 (new combination); SCHUH (1995): 752 (catalog).*Prolygus nigriclavus*: SCHWARTZ & KERZHNER (1997): 255 (new combination); KERZHNER & JOSIFOV (1999): 172 (catalog); ZHENG et al. (2004): 561 (diagnosis, key).*Neolygus nigriscutellaris* Lu & Zheng, 2004 in ZHENG et al. (2004): 414, 750 (original description). **New synonymy.****Type material examined.** *Lygus nigriclavus*: HOLOTYPE: ♀, TAIWAN: Chip-Chip [currently Nantou County, 23.83, 120.77] 9 Feb. H. Sauter (HNHM, without USIs, examined by F. Chérot, Fig. 68).**Additional material examined.** TAIWAN: KAGI: Tek-kia, 23.50, 120.69, 13 Apr 1965, S. Miyamoto, 1 ♂ (TYCN) (AMNH_PBI 00380499); Fenchihu, 10 Apr 1965, T. Shirozu, 1 ♀ (TYCN). NANTOU: Huiseun Forest Area, forest trail no. 45 toward Guandao, 24°04'57.9"N 121°01'54.9"E, 1000–1200 m, 14 Mar 2017, T. Yasunaga (TYCN). TAOYUAN: Tengihih National Forest Recreation Area, 23.06, 120.75, 12–13 May 1989, S. Gotoh, 2 ♂♂ 3 ♀♀ (TYCN). INDONESIA: SUMATRA: Brastagi, North of Toba Lake, 3.18, 98.50, 1,400 m, UV light trap, 7 Dec 1989, T. Yasunaga, 1 ♂ (TYCN) (AMNH_PBI 00380500). MALAYSIA: PERAK: Taiping, Bukit Larut (Maxwell Hill), 4.8624, 100.7999, 1100 m, UV light trap, 6 Jan 1990, T. Yasunaga, 1 ♂ (TYCN) (AMNH_PBI 00380501). NEPAL: KATHMANDU VALLEY: Samakhusi, Gongabu, 27°43'59.5"N, 85°18'49"E, 1,300 m, UV light trap, 31 May 2005, T. Yasunaga, 1 ♀ (TYCN) (AMNH_PBI 00380502); Swayambhu, Natural History Museum Garden, 27°42'52.8"N, 85°17'13.5"E, 1,350 m, on inflorescence of *Trema?* sp., 12 May 2006, T. Yasunaga, 1 ♂ 1 ♀ (TYCN). KASKI: Pokhara, 4 Nov 2005, T. Yasunaga, 1 ♂ (TYCN). RASUWA: Langtang Himal National Park, trekking path between Ghora Tabela and Lama Hotel, 28.18, 85.44, flowers of *Cotoneaster affinis*, 6 Jun 2006, T. Yasunaga, 1 ♂ (5th instar when collected; emerging on June 13) (NMTU). THAILAND: CHIANG MAI: Doi Pui, 18.8, 98.8, 1,400 m, 15 May 2001, S. Sakurai, 4 ♀♀ (TYCN).**Redescription.** Detailed description of the holotype female (Fig. 66) was provided by POPPIUS (1915) and is not repeated here. **Male.** Total length of body 3.47–3.65 mm, basically similar to female, but darker patterns on dorsum variable, particularly on pronotum and hemelytron (cf. Fig. 8) often extensive. COLOURATION: Body yellowish brown, elongate-oval, subparallel-sided; vertex uniformly pale (Fig. 7), sometimes with a dark spot at middle (Fig. 8); clypeus usually infusate. Antenna dark brown, except for segment I pale brown. More than posterior third of pronotum and entire scutellum fuscous. Pronotum more or less darkened posteriorly (sometimes almost entirely fuscous), except for always pale posterior margin. Hemelytron shiny pale yellowish brown, somewhat tinged with green in fresh specimens; clavus, and inner margin of corium fuscous; base of clavus more or less keeled. Coxae and legs creamy yellow (fading to pale brown in dried specimens); metafemur pale reddish brown at apical half, with two obscure rings subapically; tibial spines pale brown; each tarsomere III darkened. Abdomen shiny fuscous; ventral median part largely yellow. SURFACE AND VESTITURE: Dorsal surface shining, with uniformly distributed, silky, semierect setae; head smooth; vertex faintly carinate basally. GENITALIA (Figs 33–36): Pygophore with a weak, tiny PS (Fig. 33). Left paramere (Fig. 34) with rather tumid sensory lobe; hypophysis strongly protruded mesially, with a short process ventrally. Right paramere well developed,

weakly curved at basal third, with a small, blunt-tipped hypophysis (Fig. 35). Endosomal primary lobe sclerite horn-like; third lobe with a small, spinulate sclerite at apex; secondary gonopore small, thick-rimmed; seminal duct expanded subapically (Fig. 36).

Measurements (in mm). ♂/♀: Total length of body 3.47–3.65 / 3.92; head width including eyes 0.88–0.89 / 0.87–0.88; vertex width 0.21 / 0.31–0.33; lengths of antennal segments I–IV 0.40, 1.29, 0.66, 0.44 / 0.45, 1.35, 0.77, 0.45; labial length 1.22 / 1.28; mesal length of pronotum including collar 0.70 / 0.77; basal width of pronotum 1.20 / 1.35; maximum width across hemelytron 1.25–1.32 / 1.47–1.50; and lengths of metafemur, tibia and tarsus 1.28, 1.92, 0.47 / 1.40, 1.95, 0.47.**Nymph.** Final-instar nymph (Fig. 9) is recognized by its generally yellow (partly tinged with green), ovoid, slightly elongate body; sparse, simple, short vestiture on dorsum; pale tibial spines; and reddish apical half of metafemur.**Differential diagnosis of adults.** Recognized readily by elongate ovoid, medium sized body (Figs 6–8, 46); yellowish brown general colouration; darkened posterior part of pronotum, inner part of corium, and entire scutellum and clavus; and pale orange-brown apical half of metafemur.**Biology.** Both adults and final-instar immatures of this mirid were collected from inflorescences of several unidentified broadleaf trees in Nepal and Thailand. A male adult was found on flowers of *Styrax formosana* Matsum. (Styracaceae) in Taiwan. In Rasuwa District, Nepal, a final-instar nymph was captured from inflorescence of *Cotoneaster affinis* Lindl. (Rosaceae), which is considered as one of the breeding hosts, successfully developed into adult after a week reared with flesh of mango and banana as alternative diets (Figs 9–11).**Distribution.** Taiwan (Nantou, Kagi, Taoyuan) (POPPIUS 1915 and additional records), Indonesia (Sumatra) (new record), Malaysia (Perak) (new record), Laos (Bolikhamsai) (new record), Nepal (Kathmandu Valley, Kasuki, Rasuwa) (new records), Thailand (Chiang Mai, Nakhon Ratchasima) (new records).**Comments.** Judging from the overall features (elongate body form, keeled base of clavus, presence of a weak pygophoral spine, developed right paramere, general shape of endosoma, thick-rimmed, ovoid female sclerotized rings and wide, rectangular interramal lobes), the placement of this species in *Prolygus* is certain. However, its most closely related congener is yet to be confirmed. Now *P. nigriclavus* is known widely from Taiwan and the Oriental Region.***Prolygus palauensis* (Carvalho, 1956) comb. nov.**

(Fig. 49)

Lygus palauensis Carvalho, 1956: 87 (original description).**Type material examined.** HOLOTYPE: ♂, REPUBLIC OF PALAU: KOROR: Auluptagel (Aur-apushekaru), [7.30863°N 134.47793°E, 30 m], Sep 1952, N.L.H. Krauss (AMNH_PBI 00418744) (USNM, Fig. 49). ALLOTYPE: ♀, the same locality (AMNH_PBI 00418745).**Distribution.** Republic of Palau (CARVALHO 1956).

Comments. We have examined the holotype (Fig. 49) and allotype, the male genitalic structures are as illustrated by CARVALHO (1956). With the flattened hypophysis of left paramere, developed pointed hypophysis of right paramere, and presence of two lobal sclerites, and a basal spicule on endosoma (pygophore was missing from the genitalia vial attached to the pin). The claval setae are arranged in a vittate pattern (Fig. 49) confirming that this taxon is a member of *Prolygus*.

Prolygus papuanus (Poppius, 1914)

(Figs 3–5, 18–23, 37–42, 50–53)

Lygus papuanus Poppius, 1914: 353 (original description).

Prolygus papuanus: CARVALHO (1987): 147 (new combination, redescription).

Material examined. **INDONESIA: SUMATRA:** Brastagi, North of Toba Lake, 3.18, 98.50, 1,400 m, UV light trap, 5–9 Dec 1989, T. Yasunaga, 80 ♂♂ 45 ♀♀ (AMNH, CNC, TYCN), 1 ♂ 1 ♀ with USIs (AMNH_PBI 00380534–00380535). **MALAYSIA: PERAK:** Taiping, Bukit Larut (Maxwell Hill), 4.8624, 100.7999, 1100 m, UV light trap, 6–8 Jan 1990, T. Yasunaga, 20 ♂♂ 15 ♀♀ (TYCN). **NEPAL: KATHMANDU VALLEY:** Kiripur, Horticulture Center Experimental Farm, 27°40'22"N, 85°17'11"E, on flowers of pecan nut, 8 May 2006, T. Yasunaga & R.K. Duwal, 1 ♂ 1 ♀ (TYCN). **THAILAND: NAKHON RATCHASIMA:** Wang Nam Khieo, Sakaerat Environmental Research Station, 14°30'27"N, 101°55'39"E, 410 m alt., UV light trap, 12–14 Jun 2009, T. Yasunaga & K. Yamada, 1 ♂ (TYCN).

Biology. In Kathmandu, Nepal, a few adults were found on flowers of a pecan nut, *Carya illinoensis* K. Koch (Juglandaceae); however, they are assumed to represent an adventive population, because the pecan nut trees were introduced (probably secondarily from somewhere in Asia) for the growing tests into the Nepal Horticulture Experimental farm.

Distribution. Papua New Guinea (CARVALHO 1987); Indonesia (Sumatra) (new records), Malaysia (Perak) (new records), Nepal (Kathmandu Valley) (new records) and Thailand (Nakhon Ratchasima) (new record).

Comments. CARVALHO (1987) redescribed the type species of *Prolygus*, based on more than 400 widely dispersed specimens from Papua New Guinea including New Britain Island, which implies *P. papuanus* could be a common, rather widespread mirid. The first author collected (mostly using UV light traps) hundreds of specimens probably corresponding to *P. papuanus* in several countries in the Oriental Region. The SEM images and genitalic structures shown in this work were principally based on the Sumatra specimens.

Prolygus subrufilori (Lu & Zheng, 2004) comb. nov.

Neolygus subrufilori Lu & Zheng, 2004 in ZHENG et al. (2004): 425, 756 (original description).

Distribution. P. R. China (Yunnan) (ZHENG et al. 2004).

Comments. The original description, biometrics and illustrations of the male genitalia (ZHENG et al. 2004) clearly suggest that this Chinese species should be placed in *Prolygus*, instead of *Neolygus*. Based on the male genitalia, *P. subrufilori* is most closely related to *P. nigriclavus*, from which it can be distinguished by the almost uniformly yellowish brown dorsum, pale basal 0.80 of antennal seg-

ment II, and darkened apical inner corner of the corium.

Related taxa

Anthophilolygus gen. nov.

Type species. *Lygus bakeri* Poppius, 1915, present designation.

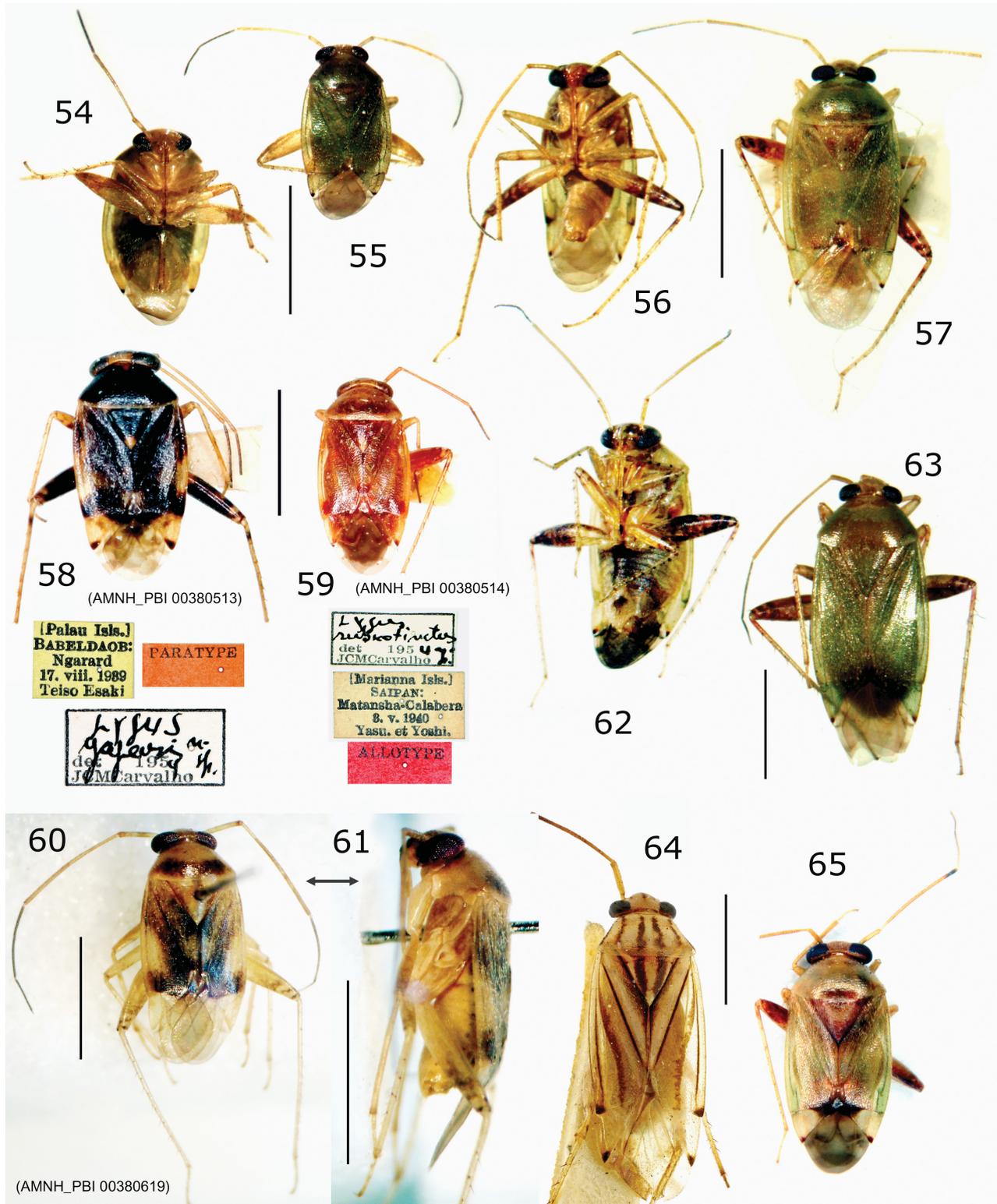
Diagnosis. *Anthophilolygus* gen. nov. can be distinguished from other related genera (*Dagbertus*, *Micromimetes* or *Prolygus* in particular) by the following combination of characters: Largely pale greenish, ovoid body (Figs 73–75); long, uniformly linear antenna that is subequal in length to body; shiny, finely punctate dorsum; sericeous, scale-like setae on mesoscutum, scutellum and anterior part of hemelytron; two reddish fasciae on hemelytron; darkened apices of clavus, embolium and cuneus; pretarsus with developed, elongate parempodia and thick, rather blunt-tipped apex of claws; reduced dark spots at bases of tibial spines; and form of male and female genitalia as described below, in addition to final instar immature having ovoid body and almost glabrous dorsum only with sparsely distributed, silky, fine setae (Figs 75, 80, 82).

Description. Male. Body small (3.2–4.0 mm), slightly elongate, rather tumid. COLOURATION: Generally pale green (pale stramineous in dried specimens), partly with reddish or brownish tinge; scutellum and anterior part of hemelytron often with reddish or sanguineous fascia; apex of corium usually with dark fascia; apices of clavus, embolium and cuneus darkened. Apical half of metafemur usually dark or reddish; each tibia lacking or only with tiny, faint dark spots at bases of pale reddish brown spines. SURFACE AND VESTITURE: Dorsal surface shining, with rather densely distributed, silvery, silky, reclining or semierect setae. Pronotum shiny, finely and shallowly punctate, with uniformly distributed, pale, simple, semierect setae; mesoscutum and scutellum with reclining, sericeous, scale-like setae. Hemelytron shallowly punctate, with two types of vestiture (uniformly distributed, pale, simple setae and sparsely distributed, sericeous, scale-like, reclining setae predominant on anterior portion). STRUCTURE: Head vertical; eyes moderate to relatively large; vertex with flat, narrow basal transverse carina. Antenna long, subequal in length to body, uniformly slender. Labium reaching apex of metacoxae. Calli slightly prominent; mesoscutum and scutellum nearly flat. Each tarsomere III slightly longer than I or II; pretarsus with developed, elongate parempodia and thick, rather blunt-tipped apex of claws. GENITALIA (Figs 118–130): Pygophore usually with distinct spine (PS) at base of left paramere. Left paramere with sensory lobe rather flattened; hypophysis usually with elongate shaft, weakly tapered toward apex; right paramere small, ovoid, less than half as long as left one, with pointed hypophysis. Endosoma (Figs 122, 128) simple, largely membranous; primary lobe narrowly sclerotized above secondary gonopore, furnished with hair-like spinules; apical margin of phallosome weakly keeled.

Female. Body ovoid; except larger than male. COLOURATION: Fascia on anterior part of hemelytron interrupted, narrowed, or missing. GENITALIA (Figs 124–125,

129–130): Bursa copulatrix simple, weakly sclerotized (Figs 124, 129), with weak dorsal labiate plate; sclerotized rings ovoid, thin-rimmed, separated from each other; posterior wall lacking lateral lobe, with a U- or Y-shaped dorsal structure; interrampal lobe small, semi-circular, spinulate (Figs 125, 130).

Etymology. From Greek, *anthos* (flower) + *philos* (prefer), combined with the mirine generic name *Lygus* Hahn, referring to the type species and a few unidentified relatives that preferably inhabit inflorescences of various dicot angiosperms; masculine.

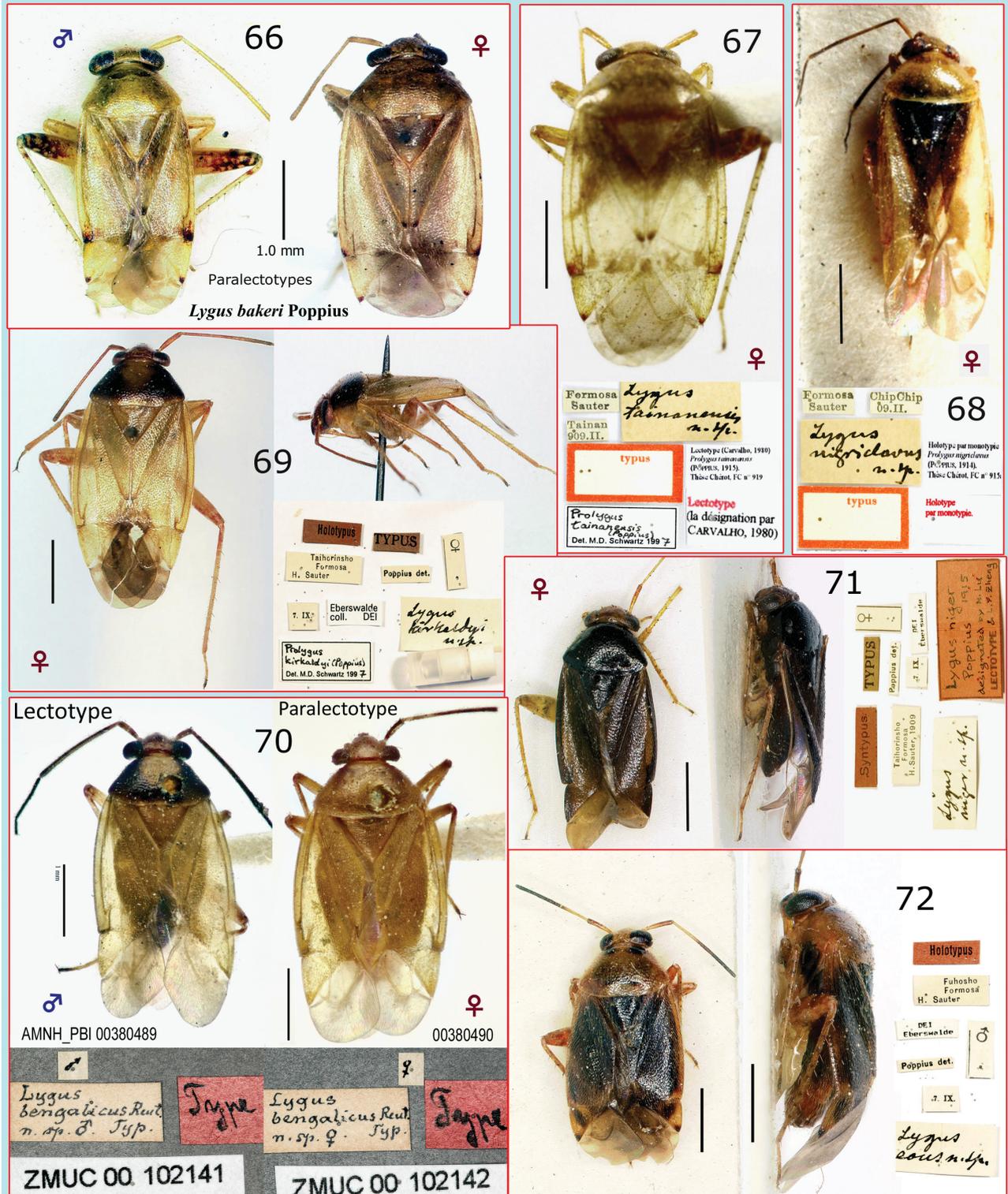


Figs 54–65. Habitus images of species of the *Lygus* complex. 54–55 – *Anthophilolygus alaneylesi* sp. nov. (Nakhon Nayok, Thailand): 54 – ♀, ventral view, 54 – ♂; 56–57 – *A. bakeri* (Poppius, 1915): 56 – ♂ (Nagasaki, Japan), 57 – ♀ (Okinawa, Japan); 58 – *Lygus dybasi* Carvalho, 1956, ♂ (KUEC) with incorrect paratype label and determination (as *Lygus yapensis* n. sp.); 59 – *Micromimetes rubrotinctus* (Carvalho, 1956), allotype ♀; 60–61 – *M. sunweni* sp. nov.: 60 – holotype, ♂, 61 – same, left lateral view; 62–63 – *Miyamotolygus rufilorum* (Lu & Zheng, 1998) (Kathmandu, Nepal): 62 – ♂, ventral view, 63 – ♀; 64 – *Dagbertus darwini* (Butler, 1904), holotype (Galapagos, BMNH); 65 – *D. olivaceus* (Reuter, 1907), ♂ (Florida, USA). Scale bars 2 mm.

Distribution. Oriental and Eastern Palearctic Regions (currently up to 33°N in Kyushu, Japan); some populations (considered to be introduced) occur on Bonin and Mariana Islands.

Discussion. The generic placement of *Lygus bakeri* has been problematic. This taxon was considered *Lygus* [*sensu*

lato] (as *incertae sedis*) for eight decades. SCHWARTZ & KERZNER (1997) evaluated the features of *L. bakeri* and provisionally provided a new combination in *Prolygus*. Nonetheless, *P. bakeri* lacks several diagnostic characters that we herein redefine (see above diagnosis and discussion for *Prolygus*).



Figs 66–72. Asian species of *Prolygus* and related genera, type specimens. 66 – *Lygus bakeri* Poppius, 1915 [now in *Anthophilolygus*], paralectotypes; 67 – *Lygus tainanensis* Poppius, 1915 [synonym of *A. bakeri*]; 68 – *Lygus nigriclavus* Poppius, 1915 [now in *Prolygus*]; 69 – *Lygus kirkaldyi* Poppius, 1915 [synonym of *Poppiohygus bengalicus*]; 70 – *Lygus bengalicus* Reuter, 1885 [now in *Poppiohygus*], lectotype (herein designated) and paralectotype; 71 – *Lygus niger* Poppius, 1915 [now in *Apolygopsis*]; 72 – *Lygus eous* Poppius, 1915 [now in *Apolygopsis*]. Scale bars ca. 1 mm (based on original description of each taxon, except for Fig. 70 recently re-measured by courtesy of Prof. Enghoff of ZMUC).

We have been seeking more suitable placement of *P. bakeri* in either *Dagbertus* or *Micromimetes* or others. Although this Asian taxon is at first sight very similar to some members of *Dagbertus* (e.g., *D. olivaceus* (Reuter, 1907), Fig. 65), the latter is a group from the New World including Galapagos (cf. Fig. 64) and has the evidently different genitalic structures (see below discussion of *Poppiolygus*). The other candidate genus *Micromimetes* was proposed to accommodate a single species, *M. pictipes* Eyles, 1999, from Cook Islands (EYLES 1999).

Lygus bakeri is similar in body shape and size to some *Micromimetes* members, which however share the following diagnostic characters: Body small (less than 4.0 mm), ovoid to slightly elongate rather tumid; basic colouration usually brown to fuscous, sometimes pale brown with reddish or dark brown maculae, without greenish tinge; dorsal surface with rather densely distributed, silvery or silky, recumbent setae, partly intermixed with dark or brown, simple setae; male genitalia with distinct spine on pygophore; sensory lobe of left paramere weakly produced basally; hypophysis usually with an elongate shaft and two slightly pointed subapical processes; right paramere straight, not much shortened, with pointed hypophysis; endosoma composed of two membranous lobes, with a conspicuous spicule dorsal to secondary gonopore and usually with primary lobal-sclerite; female genitalia with bursa copulatrix simple, weakly sclerotized; sclerotized rings ovoid, thin-rimmed, separated from each other; posterior wall lacking lateral lobe, with a U- or Y-shaped dorsal structure; interramal sclerite narrow; and interramal lobes small, semi-circular, spinulate.

Lygus bakeri does not have most of above diagnostic characters of *Micromimetes*, and any other known genera also cannot accommodate it. Therefore, we conclude that establishment of a new genus *Anthophilolygus* is the best solution. Incidentally, our new genus will include a couple of unidentified mirines collected in Indonesia, Malaysia and Thailand (cf. Fig. 81). Because identities of numerous described species still left in *Lygus [sensu lato]* (cf. POPPIUS 1914, 1915) need further verification, however, we currently document just one additional congener, *Anthophilolygus alaneylesi* sp. nov., with a distinctive identity, to avoid unnecessary synonymy or misidentification.

Most of the mirids belonging to *Anthophilolygus* (including *A. bakeri*) were found on inflorescences of various broadleaf angiosperms. The dorsal color pattern is assumed to represent a camouflage in inflorescences (cf. Fig. 79). Also, many specimens of the congeners were collected by UV-lighting. The final instar nymph of *A. bakeri* is similar in general appearance to the adult (Fig. 80), whereas the final instar of an unidentified (more colorful) congener from Thailand (Fig. 81) has the totally whitish green body, antennae and legs, and almost glabrous dorsum (Fig. 82).

Anthophilolygus alaneylesi sp. nov.

(Figs 54–55, 73–76, 94–98, 118–125)

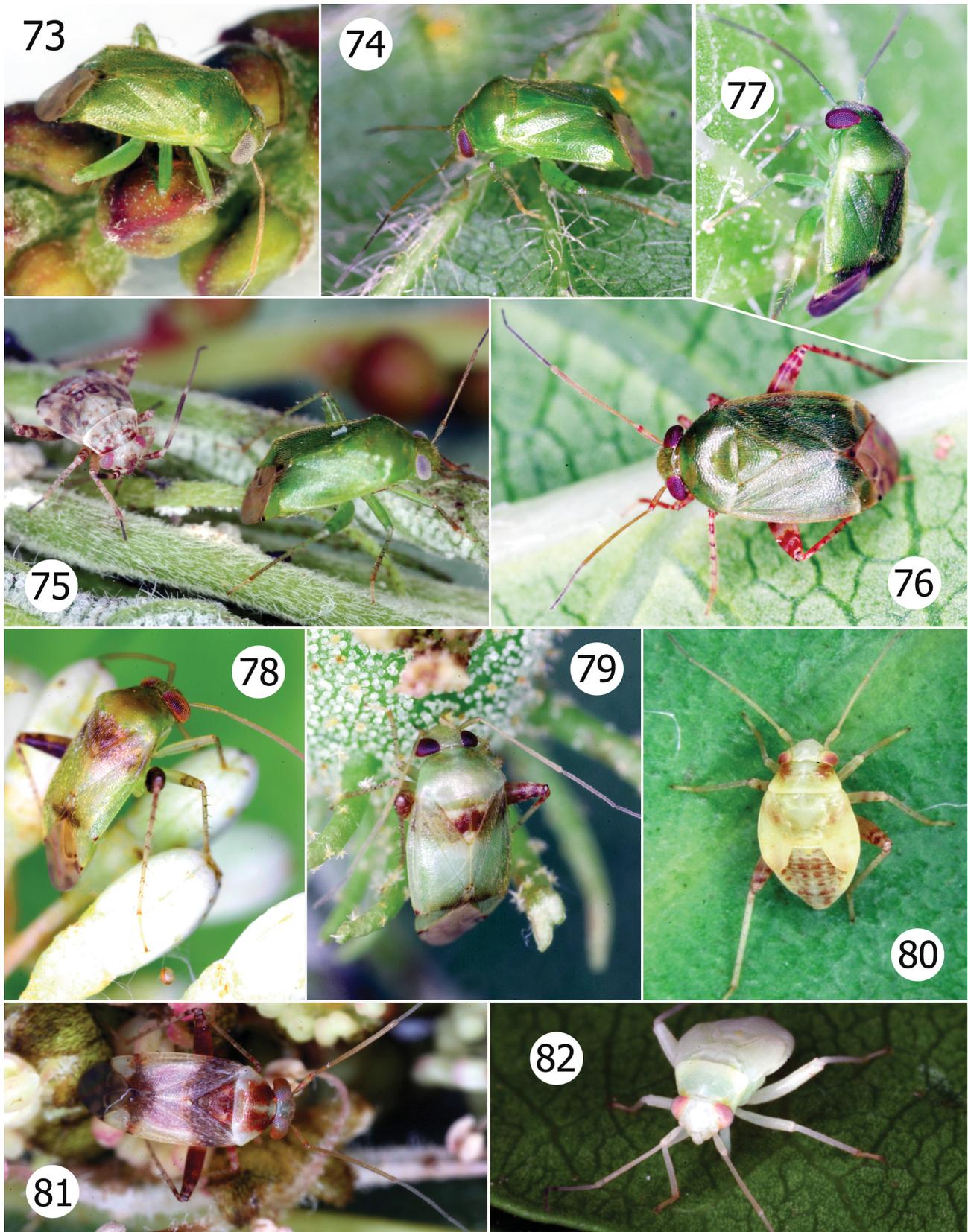
Type material. HOLOTYPE: ♂, THAILAND: NAKHON NAYOK: Sarika, Maduea Riv. upper stream margin, 14.3677, 101.2719, on *Homonoia riparia* (flowers and leaves), 20 Mar 2014, T. Yasunaga & K. Yamada (AMNH_PBI 00380617) (DOAT). PARATYPES: THAILAND: CHAIYAPHUM: Chulabhom Dam, 16°32–33'N, 101°38–39'E, 760–780 m alt, 16

Apr 2013, T. Yasunaga, 1 ♀ (TYCN). NAKHON NAYOK: Same data as for holotype, 1 ♂ (TYCN); Sarika near Nang Rong Waterfall along stream, 14°19'39.5"N 101°19'07.4"E, on *Homonoia riparia*, 31 Dec 2012, T. Yasunaga, 1 ♂ 2 ♀♀ (CNC, TYCN); Sarika near Sarika Waterfall, 14°18'32"N 101°15'20"E ~14°18'09"N 101°15'38"E, on *Homonoia riparia* mixed with *Scurrula* sp., 22 Mar 2010, T. Yasunaga & K. Yamada, 1 ♂ (TYCN). NAKHON RATCHASIMA: Wang Nam Khieo, Udom Sap, Sakaerat Environmental Research Station, 14.5163, 101.9325, on *Homonoia riparia*, T. Yasunaga, 1 ♀ (AMNH_PBI 00380618) (TYCN); same locality, 14°30'27"N, 101°55'39"E, 410 m alt., UV light trap, 19–20 Aug 2008, T. Yasunaga & B. Shishido (TYCN), 1 ♀; 12–14 Jun 2009, T. Yasunaga & K. Yamada, 1 ♂ (TYCN).

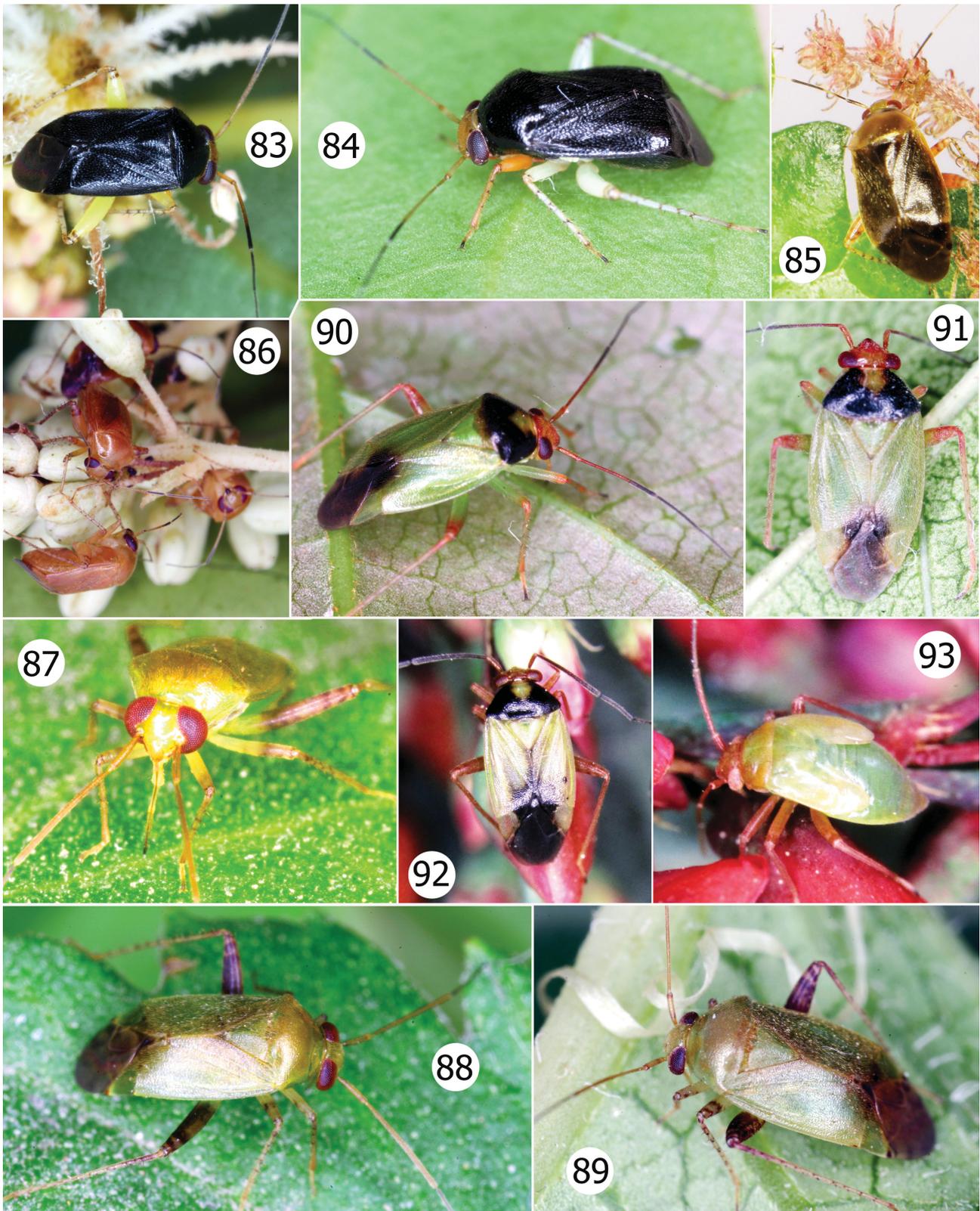
Description. Male. Body ovoid, very tiny in size, 2.52–2.70 mm. COLOURATION: Generally pale green (but sometimes fading to yellowish or brownish in dry-preserved specimens). Antennae pale green (yellowish brown in dry-preserved specimen), two distal segments dark brown. Labium pale brown, apex of segment IV reddish brown. Ostiolar peritreme creamy yellow. Hemelytron almost uniformly pale green, paracuneus more or less darkened; apex of cuneus narrowly infuscate; membrane including veins pale smoky brown, with distally darkened large areolar cell and a dark spot posterior to cuneus. Coxae and legs pale green (yellowish brown in dry-preserved specimen); each femur sometimes tinged with red (cf. Fig. 76), apically with two obscure rings; tibia with reddish brown spines, lacking dark spot at base of each spine. Abdomen uniformly pale green (yellowish brown in dry-preserved specimen). SURFACE AND VESTITURE: Dorsal surface shining, shallowly and somewhat coarsely punctate, with densely distributed, pale, simple, semierect setae. Head with pale, short, erect setae; labium shiny. Pronotum shallowly and transversely rugose; scutellum almost flat. Hemelytron shallowly and coarsely punctate. STRUCTURE: Vertex with a basal transverse carina as thick as pronotal collar. Antennae a little shorter than body; segment II slightly incrassate toward apex, about as long as basal width of pronotum; antennal segments III and IV filiform. Labium reaching or slightly exceeding apex of metacoxa, almost equal in length to antennal segment II. Pronotal collar about as thick as antennal segment III; scutellum almost flat. Metatarsomere III longer than I or II. GENITALIA (Figs 118–123): Pygophore with a triangular PS (Fig. 119). Left paramere C-shaped, with tumid sensory lobe; hypophysis with an elongate median process and small ventral process (Fig. 120); right paramere rather bulbous, with slender, pointed hypophysis (Fig. 119); endosoma almost membranous with sparsely distributed, short spinules and a thin, primary lobal sclerite (PL) (Figs 121–122); secondary gonopore small, thick-rimmed; phallosome simple, slender (Fig. 123).

Female. Similar to male, 2.82–2.98 mm, except antennae segment II slightly shorter than basal width of pronotum. GENITALIA (Figs 124–125): Sclerotized rings narrow-rimmed, elongate ovoid, rather large; interramal lobe narrow, sparsely spinulate.

Measurements (in mm). ♂/♀: Total length of body 2.52–2.70 / 2.82–2.98; head width including eyes 0.76–0.80 / 0.76–0.81; vertex width 0.25–0.29 / 0.30–0.33; lengths of antennal segments I–IV 0.34–0.38, 1.05–1.08, 0.55–0.60, 0.43–0.47 / 0.39–0.45, 1.09–1.10, 0.61–0.63, 0.46–0.48;



Figs 73–82. Habitus images of live individuals. 73–76 – *Anthophilolygus alaneylesi* sp. nov. (73 – ♂ on breeding host *Homonoia riparia* in Nakhon Nayok, Thailand; 74 – ♀, same locality; 75 – ♀ adult (right) and final instar nymph, same locality; 76 – a variant ♀ with reddish legs in Nakhon Ratchasima, Thailand). 77 – *Nepiolygus arare* Yasunaga, Schwartz & Chérot, 2002, ♂ from Iriomote Island, Japan. 78–80 – *Anthophilolygus bakeri* (Poppius, 1915): 78 – ♂, on *Fraxinus griffithii* in Iriomote Island, Japan; 79 – ♀, on *Mallotus japonicus* in Nagasaki, Japan; 80 – final instar nymph, Okinawa, Japan) 81–82 – unidentified *Anthophilolygus* species found in Thailand: 81 – ♂, Nakhon Ratchasima; 82 – final instar nymph, Chon Buri.



Figs 83–93. Habitus images of Asian species of the *Lygus* complex. 83–84 – *Apolygopsis nigra* sp. nov. (Poppius, 1915): 83 – ♂ (Nakhon Ratchasima, Thailand), 84 – ♀ (Kathmandu, Nepal). 85 – *Apolygopsis nigriflora* (Linnavuori, 1961), ♀ (Nagasaki, Japan). 86 – *Apolygopsis furvocarinata* Yasunaga, Schwartz & Chérot, 2002, adults aggregated on *Fraxinus griffithii* (Iriomote Island, Japan). 87–89 – *Miyamotolygus rufiflorum* (Lu & Zheng, 1998) (Kathmandu, Nepal): 87–88 – ♂, 89 – ♀. 90–93 – *Poppiolygus bengalicus* (Reuter, 1885): 90 – ♀ (Nakhon Ratchasima, Thailand), 91 – ♀ (Ayeyawady, Myanmar), 92 – ♂ (Kaski, Nepal), 93 – final instar nymph (Kasuki).

labial length 1.05–1.08 / 1.07–1.20; mesal length of pronotum including collar 0.46–0.62 / 0.66–0.75; basal width of pronotum 1.05–1.11 / 1.17–1.27; maximum width across hemelytron 1.20–1.28 / 1.30–1.53; and lengths of metafemur, tibia and tarsus 1.05–1.17, 1.44–1.63, 0.31–0.35 / 1.20–1.35, 1.65–1.77, 0.40–0.43.

Differential diagnosis. Recognized by its remarkably tiny size (total length < 3 mm); shiny pale green general colouration; shallowly punctate dorsum with densely distributed, simple, semierect setae; and a dark spot on paracuneus; and narrowly darkened apex of cuneus. Most similar in external appearance to *Nepiolygus arare* Yasunaga, Schwartz & Chérot, 2002 (known from Ryukyus, Japan, Figs 77, 110–111) rather than other *Anthophilolygus* congeners; distinguished by denser dorsal vestiture, presence of two obscure rings at apex of metafemur that is sometimes tinged with red, endosoma without distinct lobal sclerites, and posterior wall of bursa copulatrix lacking median process between interramal lobes.

Etymology. Named in honor of our long time New Zealand colleague, Alan C. Eyles.

Biology. This new species is associated with willow-leaved water croton, *Homonoia riparia* Lour. (Euphorbiaceae), grown along clean mountain streams in central Thailand. Adults were occasionally attracted to UV light at night. Collection records suggest a multivoltine life cycle for this mirid.

Distribution. Central Thailand (Nakhon Nayok, Nakhon Ratchasima).

Comments. Placement of this new species in *Anthophilolygus* is based on (1) dorsal vestiture pattern, (2) shape of metathoracic scent efferent system and pretarsal structure, (3) proportion of each tarsomere, (4) almost membranous endosoma with a single, thin sclerite and sparse spinules, and (5) simple form of female genitalia with narrow, sparsely spinulate interramal lobes and narrow-rimmed sclerotized rings, although it at first sight more resembles *Nepiolygus* Yasunaga, Schwartz & Chérot, 2002 or *Micromimetes* species (due to its remarkably small size). All other species of the *Lygus*-complex described from the Asia-Pacific region, except for *Nepiolygus arare* (cf. Fig. 77), are obviously larger in size (> 3.2 mm, mostly > 4 mm).

***Anthophilolygus bakeri* (Poppius, 1915) comb. nov.**

(Figs 56–57, 66–67, 78–80, 99–105, 126–130)

Lygus bakeri Poppius, 1915: 30 (original description).

Lygus bakeri: POPPIUS (1914): 342 (key); SCHUH (1995): 808 (catalog).

Prolygus bakeri: SCHWARTZ & KERZHNER (1997): 253 (new combination); KERZHNER & JOSIFOV (1999): 172 (catalog); SCHUH (1995): 941 (catalog); YASUNAGA (2001): 260 (diagnosis); ZHENG et al. (2004): 561 (diagnosis, key).

Lygus tainanensis Poppius, 1915: 35 (original description). **New synonym.**

Lygus tainanensis: POPPIUS (1914): 340 (key); SCHUH (1995): 827 (catalog).

Prolygus tainanensis: SCHWARTZ & KERZHNER (1997): 255 (new combination); KERZHNER & JOSIFOV (1999): 173 (catalog); ZHENG et al. (2004): 565 (diagnosis, key).

Type material examined. *Lygus bakeri*: LECTOTYPE (designated by SCHWARTZ & KERZHNER 1997): ♂, TAIWAN: KAGI: Taihorinsho [= currently Dalin, 23.60, 120.47], 7 Nov, H. Sauter (MZHF). PARALECTOTYPES:

TAIWAN: KAOHSIUNG: Kosempo [= currently Kahsian (Jiaxian), 23.07, 120.60], April 1912, H. Sauter, 1 ♂ (DEIC, without USIs, image examined, Fig. 66). KAGI: Taihorinsho, 7 Nov 1909, H. Sauter, 1 ♀ (DEIC, without USIs, image examined, Fig. 66).

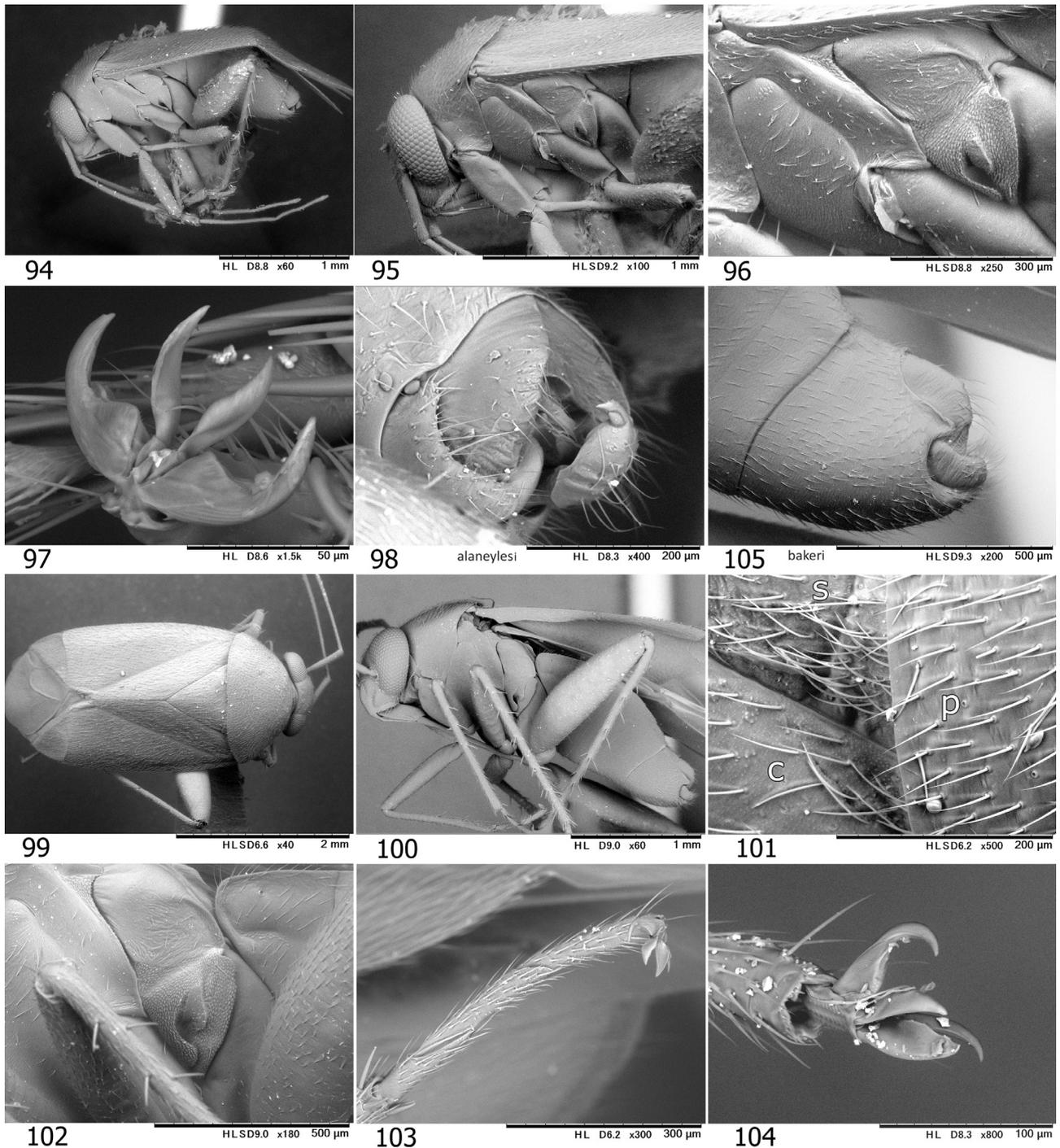
Lygus tainanensis: LECTOTYPE (designated by CARVALHO 1980): ♀, TAIWAN: TAINAN [City]: Feb 1909, H. Sauter (Fig. 67, without USIs, image examined; genitalia dissected by the second author, HNHM).

Additional material examined. More than 300 specimens (AMNH, BMNH, CNC, NIAES, NSMT, SNUK, TYCN) from the following localities. **JAPAN: KYUSHU:** Nagasaki City, Nomo, Kabashima; Kagoshima Pref., Yakushima & Tanegashima Islands – 1 ♂ from Nagasaki City, Nomo, Kabashima (32.5541, 129.7750; current northernmost locality) with USIs (AMNH_PBI 00380495). **TOKARA ISLANDS:** Takara-jima Is. **AMAMI-OSHIMA ISLAND:** Amami City, Kasari City, Tatsugo Town. **OKINAWA ISLAND:** Ginowan City, Kunigami Village, Motobu City, Nago City, Naha City, Chinen Peninsula. **ISHIGAKI ISLAND:** Ban'n Park, Hirakubo, Hirano, Itona, Kabira, Kuura, Miwa, Nosoko, Omoto, Sakie, Takeda. – 1 ♂ from Ishigaki Island Miwa (24.39, 124.21), with USIs (AMNH_PBI 00380496). **IRIOMOTE ISLAND:** Funaura, Haemida, Komi, Mombanare, Ohara, Otomi, Shirahama, Uehara. **HATERUMA ISLAND:** Buribichi Park. **YONAKUNI ISLAND:** Urabe-dake. **CAMBODIA:** Siem Reap. **LAOS:** Vientiane. **PHILIPPINES: LUZON:** Los Banõs; Negros, Camp Lookout, Dumaguete; Visayas, Panay Island, Iloilo City. **TAIWAN: PINTUNG:** Hengchun (22.00, 120.45), 1 ♂ with USIs (AMNH_PBI 00380497); Manchu (22.02211, 120.8443). **TAINAN:** Tainan Agriculture Research Station. **THAILAND: CHIANG MAI:** Doi Pui area. **NAKHON RATCHASIMA:** Wang Nam Khiao. **NAKHON NAYOK:** Sarika. – 1 ♂ from Nakhon Ratchasima with USIs (AMNH_PBI 00380498).

Measurements (in mm). ♂/♀: Total length of body 3.20–3.65 / 3.50–4.10; head width including eyes 0.96 / 1.02; vertex width 0.28–0.29 / 0.37–0.38; lengths of antennal segments I–IV 0.48, 1.77, 0.90, 0.48 / 0.47, 1.55, 0.90, 0.54; labial length 1.38 / 1.50; mesal length of pronotum including collar 0.77 / 0.90; basal width of pronotum 1.35 / 1.62; maximum width across hemelytron 1.50 / 1.80; and lengths of metafemur, tibia and tarsus 1.58, 2.28, 0.57 / 1.73, 2.40, 0.53.

Differential diagnosis. Recognized by moderate size (3.2–4.1 mm); pale green general colouration, usually with reddish fasciae on hemelytron (Figs 78–79, but hemelytron sometimes widely pale as in Figs 63, 66); reddish brown metafemur (Fig. 56); developed pygophoral spine (Fig. 126); elongate, not bifurcate hypophysis of left paramere; and long hair-like spinules on endosoma (Fig. 128). Distinguished readily from the preceding *A. alaneylesi* sp. nov. by significantly larger size and reddish metafemur.

Biology. This polyphagous mirid is associated with inflorescences of various dicots, such as Amaranthaceae, Anacardiaceae, Araliaceae, Asteraceae, Euphorbiaceae, Fabaceae, Fagaceae, Oleaceae, Rutaceae and Sabiaceae (YASUNAGA 2001); the immature forms were also confirmed on *Rhus javanica* L. (Simaroubaceae), *Mallotus* spp. (Euphorbiaceae), *Meliosma arnottiana* (Wight) Walp. (Sabiaceae), *Zanthoxylum ailanthoides* Siebold & Zucc. (Rutaceae). Some individuals were found to feed on crops, cucumber, eggplant, mango or papaya. A multivoltine cycle is assumed for *Anthophilolygus bakeri*; in subtropics and tropics, the adults are collected almost throughout a year. The adults are frequently attracted to UV lights, and occasionally hundreds of individuals were observed to visit light trap screens at night. Both adults and immature forms of *Anthophilolygus bakeri* comb. nov. are found dominantly on inflorescences



Figs 94–105. Scanning electron micrographs for *Anthophilolygus* species. 94–98 – *A. alaneylesi* sp. nov., ♂: 94 – left lateral surface; 95 – head and thorax, left lateral view; 96 – scent efferent system; 97 – pretarsus (hind leg); 98 – apical part of pygophore. 99–105 – *A. bakeri* (Poppius, 1915): 99 – ♀, dorsal surface; 100 – ♂, left lateral surface; 101 – ♀ dorsal vestiture (c: corium, p: pronotum, s: scutellum); 102 – ♂, scent efferent system; 103 – ♂, metatarsus; 104 – ♀, pretarsus (hind leg); 105 – pygophore, left lateral view.

of various dicots, evergreen broadleaf trees in particular; this taxon does not appear to be host plant specific, presumably utilizing pollen and/or honey dew as a major diet component. **Distribution.** Japan (Kyushu, Bonin Islands, Ryukyus) (YASUNAGA & TAKAI 2014), Taiwan (almost whole country except for central highlands) (POPPIUS 1915 and present records), Philippines (Luzon, Negros, Visayas) (POPPIUS 1915; new record for Visayas), Cambodia (Siem Reap) (new record), Laos (Vientiane) (new record), Thailand

(Chaiyaphum, Chiang Mai, Nakhon Nayok, Nakhon Ratchasima) (new records).

This widespread mirid has presumably been introduced to some Japanese subtropical islands (YASUNAGA 2001), and is recently expanding its distribution northward in Japan, probably due to the global warming (YASUNAGA & TAKAI 2014).

Comments. Colouration is variable (reddish pattern on dorsum in particular). There are a few more unidentified

congeners (with darker and larger dorsal maculae) in the Oriental Region (cf. Fig. 81); *A. bakeri* is generally paler than those mirids, with smaller dorsal maculae or fasciae.

POPPIUS (1915) described *Lygus tainanensis* [later transferred to *Polygus* by SCHWARTZ & KERZHNER (1997)] from Taiwan, comparing it only with *L. matsumurae* Poppius, 1915 [placed in *Neolygus* by LU & ZHENG (1998b)]. POPPIUS (1915) did not mention its similarity to *Lygus bakeri*, although pale female specimens of *L. bakeri* (Figs 58, 66 right) are nearly impossible to be distinguished from *L. tainanensis* (Fig. 67). Based on the great similarity in habitus and female genitalia (cf. SCHWARTZ & KERZHNER 1997: Figs 33–34), both species are regarded to be conspecific, and what was described as *L. tainanensis* is apparently a pale variant of *L. bakeri*, one of the most common mirids in Taiwan. Accordingly, a new synonymy is proposed: *Anthophilolygus bakeri* (Poppius, 1915) = *Polygus tainanensis* (Poppius, 1915), syn. nov.

Both specific names were published simultaneously by POPPIUS (1915) and have been impartially treated by subsequent authors in 20th century (CARVALHO 1959, 1980; SCHUH 1995; SCHWARTZ & KERZHNER 1997; KERZHNER & JOSIFOV 1999). We presently select *L. bakeri* as valid name.

Apolygopsis Yasunaga, Schwartz & Chérot, 2002

Apolygopsis Yasunaga, Schwartz & Chérot, 2002: 3 (new genus), type species by original designation: *Apolygopsis fuvocarinatus* Yasunaga, Schwartz & Chérot, 2002: 4.

Diagnosis. Body oval, relatively rounded, usually small in size (3.0–4.5 mm); basic colouration brown, red, or fuscous, not greenish; dorsal surface shining, with uniformly distributed, pale, simple, semierect setae. Head vertical; vertex carinate basally, without longitudinal sulcus; frons almost smooth; apical part of clypeus usually infuscate. Punctuation on pronotal disk relatively sparse and shallow; calli often darkened. Labium reaching apex of mesocoxae. Scutellum almost flat. Metatibial spines black, prominent, stout, arising from black spots. Left paramere sensory lobe weakly developed, always lacking an associated lamellate and toothed process; hypophysis hooked and somewhat widened, with two subapical processes — one (on ventral or anterior margin) small, short, slightly curved and pointed, whereas the other (on dorsal or posterior margin) rounded. Right paramere stout, with a short, often pointed hypophysis. Endosoma with paired, long, slender spiculi originated from endosomal bottom, sheathed within a thin, basal trough-shaped sclerite, lacking any sclerite associated with secondary gonopore nor needle-shaped sclerite (*sensu* YASUNAGA 1991). Bursa copulatrix with sclerotized rings elongate ovoid, relatively large, connected by a transversal sclerite medially. Posterior wall lacking dorsal structure; interramal lobe small, rounded, spinulate; lateral lobe usually widened, connected by a small, protruding spinulate sclerite.

Distribution. Known from the Oriental and eastern Palearctic Regions.

Discussion. *Apolygopsis* Yasunaga, Schwartz & Chérot, 2002 and *Apolygus* China, 1941 are externally very similar to each other, but members of the former usually have

an uniformly brownish, reddish or fuscous colouration (currently no greenish species known, cf. Fig. 86) and smaller-sized, more tumid body. The best characters to distinguish *Apolygopsis* from *Apolygus* are found in the male genitalia (cf. Figs 170–173); specifically, the apical prong of left paramere and the two long, slender, basally fused spicules sheathed within a trough-shaped sclerite are unique to *Apolygopsis* (SCHWARTZ & CHÉROT 2005, YASUNAGA et al. 2002).

Apolygopsis eoa (Poppius, 1915) comb. nov.

(Fig. 72)

Lygus eous Poppius 1915: 27 (original description).

Apolygus eous: LU & ZHENG (1998b): 186 (new combination); KERZHNER & JOSIFOV (1999): 63 (catalog); ZHENG et al. (2004): 146 (diagnosis).

Type material examined. HOLOTYPE: ♂, TAIWAN: Fuhosho, Formosa [currently Nantou City], 7 Sep, H. Sauter (without USIs, image examined, DEIC, Fig. 72).

Distribution. Taiwan (Nantou) (POPPIUS 1915).

Comments. Although LU & ZHENG (1998b) placed this Taiwanese species in *Apolygus*, images of the holotype suggest it is more evidently related to some representatives of *Apolygopsis*, particularly *A. nigrifula* (Linnavuori, 1963) in overall appearance. Comparing with *A. nigrifula* (Fig. 85), the holotype of *A. eoa* (Fig. 72) differs only in being smaller in size and has the base of antennal segment II pale. Accordingly, *Lygus eous* is transferred from *Apolygus* to *Apolygopsis*. The significantly small size and reddish brown tibial spines of this mirid also confirm its placement in *Apolygopsis*. Measurements of the male was given by ZHENG et al. (2004): Body length 3.71, maximum width 1.75; width of head across eyes 0.91; vertex width 0.27; lengths of antennal segment I 0.51, II 1.32, III 0.80; pronotum length 0.86; and pronotal width 1.49.

Apolygopsis fuhoshoensis

(Poppius, 1915) comb. nov.

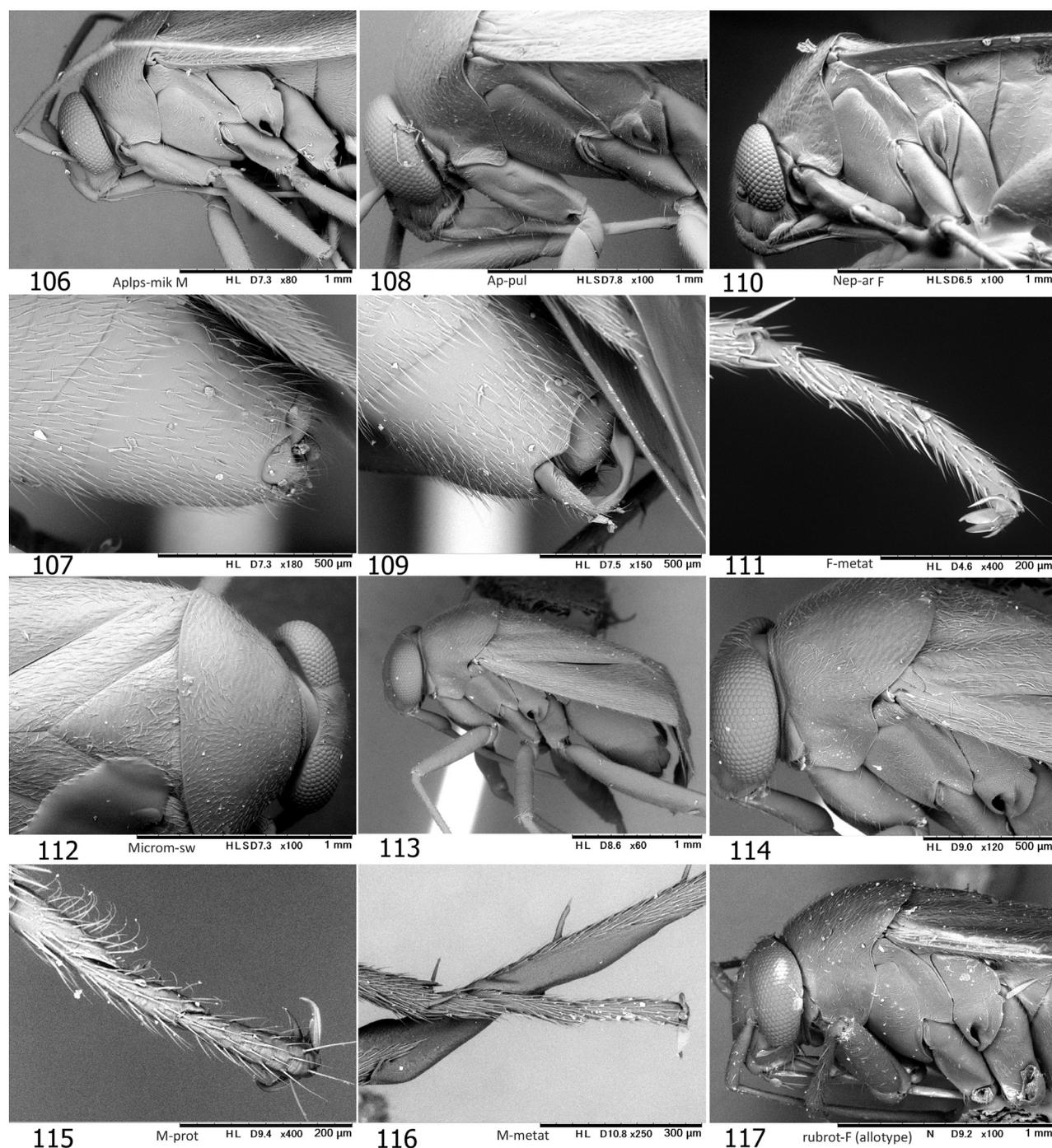
Lygus fuhoshoensis Poppius, 1915: 27 (original description).

Apolygus fuhoshoensis: LU & ZHENG (1998b): 188 (new combination); KERZHNER & JOSIFOV (1999): 63 (catalog); ZHENG et al. (2004): 149 (diagnosis).

Type material examined. HOLOTYPE: ♂, TAIWAN: Fuhosho, Formosa [currently Nantou City], 7 Sep, H. Sauter (without USIs, image examined, DEIC).

Distribution. P. R. China (Yunnan) (ZHENG et al. 2004), Taiwan (Nantou) (POPPIUS 1915).

Comments. As in *Apolygopsis eoa* based on the small size, brown tibial spines and two long processes at apex of right paramere in the holotype (images available from <http://twinssectype.nmns.edu.tw/specimen/?id=NMNS-SDEI-00185>), *Lygus fuhoshoensis* should also be placed in *Apolygopsis*, instead of *Apolygus*. This species can be distinguished from *A. eoa* by the pale brown general colouration and uniformly pale cuneus. Measurements were provided by ZHENG et al. (2004): Body length 3.92, maximum width 1.71; width of head across eyes 0.85; vertex width 0.25; lengths of antennal segment I 0.50, II 1.30, III 0.83, IV 0.43; pronotum length 0.86; and pronotal width 1.49.



Figs 106–117. Scanning electron micrographs for species of the *Lygus* complex. 106–107 – *Apolygopsis mikioi* Yasunaga & Schwartz, 2012, ♂ (Nagasaki, Japan): 106 – head and thorax, left lateral view; 107 – pygophore, left lateral view. 108–109 – *Apolygus pulchellus* (Reuter, 1906), ♂ (Nagasaki, Japan): 108 – head and thorax; 109 – pygophore. 110–111 – *Nepiolygus arare* Yasunaga, Schwartz & Chérot, 2002, ♀ (Ishigaki Island, Japan): 110 – head and thorax; 111 – metatarsus. 112–116: *Micromimetus sunweni* sp. nov., ♂ (Lanyu Island, Taiwan): 112 – dorsal surface; 113–114 – left lateral surface; 115 – protarsus; 116 – metatarsus. 117 – *Micromimetus rubrotinctus* (Carvalho, 1956), allotype ♀, left lateral surface.

***Apolygopsis nigra* (Poppius, 1915) comb. nov.**

(Figs 71, 83–84, 131–135)

Lygus niger Poppius, 1915: 35 (original description).

Lygus niger: SCHUH (1995): 818 (catalog).

Prolygus niger: SCHWARTZ & KERZHNER (1997): 253 (new combination);

KERZHNER & JOSIFOV (1999): 173 (catalog); ZHENG et al. (2004): 563 (diagnosis, key).

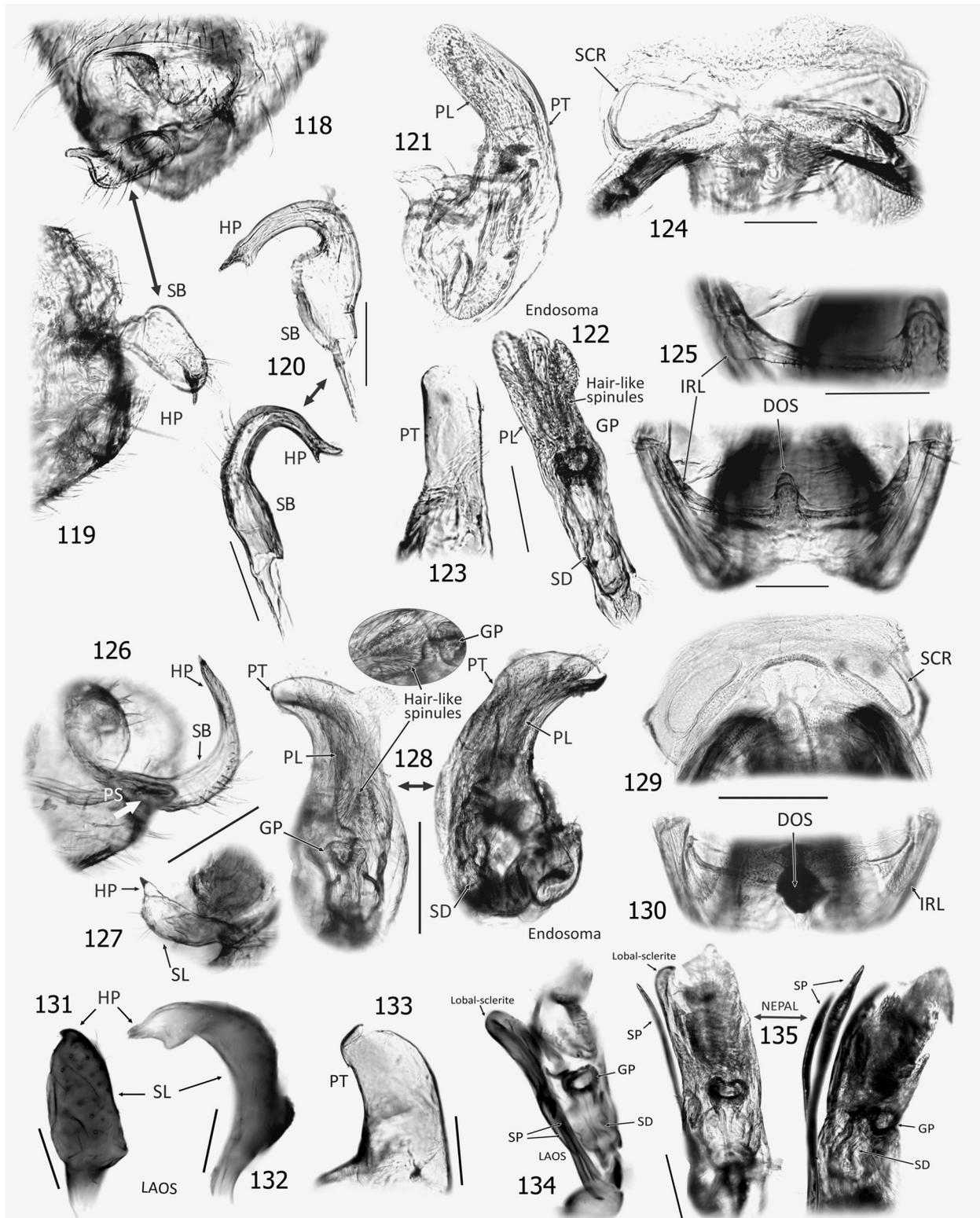
Type material examined. LECTOTYPE: ♀, TAIWAN: Formosa, Taihorrinsho [= currently Dalin of Kagi County], 7 Nov 1909, H. Sauter (Fig. 71, without USIs, image examined).

Additional specimens examined. NEPAL: KATHMANDU VALLEY: Sarmakhusi, Gongabu, 27°43'59.5"N, 85°18'49"E, 1,300 m, UV light trap, 15 Jun 2005, T. Yasunaga, 1 ♂ (TYCN) (AMNH_PBI 00380506); Swayambhu, Natural History Museum Garden, 27°42'52.8"N, 85°17'13.5"E, 1,350 m, on *Lantana* flowers, May–July 2005, T. Yasunaga, 3 ♂♂ 3 ♀♀ (NMTU, TYCN). THAILAND: CHAIYAPHUM: Chulabhom-dam, 16.5346, 101.6421, UV light trap, 16 Apr 2013, T. Yasunaga, 2 ♀♀ (TYCN). NAKHON RATCHASIMA: Wang Nam Khieo, Sakaerat Environmental Research Station, 14°30'27"N, 101°55'39"E, 410 m alt., sweeping inflorescence of broadleaf, 24 Jan 2009, T. Yasunaga, 1 ♂ (TYCN) (AMNH_PBI 00380507); same locality, UV light trap, 23 Mar 2014, T.

Yasunaga, K. Yamada, 1 ♂ 2 ♀♀ (TYCN); same data, except for date 12–14 Jun 2009, T. Yasunaga, K. Yamada, 2 ♀♀ (TYCN).

Redescription. Male. As in female, not sexually dimorphic, but somewhat smaller and narrower. Body small, ovoid, 3.08–3.29 mm. COLOURATION: Generally fuscous; head

pale orange-brown; vertex with an obscure, small spot near inner margin of eye. Antenna dark brown, except for segment I and basal half of II pale brown. Pleura fuscous, except for scent efferent system creamy yellow. Hemelytron uniformly black, membrane including veins dark smoky brown. Legs



Figs 118–135. Male (118–123, 126–128, 131–135) and female (125–126, 129–130) genitalia of *Anthophilolygus* spp. (118–130) and *Aplygopsis nigra* (Poppius, 1915) (131–135: 131 – right paramere; 132 – left paramere; 133 – phallosome; 134–135 – endosoma). 118–125 – *A. alanylesi* sp. nov.: 118–119 – apex of pygophore with right paramere, dorsal (118) and left lateral (119) view; 120 – left paramere; 121 – aedeagus; 122 – phallosome; 123 – endosoma; 124 – bursa copulatrix, dorsal view; 125 – posterior wall; 126–130 – *A. bakeri* (Poppius, 1915): 126 – apex of pygophore with left paramere, 127 – right paramere; 128 – aedeagus; 129 – bursa copulatrix, dorsal view; 130 – posterior wall. Scale bars 0.2 mm (0.1 mm for 118–125).

creamy yellow; profemur and protibia pale orange-red; metafemur with two dark, narrow rings at apex; tibial spines dark brown. SURFACE AND VESTITURE: Dorsal surface shiny, with uniformly distributed, silky, semierect setae. Pronotum finely and sparsely punctate. Hemelytron uniformly shiny. Tibial spines prominent. STRUCTURE: Vertex carinate basally. Pronotal collar about as thick as basal transverse carina of vertex; scutellum weakly swollen. Hemelytron declivous at cuneal fracture. GENITALIA (Figs 131–135): Left paramere C-shaped, tumid throughout, with hypophysis weakly produced apically, lacking elongate branch (Fig. 132); right paramere short, tumid, with tiny, hooked hypophysis (Fig. 131). Endosoma with distinct paired spiculi originated from endosomal bottom and broad, spatula-like lobal-sclerite; secondary gonopore thick-rimmed (Fig. 134).

Measurements (in mm). ♂/♀: Total length of body 3.08–3.29 / 3.18–3.43; head width including eyes 0.89–0.91 / 0.88–0.89; vertex width 0.30 / 0.33; lengths of antennal segments I–IV 0.42, 1.29, 0.60, 0.45 / 0.43–0.45, 1.30–1.31, 0.67–0.68, 0.49–0.50; labial length 1.26 / 1.23; mesal length of pronotum including collar 0.75 / 0.75; basal width of pronotum 1.23–1.24 / 1.29; maximum width across hemelytron 1.38 / 1.50; and lengths of metafemur, tibia and tarsus 1.35, 1.75, 0.45 / 1.35, 1.85, 0.44.

Differential diagnosis. Readily recognized by its largely fuscous body, small size, and contrastingly creamy yellow femora (except for pale red-orange profemur and pale orange-brown head) (Figs 83–84). No other known congener exhibits such distinct colouration; but final instar nymph (possibly fitting this taxon) is almost entirely whitish yellow-green, as in that of *A. mikioi* Yasunaga & Schwartz, 2005. Further descriptions were provided by POPPIUS (1915) for external morphology and by SCHWARTZ & KERZHNER (1997) for female genitalia.

Biology. Most of specimens were collected using UV light traps. Several specimens were taken on inflorescence of *Lantana* sp. (Verbenaceae) and some unidentified broadleaf angiosperms.

Distribution. Laos (Bolikhamsai) (new record), Malaysia (Perak) (new record), Nepal (Kathmandu Valley) (new record), Philippines (POPPIUS 1915), Taiwan (POPPIUS 1915), Thailand (Chaiyaphum, Nakhon Ratchasima) (new records).

Comments. SCHWARTZ & KERZHNER (1997) provisionally placed this species in *Prolygus*, based on the female genitalia; no male specimen was available and the genus *Apolygopsis* had not yet been established. The present examination on the male genitalia suggests that it is evidently a member of *Apolygopsis*, and a new combination is accordingly proposed. The male is also documented for the first time. This species is easily distinguished from other known congeners by the entirely fuscous, shiny body with contrastingly creamy yellow meso- and metafemora. *Apolygus furvus* (Kerzhner, 1972) and high-summer variant of *Apolygopsis nigrifula* (Linnavuori, 1963) sometimes exhibit similar (almost uniformly fuscous) color pattern, but these taxa have much larger body (more than 4.5 mm), always pale median part of cuneus and pale brown metafemur with a few obscure rings apically.

Micromimetes Eyles, 1999

Micromimetes Eyles, 1999: 346 (original description), type species by original designation: *Micromimetes pictipes* Eyles, 1999.

Micromimetes: SCHUH (2013) (online catalog).

Diagnosis. Recognized primarily by its small size (total length 3.3–4.0 mm, max width 1.4–1.9 mm); widely brown to fuscous basic colouration (ventral surface usually yellowish); dorsal surface weakly shining, partly reddish or (in some species widely) yellowish, with densely distributed, silvery, reclining setae intermixed with dark, simple setae (silvery setae easily rubbed off during preservation); weak, shallow punctures on dorsum; light colored, long antenna, often longer than body; long, slender labium reaching or slightly exceeding apex of metacoxa; shiny pronotum more or less darkened (sometimes with fascia) posteriorly; rather large scent efferent system, with posterior margin of evaporative area notched; pale tibiae with reddish to dark brown, prominent spines; each tarsomere III subequal in length to II, much longer than I, with sharp, rather slender parempodia; developed pygophoral spine; rudimental hypophysis of right paramere; and bilobate endosoma with primary lobe subdivided into 3–4 lobules and bearing a lobal-sclerite from aperture of secondary gonopore; cylindrical seminal duct not expanded apically. Additional diagnostic characters including female genitalia were provided by EYLES (1999).

Distribution. Currently known fragmentarily from Mariana Islands, Cook Island and Taiwan (tropical Lanyu Island); however, its distribution range is anticipated to extend more widely into the Asia-Pacific Region.

Discussion. Several Oriental-Pacific members of *Lygus*-complex should apparently be transferred into *Micromimetes*, especially the Oceanian *Lygus* fauna, including *Lygus kusaiensis* Carvalho, 1956 and *L. dybasi* Carvalho, 1956 described by CARVALHO (1956). It will be the topic of future work. Herein we propose a new species of *Micromimetes* from Taiwan and a new combination for *Lygus rubrotinctus* (Carvalho, 1956) in *Micromimetes*.

Micromimetes rubrotinctus (Carvalho, 1956)

comb. nov.

(Figs 59, 117)

Lygus rubrotinctus Carvalho, 1956: 91 (original description).

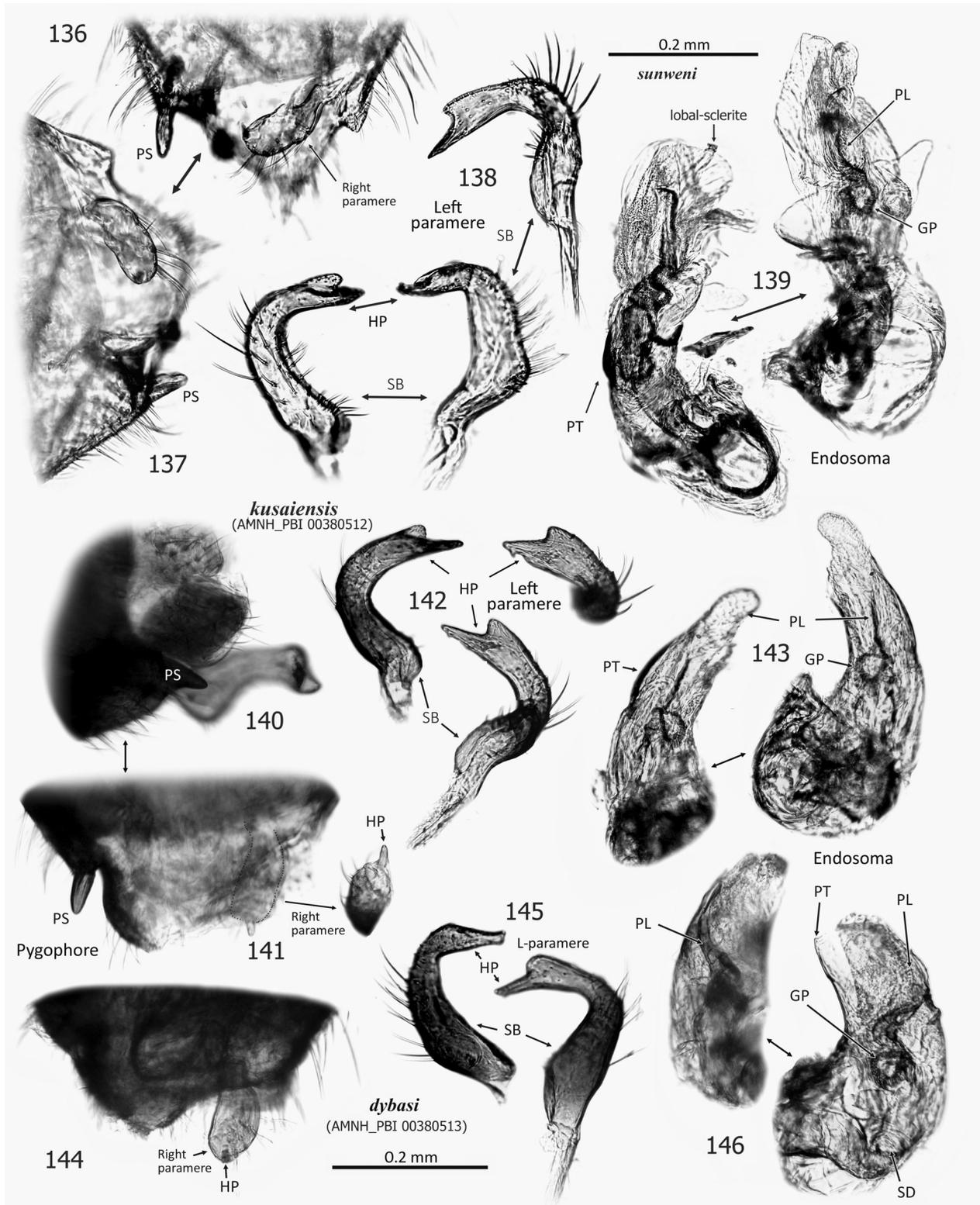
Distribution. Mariana Islands (Saipan) (CARVALHO 1956).

Comments. We could only access the allotype female (KUEC, AMNH_PBI 00380514, Fig. 59), which has a generally pale reddish, small, ovoid body (total length 3.05 mm, maximum width 1.41 mm). According to illustrations of the male genitalic structures (CARVALHO 1956), the endosoma has the primary lobe weakly sclerotized and secondary lobe elongate, sclerotized. Our examination of the thoracic pleura including scent efferent system by a SEM (Fig. 117) also suggests an apparent similarity between *M. rubrotinctus* and the following Taiwanese species. The evidence suggest that this taxon probably belongs to *Micromimetes*.

We additionally examined two relevant specimens — a male paratype of *Lygus kusaiensis* Carvalho, 1956 (Figs

140–143) and a male from Republic of Palau, with a paratype label and another label with the manuscript name '*Lygus yapensis*' handwritten by Carvalho (Fig. 58). Using the species key in CARVALHO (1956, p. 83) the pale apex of antennal segment II, dark apical cuneal mark, uniformly dark pronotum, mostly dark dorsum, and tibial spines without

dark basal spots allows us to determine the latter male as *L. dybasi* Carvalho, 1956. The male genitalia (Figs 144–146) also matches the illustrations in CARVALHO (1956, figs 50e–g) for this species. However the collecting information "Babeldaob: Ngarard 17.viii.1939 Teiso Esaki" is not among the paratypes listed in the original description of *L. dybasi*.



Figs 136–146. *Lygus* complex, male genitalia. 136–139 – *Micromimetes sunweni* sp. nov.: 136–137 – apex of pygophore with right paramere, dorsal (136) and left lateral (137) view; 138 – left paramere; 139 – endosoma; 140–143 – *Lygus kusaiensis* Carvalho, 1956: 140 – pygophoral spine, dorsal view; 141 – apex of pygophore with right paramere; 142 – left paramere; 143 – endosoma; 144–146 – *L. dybasi* Carvalho, 1956: 144 – apex of pygophore with right paramere; 145 – left paramere; 146 – endosoma.

***Micromimetes sunweni* sp. nov.**

(Figs 60–61, 112–116, 136–139)

Type material. HOLOTYPE: ♂, TAIWAN: TAITUNG: Lanyu Island, 22.05, 121.53, 7–10 Aug 2000, C. S. Lin & W. T. Wang (AMNH_PBI 00380619) (NMNS, No. 3443-1009). PARATYPES: TAIWAN: same data as for holotype, 4 ♂♂ 1 ♀ (NMNS).

Description. Male. Body ovoid, slightly elongate, medium-sized compared to congeners, 3.38–3.70 mm. COLOURATION: Body generally yellow brown, partly darkened (proportion of yellowish areas greater than dark areas). Head pale castaneous; clypeus fuscous. Antenna pale brown, segments I and II partly or narrowly infusate; III and IV dark brown. Labium yellowish brown, partly tinged with red, apex of segment IV fuscous. Pronotum somber ochreous, with a distinct dark fascia posteriorly; scutellum yellow; pleura almost uniformly yellow brown. Hemelytron yellowish brown, slightly tinged with red; inner and posterior parts of corium, and posterior 0.50–0.66 of clavus darkened; cuneus entirely pale; membrane pale grayish brown, semitransparent, partly narrowly obscured along veins. Coxae and legs yellow brown; apical part of metafemur sometimes with obscure, irregular rings; tibia without spot at base of spine; tibial spines reddish brown. Abdomen ochreous. SURFACE AND VESTITURE: Dorsum with uniformly distributed, pale, reclining setae intermixed with silvery, recumbent setae. Pronotum weakly and shallowly rugose. Abdomen shiny. STRUCTURE: Vertex carinate basally. Antennal segments III and IV filiform. Labium slightly exceeding apex of metacoxa. Pronotal collar slightly narrower than basal carina of vertex; scutellum flat; ostiolar peritreme rather large (Fig. 114). Pempodia narrow, rhombic, with sharp apex. GENITALIA (Figs 136–139): Pygophore with a prominent PS (Fig. 136). Parameres small, slender; left paramere C-shaped, with sensory lobe not strongly inflated (Fig. 138); hypophysis with a single, elongate process; right paramere ovoid, with tiny hypophysis; endosoma with short primary lobal-sclerite from secondary gonopore aperture (PL) connecting to distal, bifurcate sclerite and with a thin, secondary lobal-sclerite (SL); seminal duct not expanded apically (Fig. 139).

Female. Larger than male, otherwise similar; length 3.99 mm. GENITALIA: Not examined.

Measurements (in mm). ♂/♀: Total length of body 3.38–3.70 / 3.99; head width including eyes 0.93–0.96 / 1.05; vertex width 0.28–0.29 / 0.36; lengths of antennal segments I–IV 0.60–0.62, 1.65–1.70, 1.14, 0.60 / 0.59, 1.50, 0.95, 0.60; labial length 1.51–1.62 / 1.59; mesal length of pronotum including collar 0.73–0.77 / 0.84; basal width of pronotum 1.21–1.31 / 1.53; maximum width across hemelytron 1.41–1.56 / 1.80; lengths of metafemur, tibia and tarsus 1.51–1.58, 2.32–2.55, 0.58–0.60 / 1.62, 2.40, ? (missing).

Differential diagnosis. Recognized by its distinct yellow brown colouration; clear dark fascia on posterior pronotum (Fig. 60); yellow anterior clavus, lateral corium, entire scutellum and cuneus; almost wholly yellow brown ventral surface including legs; prominent pygophoral spine; generally slender parameres; shortened primary lobe on

endosoma. A combination of these characters and isolated distribution on Lanyu Island enable this new species to be distinguished from other known *Micromimetes* species (e.g., Figs 58–59).

Etymology. Named in honor of Sun Wen (1866–1925) [often called Sun Yat-Sen], known as ‘the Father of Nation’ and ‘Forerunner of the Revolution.’

Biology. Unknown.

Distribution. Taiwan (Lanyu Island).

***Miyamotolygus* gen. nov.**

Type species. *Lygocoris rufiflorum* Lu & Zheng, 1998, here designated.

Diagnosis. Distinguished from other superficially similar genera by the following combination of characters: generally pale green, ovoid body; two types (pale simple setae and sericeous setae) of dorsal vestiture; narrow but continuous basal carina of vertex; red stripe on lorum; uniformly linear antenna slightly shorter than body; darkened extreme apices of clavus, embolium and cuneus; broadly reddish brown metafemur; and unique shape of male and female genitalia.

Description. Male. Body ovoid, rather small to moderate in size (3.9–4.5). COLOURATION: Generally pale (somewhat olive) green, partly with brownish or reddish patterns (Figs 63, 88–89, 148). Maxillary plate with red stripe. Apices of clavus and scutellum dark or reddish brown; apex of embolium usually faintly darkened. Metafemur with apical 0.66 deep reddish brown; each tibia without dark spots at bases of spines; tibial spines dark or reddish brown. Ventral surface of abdomen partly or widely darkened (♂ in particular). SURFACE AND VESTITURE: Dorsal surface shining, with uniformly distributed, simple, silky, reclining setae, partly mixed with sericeous, reclining setae on mesoscutum, scutellum and hemelytron (Figs 63, 88–89, 148). Pronotum shiny, uniformly and shallowly punctate. STRUCTURE: Head vertical, short; vertex with continuous, narrow, basal transverse carina about as thick as antennal segment III. Antenna uniformly slender and linear, slightly shorter than body; segment II slightly longer than basal width of pronotum; segment IV slightly longer than I. Labium reaching or slightly exceeding apex of mesocoxa. Calli rather clearly demarcated from disc; collar slightly thicker than basal carina of vertex; scutellum weakly inflated mesally; hemelytron not strongly declivous at cuneal fracture. Metafemur relatively tumid; tarsomere III longer than I or II. GENITALIA (Figs 159–161): Pygophore weakly pointed at apex, lacking spine at base of left paramere. Left paramere (Fig. 160) with sensory lobe not developed basally; hypophysis with a small branch at apex; right paramere (Fig. 159) short, straight, about half as long as left one, with small, flattened hypophysis. Endosoma (Fig. 161) with long, flat primary lobal-sclerite (PL) and secondary lobal-sclerite (SL), densely furnished with noticeable hair-like spinules above heavy-rimmed secondary gonopore (GP); third lobe (TL) with sclerotized process apically and dentate sclerite at middle.

Female. As in male. GENITALIA (Figs 162–163): Bursa copulatrix rather heavily sclerotized (Fig. 162), with sclerotized structure; sclerotized rings thick-rimmed, large,

teardrop-shaped; posterior wall with median process, lacking dorsal structure; lateral lobe narrow, toughened with sclerotized dorsal margin; interramal lobe small, thick, triangular, spinulate; interramal sclerite wide (Fig. 163).

Etymology. Named in honor of the late Japanese heteropterist, Dr. Syoiti Miyamoto (1913–2010) (ISHIKAWA & HAYASHI 2012), combined with the mirine generic name *Lygus*; masculine.

Distribution. India (Darjeeling) (YASUNAGA et al. 2012), SW Japan (Kyushu) (new record), Nepal (YASUNAGA et al. 2012), P. R. China (Fujian, Guanxi, Shaanxi, Sichuan, Yunnan, Zhejiang) (LU & ZHENG 1998a, YASUNAGA et al. 2012, ZHENG et al. 2004), Taiwan (ZHENG et al. 2004), and N. Thailand (new record).

Discussion. *Miyamotolygus* is reminiscent of *Neolygus* (as the type species was described under this taxon), but the following characters clearly distinguish this new genus from *Neolygus*: Darkened extreme apices of clavus, embolium and cuneus (shared by *Anthophilolygus*); shorter labium slightly exceeding apex of mesocoxa; broadly reddish brown metafemur; apex of left paramere hypophysis with a lateral process (shared by *Apolygopsis*, *Micromimetes* and *Polygus*); endosoma with bundles of distinct hair-like spinules (Fig. 161); elongate, flattened endosomal primary (PL) and secondary (SL) lobal-sclerites (Fig. 161) that are not arising from cup-like endosomal base (Fig. 175, EDB); female bursa copulatrix with toughly sclerotized genital chamber (Fig. 162 vs. Fig. 176); posterior wall rather similar in general shape to that of *Apolygus*, with small, triangular interramal lobe and heavily sclerotized anterior margin of lateral lobe (Fig. 163 vs. Fig. 177). The similarities between the present new genus and *Neolygus* are considered only superficial.

As mentioned above, *Miyamotolygus* has some characters shared by *Anthophilolygus*, *Apolygus*, *Apolygopsis*, *Micromimetes* and/or *Polygus*. Currently, it seems difficult to elucidate the relationship of *Miyamotolygus* to these genera. Judging from sharing the pale green body with darkened extreme apices of clavus, cuneus and embolium, dark reddish brown apical part of metafemur, and presence of hair-like spinules on the endosoma, *Anthophilolygus* is presumed to be the closest taxon among known mirine genera. However, the definitive systematic position will depend on the acquisition of DNA sequence data.

In addition to the type species, two additional species originally described from continental China under *Neolygus* are also transferred here to *Miyamotolygus*.

***Miyamotolygus bui* (Lu & Zheng, 2004) comb. nov.**

Neolygus bui Lu & Zheng, 2004 in ZHENG et al. (2004): 387, 739 (original description).

Neolygus bui: YASUNAGA et al. (2012): 45 (diagnosis).

Distribution. India (Darjeeling) (YASUNAGA et al. 2012), Nepal (800–2,100 m alt.) (YASUNAGA et al. 2012), P. R. China (Shaanxi, Sichuan, Yunnan) (YASUNAGA et al. 2012, ZHENG et al. 2004), Taiwan (Kagi, Nantou) (ZHENG et al. 2004).

Comments. Detailed diagnostic characters and color habitus images were provided by YASUNAGA et al. (2012). The

male genitalia of this species at first sight resemble those of *Neolygus*, but the following characters admit placing it in our new genus: Spotted hemelytron, noticeably bicoloured metafemur, dark apex of cuneus; partly reddish head; reddish or chocolate brown apical part of metafemur; more or less darkened abdominal sternites; and endosoma with distinct primary and secondary lobal-sclerites but lacking proximal cup-like sclerite. *Miyamotolygus bui* is known to be associated with inflorescences of *Lantana* sp. (Verbenaceae) and *Mallotus* sp. (Euphorbiaceae).

***Miyamotolygus pictus* (Lu & Zheng, 2004)**

comb. nov.

Neolygus pictus Lu & Zheng, 2004 in ZHENG et al. (2004): 416, 751–753 (original description).

Distribution. P. R. China (Yunnan) (ZHENG et al. 2004).

Comments. As remarked by ZHENG et al. (2004), the general shape and genitalic structures of this Chinese species are very similar to those of *M. rufilorum*. Especially, the partly reddish color pattern and possession of a fully set of three lobal-sclerites on the endosoma positively support its placement in *Miyamotolygus*.

***Miyamotolygus rufilorum* (Lu & Zheng, 1998)**

comb. nov.

(Figs 62–63, 87–89, 147–152, 159–163)

Lygocoris (*Neolygus*) *rufilorum* Lu & Zheng, 1998a: 3 (original description).

Lygocoris (*Neolygus*) *rufilorum*: KERZHNER & JOSIFOV (1999): 116 (catalog).

Neolygus rufilori [incorrect subsequent spelling]: ZHENG et al. (2004): 418 (new combination, diagnosis, key).

Polygus near *tainanensis* (misidentification): NOZAKI et al. (2016): 80 (faunal list).

Material examined. **JAPAN:** KYUSHU: Kumamoto Pref., Amakusa City, Tsuruha-yama Park, 32.15, 130.04, sweeping inflorescence of *Rhus javanica*, 12 Sep 2015, T. Nozaki, 2 ♂♂ 2 ♀♀ (NIAES, TYCN) (1 ♂, AMNH_PBI 00380508). **TAIWAN:** KAGI: Fenchihui, 23.50, 120.69, 10. Apr 1965, T. Shirozu, 1 ♂ (TYCN) (AMNH_PBI 00380509). **NEPAL:** **KATHMANDU VALLEY:** Samakhusi, Gongabu, 27°43'59.5"N, 85°18'49"E, 1,300 m, UV light trap, 31 May 2005, T. Yasunaga 1 ♂ 1 ♀ (TYCN) (1 ♂, AMNH_PBI 00380510); Swayambhu, 27°43' N, 85°15' E, on flowers of broadleaf trees, 15 May 2005, T. Yasunaga, 1 ♂ 1 ♀ (TYCN); Bhaktapur, Balkot, 27.66, 85.37, 8 May 2006, *Ligustrum* inflorescence, T. Yasunaga & R. K. Duwal, 1 ♂ (NMTU). **THAILAND:** CHIANG MAI: Doi Chiang Khian, near Doi Suthep, 16–17 Nov 1989, T. Yasunaga, 1 ♂ (TYCN); Doi Pui, 1,400 m, 18.80, 98.80, 15 May 2001, S. Sakurai, 1 ♂ (TYCN) (AMNH_PBI 00380511).

Measurements (in mm). ♂/♀: Total length of body 3.95–4.18 / 4.45–4.50; head width including eyes 0.99–1.01 / 1.00–1.01; vertex width 0.25–0.29 / 0.31–0.32; lengths of antennal segments I–IV 0.51–0.53, 1.60–1.70, 0.67–0.78, 0.49–0.54 / 0.52–0.53, 1.66–1.68, 0.87, 0.49–0.50; labial length 1.47–1.55 / 1.50; mesal length of pronotum including collar 0.87–0.90 / 0.87; basal width of pronotum 1.48–1.52 / 1.60–1.61; maximum width across hemelytron 1.78–1.80 / 1.95; and lengths of metafemur, tibia and tarsus 1.63–1.65, 2.25–2.33, 0.45–0.50 / 1.65, 2.40, 0.48.

Differential diagnosis. Recognized by generally pale green, ovoid body; red stripe on maxillary plate; dark or reddish apices of clavus and cuneus; and unique shape

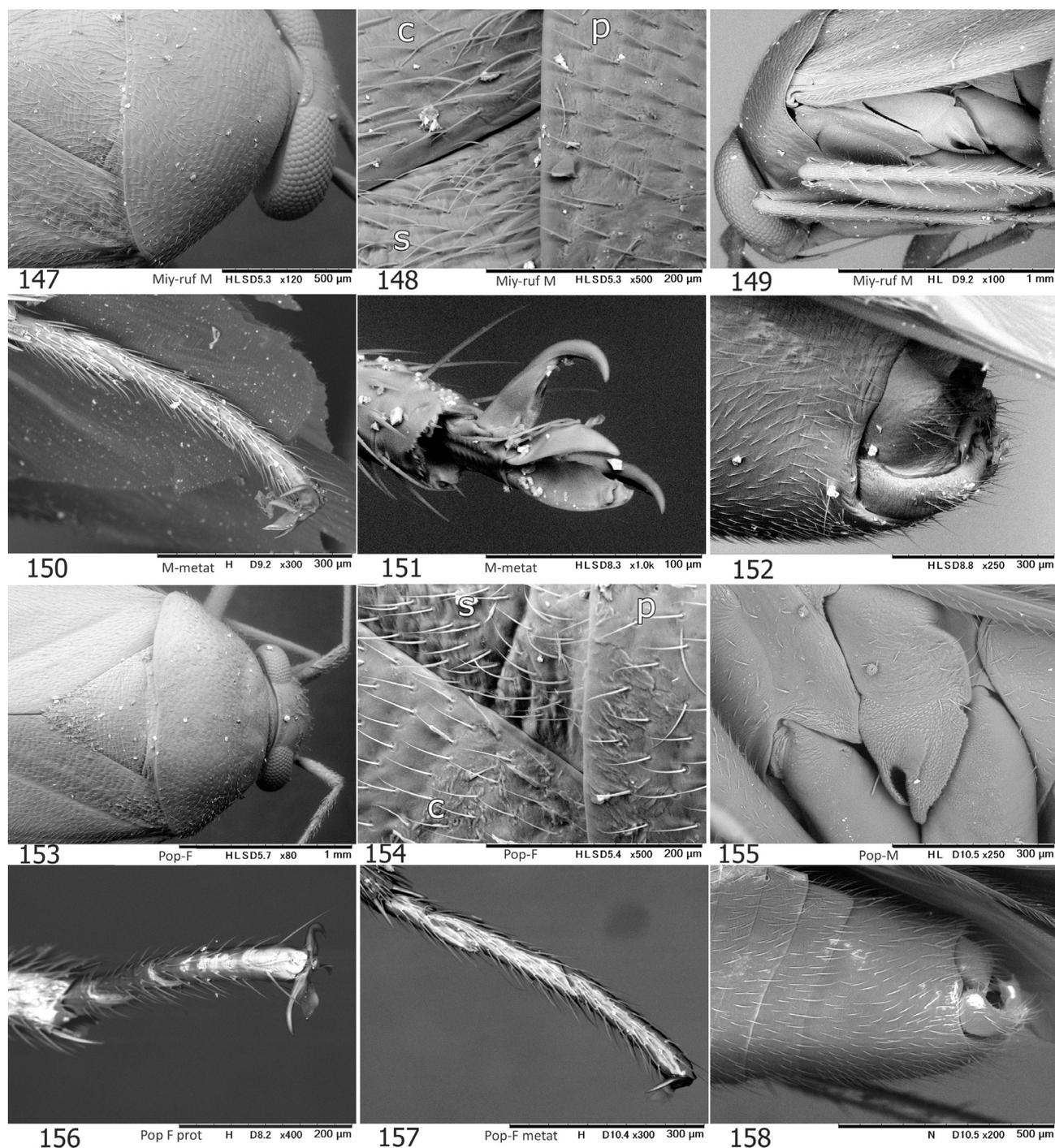
of male and female genitalia as in generic description. Detailed description of external structure was provided by LU & ZHENG (1998a). This mirine may be confused with *Anthophilolygus bakeri* (pale individual as in Fig. 57), *Apolygus spinolae* (Meyer-Dür, 1841) or *Taylorilygus apicalis* (Fieber, 1861), from which *M. rufilorum* can be readily distinguished by maxillary plate with red stripe.

Biology. This mirid has been collected by UV-lighting as well as sweep-netting inflorescences of various broadleaf angiosperms. Teneral adults were collected by sweep-netting inflorescence of *Rhus javanica* L. (Anacardiaceae)

which is presumed to be a breeding host as some teneral adults co-occurred (Nozaki, personal communication). One generation per year is assumed for populations in temperate climatic zones (Kyushu, Japan and Kathmandu Valley, Nepal).

Distribution. Japan (Kyushu) (new record), Nepal (Kathmandu Valley) (new record), P. R. China (Fujian, Guanxi, Yunnan, Zejiang) (LU & ZHENG 1998a), Taiwan (Kagi) and Thailand (Chiang Mai) (new records).

Comments. This unique mirine was recently reported from Kumamoto, Japan as '*Prolygus* near *tainanensis*' (NOZAKI et

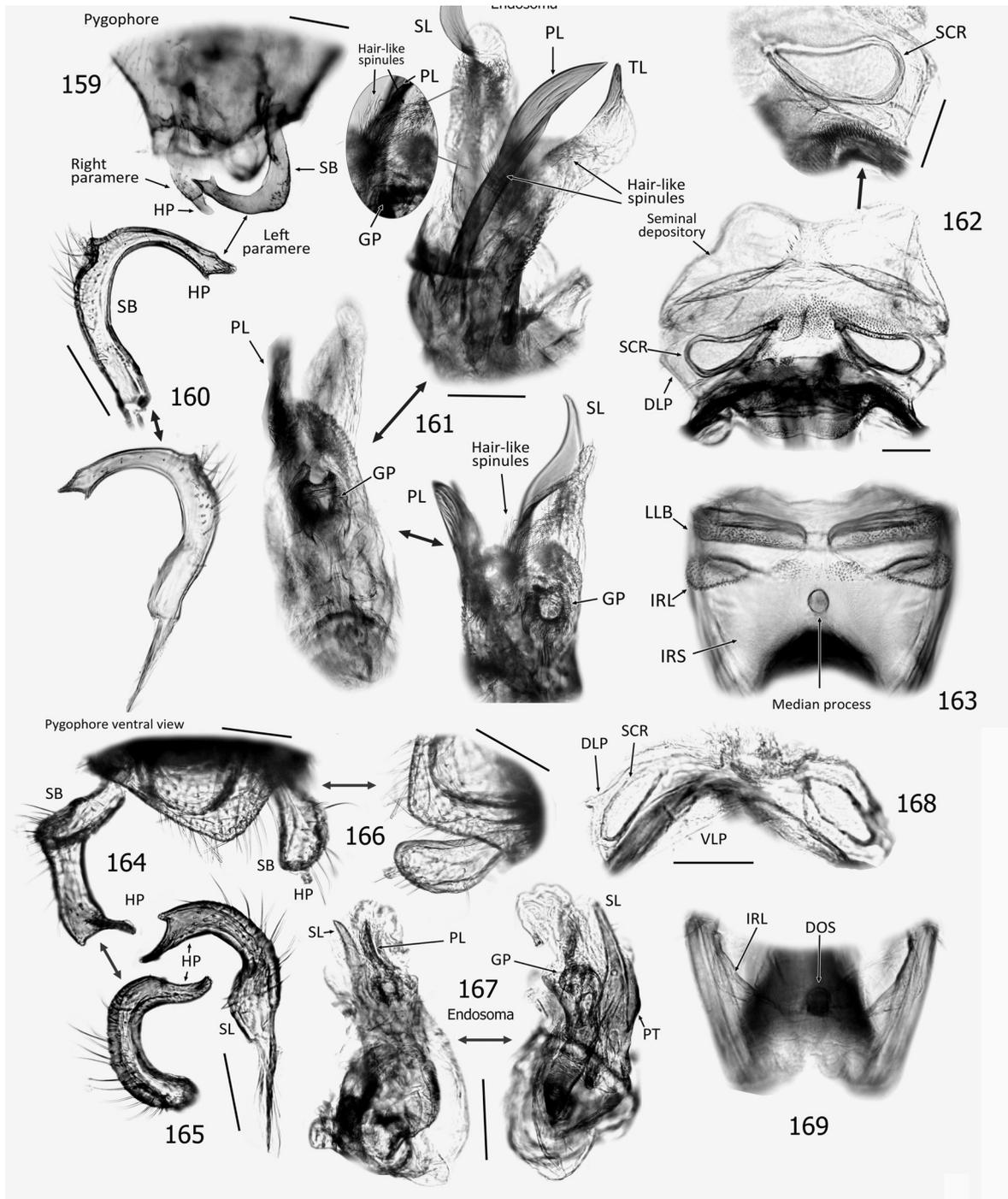


Figs 147–158. Scanning electron micrographs for *Miyamotolygus rufilorum* (Lu & Zheng, 1998) (147–152) and *Poppiolygus bengalicus* (Reuter, 1885) (153–158). 147, 153 – head and thorax, dorsal view; 148, 154 – dorsal vestiture pattern (c: corium, p: pronotum, s: scutellum); 149 – head and thorax, left lateral view; 150, 157 – metatarsus; 151 – pretarsus (hind leg); 152, 158 – pygophore, left lateral view; 155 – scent efferent system; 156 – protarsus.

al. 2016) based on the image available on the NMNS website (Fig. 65). But subsequent closer examination of specimens offered by Nozaki finally made it possible to elucidate the identity of *Prolygus tainanensis* (actually the junior synonym of *Anthophilolygus bakeri*) and proper generic placement for *Miyamotolygus rufilorum*. This small misidentification, which produced unexpected, bigger findings, was a starting point of this lengthy paper. We encourage many more investigations on basic faunas by such enthusiastic amateur researchers (e.g., NOZAKI et al. 2015, 2016), although we are

not certain how to draw the borderline between amateur and professional entomologists.

The female of *Miyamotolygus rufilorum* (Fig. 63) superficially quite resembles pale variant of *Anthophilolygus bakeri* (Fig. 54). The male of the former can rather easily be distinguished from the latter by the red stripe on maxillary plate and uniformly pale scutellum and anterior hemelytron that lack dark fascia; in female, the former has the red stripe on the maxillary plate. Usually, *M. rufilorum* is larger than *A. bakeri*.



Figs 159–169. Male (159–161, 164–167) and female (162–163, 168–169) genitalia of *Miyamotolygus rufilori* (Lu & Zheng, 1998) (159–163) and *Poptolygus bengalicus* (Reuter, 1885) (164–169). 159 – apex of pygophore with parameres, ventral view; 160, 165 – left paramere; 166 – right paramere; 161, 167 – aedeagus; 162, 168 – bursa copulatrix, dorsal view; 163, 169 – posterior wall, anterior view; 164 – apex of pygophore with parameres, dorsal view. Scale bars 0.2 mm.

***Poppiolygus* gen. nov.**

Type species. *Lygus bengalicus* Reuter, 1885, here designated.

Diagnosis. This new genus can be distinguished from other related genera of the *Lygus*-complex by the following combination of characters: Body flat, ovoid, not elongate; pronotum weakly carinate or keeled laterally; hemelytron not strongly declivous at cuneal fracture; pygophore lacking spine at base of left paramere; left paramere roundly developed basally; right paramere bulbous apically, not significantly shorter than left one; endosoma with clearly sclerotized primary and secondary lobes; female bursa copulatrix rather simple, largely membranous, with elongate ovoid sclerotized rings that are separated from each other mesially; and posterior wall with thin-rimmed narrow interramal lobe and small, ovoid dorsal structure, lacking dorsal structure.

Description. Male. Body oval, rather flat. COLOURATION: Clavus and cuneus not darkened. Tibia uniformly pale, without dark spots at bases of spines; spines pale reddish brown. SURFACE AND VESTITURE: Dorsal surface shiny, with uniformly distributed, simple, silky, short, semierect setae. Hemelytron shiny, densely, shallowly and irregularly punctate. STURCTURE: Head somewhat oblique, short; base of vertex with a confluent, narrow, transverse carina about half as thick as pronotal collar; frons weakly striolate. Antenna relatively long, slender. Labium slender, reaching middle of metacoxa. Pronotum weakly carinate laterally; calli indistinct; collar about as thick as base of antennal segment II; scutellum flat. Legs relatively long. GENITALIA (Figs 164–167): Pygophore somewhat triangularly projected at apex, without spine at base of left paramere. Left paramere horse-head-shaped, with sensory lobe roundly developed basally; hypophysis with median projection generally elongate and tapered towards apex and with a weak process at distal margin (Fig. 165); right paramere not significantly shorter than left one, bulbous apically, with a small, truncate hypophysis (Fig. 166). Endosoma composed of three lobes; primary lobar-sclerite (PL) narrow but distinct, associated to secondary gonopore and distal seminal duct; secondary lobar-sclerite (SL) developed, almost straight, tapered towards apex; endosomal lobar-sclerites not much elongate, shorter than primary membranous lobe; secondary gonopore thick-rimmed, with small, rounded aperture; seminal duct roundly expanded apically behind secondary gonopore (Fig. 167).

Female. GENITALIA (Figs 168–169): Bursa copulatrix (Fig. 168) weakly sclerotized, largely membranous including ventral labiate plate (VLP); sclerotized rings elongate-ovoid, thin-rimmed, separated from each other mesally. Posterior wall (Fig. 169) with small, rounded dorsal structure (DOS), lacking lateral lobe; interramal lobe (IRL) narrow, somewhat roundly produced at middle; interramal sclerite narrow.

Etymology. Named after the Finnish heteropterist Bertil R. Poppius (1876–1916), in honor of his great efforts to describe numerous mirine taxa; masculine.

Distribution. Known from the Oriental Region, and sub-

tropical and warm temperate zones of eastern Palearctic Region.

Discussion. The genitalia of the present new genus are similar to those of ‘broadly conceived’ *Dagbertus* which was originally established by DISTANT (1904a) to accommodate *Lygus darwini* Butler, 1877 (Fig. 64) and two additional species endemic to Galapagos Islands. *Dagbertus* had been poorly defined, without any effective diagnostic features, until KELTON (1955) for the first time indicated several significant characters in the male and female genitalia, based on examinations of four species (e.g., *D. olivaceus* Reuter, 1907, Fig. 65) from the continental New World, in addition to *D. quadrinotatus* (Walker, 1873) from Galapagos. Subsequently, CARVALHO (1968) also redescribed the type species, *D. darwini*, with figures of the male genitalia.

The external appearance of the type specimen of *D. darwini* (Fig. 64, the elongate body with clear dorsal stripes reminiscent of Australian *Ommatodema* Poppius, 1911 or Ethiopian *Taylorilygus* Leston, 1952) suggests that this taxon evidently differs from those accommodated in *Dagbertus* in the regions other than the New World including Galapagos Archipelago. Therefore, current definition and concept of the genus *Dagbertus* in Oceania may be provisional, and no true *Dagbertus* species is presumed to occur in the Oriental Region. The following characters could redefine typical *Dagbertus*: Body elongate-ovoid, moderate in size (around 4.0 mm); dorsum polished, with clear, dark stripes on pronotum, scutellum and hemelytron; pronotum margined laterally; pronotal collar raised, about as thick as basal transverse carina of vertex; scutellum somewhat arched; hemelytron subhyaline; pygophore lacking spine at base of left paramere; left paramere tumid, with horse-head-shaped hypophysis that has one elongate projection and the other shorter process at its dorsal-apical margin; right paramere ovoid, less than half as long as left one, with tiny triangular hypophysis; and endosoma with elongate, ctenoid, medially broadened primary lobar-sclerite and membranous secondary lobe.

The combination of characters mentioned in the above diagnosis allows us to distinguish the new genus *Poppiolygus* from other superficially similar congeners, such as *Dagbertus*, *Micromimetes* or *Prolygus*. In addition, a single representative of our new genus, *Poppiolygus bengalicus*, is now revealed to be associated only with the Persicariaeae weeds (Polygonaceae, Figs 92–93) grown predominantly at open water margins (marsh, stream or paddy field) (YASUNAGA 2001, ZHENG et al. 2004). Its specialized host and habitat preferences would support establishment of the new genus.

***Poppiolygus bengalicus* (Reuter, 1885) comb. nov.**

(Figs 70, 90–93, 153–155, 164–169)

Lygus bengalicus Reuter, 1885: 195–196 (original description).

Lygus bengalicus: POPPIUS (1914): 342 (key); SCHUH (1995): 808 (catalog, as *insertae sedis*).

Lygus kirkaldyi Poppius, 1915: 30 (original description). **New synonymy.** *Lygus kirkaldyi*: POPPIUS (1914): 339 (key).

Dagbertus kirkaldyi: MIYAMOTO (1975): 133 (new combination); SCHUH (1995): 752 (catalog).

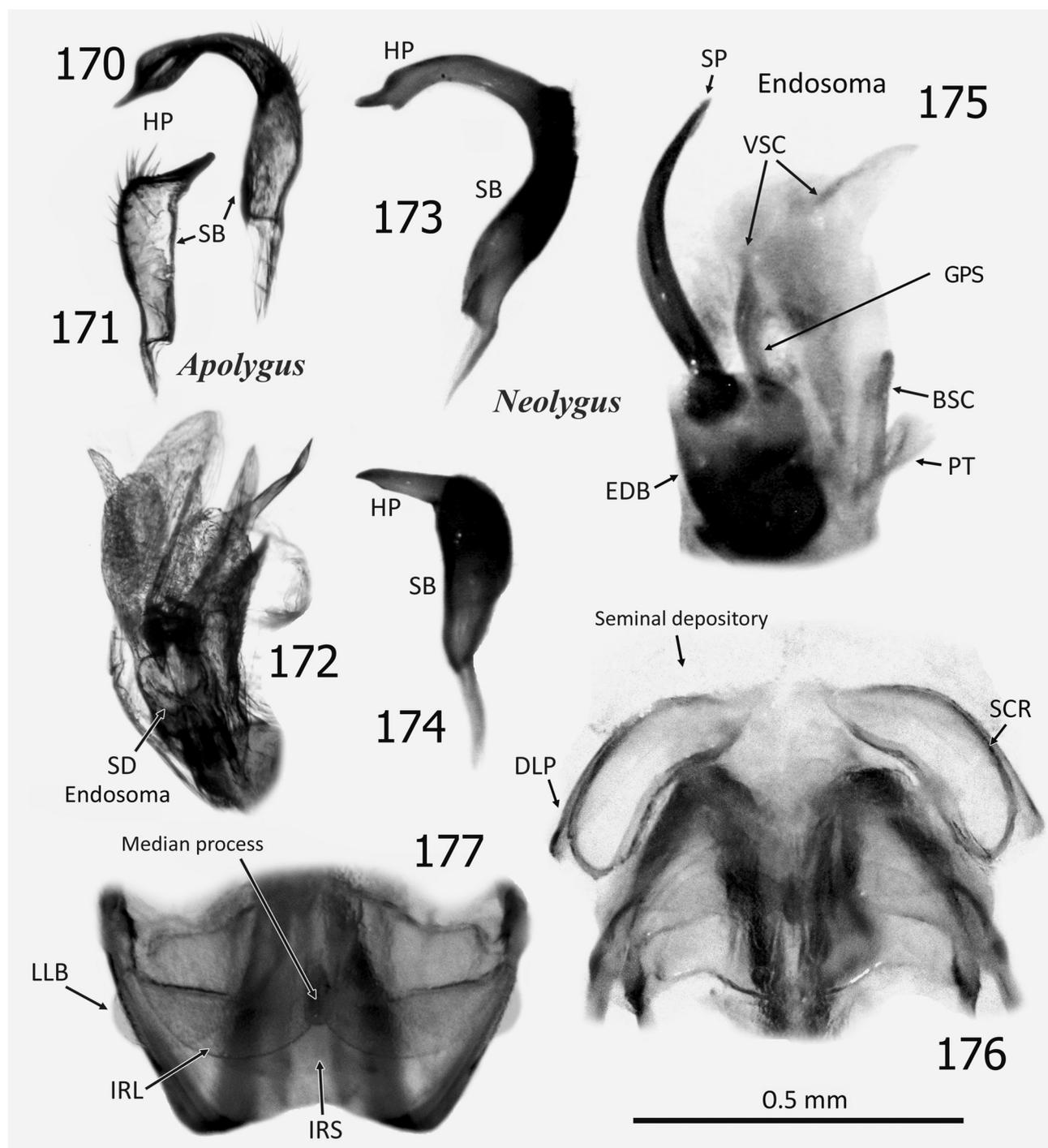
Prolygus kirkaldyi: SCHWARTZ & KERZHNER (1997): 254 (new

combination); KERZHNER & JOSIFOV (1999): 172 (catalog); YASUNAGA (2001): 260 (diagnosis, host); ZHENG et al. (2004): 561 (diagnosis, key); NOZAKI et al. (2015): 17 (faunal list).

Type material examined. *Lygus bengalicus*: LECTOTYPE (here designated): ♂, [no collecting data label and original description only citing as Bengalia = possibly Indian West Bengal State], ZMUC 00 102141 (ZMUC, Fig. 70 left) (AMNH_PBI 00380489). PARALECTOTYPE: 1 ♀, [same data], ZMUC 00 102142 (ZMUC, Fig. 70 right) (AMNH_PBI 00380490).

Lygus kirkaldyi: HOLOTYPE: ♀, **TAIWAN**: Formosa, Taihorinsho [= currently Dalin, Kagi District], 7 Nov, H. Sauter (Fig. 69, without USIs, image examined; genitalia dissected by the second author, DEIC).

Additional material examined. **JAPAN**: Kyushu: Kagoshima Pref., Yakushima Island, Koidomari, 20 Sep 1990, collector unknown, 1 ♀ (TYCN). **RYUKYUS**: Amami-Oshima Island: Tasugo Town, 28.4, 129.5, on *Persicaria* sp. (Polygonaceae), 2 Sep 1997, M. Takai, 2 ♂♂ 2 ♀♀ (TYCN); Okinawa Island, Motobu, Izumi, 26.65, 127.95, on *Persicaria* sp., 21 Oct 1963, S. Miyamoto, 1 ♂ [det. by S. Miyamoto as "*Poppolygus kirkaldyi*"] (TYCN) (AMNH_PBI 00380491). **MYANMAR**: AYEYAWADY: Myaungmya, DOA Agriculture Research Station (rice paddy), 16°35'45.30"N, 94°54'54.50"E, on *Persicaria* sp., 28 Sep 2015, T. Yasunaga, 1 ♂ 1 ♀ (TYCN), (1 ♀, AMNH_PBI 00380492). **MANDALAY**: Mandalay Burma, 12 Mar 1908, Distant-Coll. 1911-383 [det. by Distant as *Lygus bengalicus* (DISTANT, 1904b)], 1 ♂ (BMNH). **NEPAL**: **KASKI**: Pokhara, 28.19, 83.95, on *Persicaria* sp., 16 Oct 2005, T. Yasunaga &



Figs 170–177. Male (170–175) and female (176–177) genitalia of the taxa superficially similar to *Polygus*. 170–172 – *Apolygus pulchellus* (Reuter, 1906) (Nagasaki, Japan): 170 – left paramere, 171 – right paramere, 172 – endosoma. 173–175 – *Neolygus honshuensis* (Linnavuori, 1963) (Hokkaido, Japan): 173 – left paramere, 174 – right paramere, 175 – endosoma. 176–177 – *N. zhugei* (Yasunaga, 1992) (Nagasaki): 176 – bursa copulatrix, dorsal view; 176 – posterior wall, anterior view. Additional abbreviations: BSC – basal sclerite; EDB – endosomal base; VSC – ventral sclerite.

R. K. Duwal, 5 ♂♂ 10 ♀♀ (CNC, NMTU, TYCN) (1 ♂, AMNH_PBI 00380493). **THAILAND:** NAKHON RATCHASIMA: Wang Nam Khieo, Udom Sap, Sakaerat Environmental Research Station, 14°30'27"N, 101°55'39"E, 410 m alt., UV light trap, 26 Sep 2013, T. Yasunaga, 1 ♀ (TYCN) (AMNH_PBI 00380494).

Measurements (in mm). ♂/♀: Total length of body 3.43 / 3.68; head width including eyes 0.87 / 0.87; vertex width 0.30 / 0.39; lengths of antennal segments I–IV 0.42, 1.43, 0.60, 0.50 / 0.39, 1.20, 0.71, 0.60; labial length 1.25 / 1.35; mesal length of pronotum including collar 0.72 / 0.75; basal width of pronotum 1.23 / 1.35; maximum width across hemelytron 1.62 / 1.68; and lengths of metafemur, tibia and tarsus 1.20, 1.95, 0.53 / 1.35, 1.95, 0.48.

Differential diagnosis. Recognized easily by ovoid, medium-sized body; shiny pale green general colouration (fading to brownish in dried specimens); reddish head, antennal segment I and apex of each femur; significantly shiny fuscous pronotum (posterior margin sometimes narrowly pale), with pale, arrow-shaped anteromedian part; more or less darkened apical inner corner of corium; and shape of male and female genitalia as mentioned in generic description (Figs 164–169). Final-instar nymph (Fig. 93) recognized by its ovoid, pale yellow-green body, and head, antennae, lateral part of pronotum and legs more or less tinged with red.

Biology. Both adults and late instar immatures were found on knotweeds (water peppers, cf. Figs 92–93), *Persicaria* spp. (Polygonaceae: Persicarieae) as reported by YASUNAGA (2001), and preferably feeding on the red inflorescences and young seeds. The unique color pattern (pale green mixed with black and red) is assumed to be cryptic, harmonious with the host plant inflorescences.

Comments. MIYAMOTO (1975) tentatively placed this species in *Dagbertus*, but he surely intended to propose a new genus for the taxon (personal communication to Yasunaga in the 1990's; then he provided a male specimen from Okinawa, with a label handwritten as "*Poppiolygus kirkaldyi*"). We positively agree with his memorable proposition, and the new genus *Poppiolygus* is herein established for this unique species, *P. bengalicus*.

Lygus kirkaldyi described from Taiwan by POPPIUS (1915) is herein synonymized with *L. bengalicus* from East India. Distribution of each species appeared disjunct, but the subsequent investigations suggested that a single species is distributed widely in the Oriental and eastern Palearctic Region. Judging from the revealed distribution pattern and same host association (knotweeds), the two nominal species are undoubtedly considered to be conspecific.

Nomen dubium

Lygus sacchari Matsumura, 1910

Lygus sacchari Matsumura 1910: 23 (original description).

Lygus sacchari: YASUNAGA et al. (1996): 92 (note on missing type specimen); SCHUH (2013) (online catalog).

Comments. This is the final unclear member of the *Lygus*-complex in eastern Asia. Although the type material appears to have been lost (cf. YASUNAGA et al. 1996), this taxon, described from Taiwan, most probably belongs to *Deraeocoris* Kirschbaum, 1856 (Deraeocorinae) or

its allied genera (e.g., *Dortus* Distant, 1910), or to *Pro-dromus* Distant, 1904 (Bryocorinae), judging from the original description (MATSUMURA 1910). SHIRAKI (1913) subsequently provided a detailed redescription in Japanese and also mentioned rice, sugar cane, and various weeds as hosts. *Lygus sacchari* is currently presumed to fit *Dortus chinai* Miyamoto, 1965, a common graminoid inhabitant in Taiwan and southwestern Japan (YASUNAGA 2001). This taxon nonetheless should be treated as *nomen dubium*, due to absence of the type series.

Summary

Current classification and distribution of the species treated in this study:

Species correctly placed in *Prolygus*

Prolygus alboscuteclatus Carvalho, 1987 – Indonesia, Papua New Guinea

Prolygus disciger (Poppius, 1915) **comb. nov.** – Japan, P.R. China, Taiwan, Thailand

Prolygus lorae (Poppius, 1914) – Papua New Guinea

Prolygus nigriclavus (Poppius, 1915) [= *Neolygus nigricutellaris* Lu & Zheng, 2004, **syn. nov.**] – Indonesia, Laos, Malaysia, Nepal, P. R. China, Taiwan, Thailand

Prolygus palauensis (Carvalho, 1956) **comb. nov.** – Palau

Prolygus papuanus (Poppius, 1914) – Indonesia, Malaysia, Nepal, Papua New Guinea, Thailand

Prolygus subrufilori (Lu & Zheng, 1998) **comb. nov.** – P. R. China

Species removed from *Prolygus*

Anthophilolygus bakeri (Poppius, 1915) **comb. nov.** [= *Prolygus tainanensis* (Poppius, 1915) **syn. nov.**] – Cambodia, Japan, Laos, Philippines, Taiwan, Thailand

Apolygopsis nigra (Poppius, 1915) **comb. nov.** – Laos, Malaysia, Nepal, Philippines, Taiwan, Thailand

Micromimetes rubrotinctus (Carvalho, 1956) **comb. nov.** – Mariana

Poppiolygus bengalicus (Reuter, 1885) **comb. nov.** [= *Prolygus kirkaldyi* (Poppius, 1915) **syn. nov.**] – Japan, India, Myanmar, Nepal, P.R. China, Taiwan, Thailand

Species incertae sedis in *Prolygus*

Prolygus albocuneatus Carvalho, 1987 – Papua New Guinea

Prolygus biscutellatus Carvalho, 1987 – Papua New Guinea

Prolygus erimensis (Poppius, 1914) – Papua New Guinea

Prolygus femoralis (Poppius, 1914) – Papua New Guinea

Prolygus finisterrensis Carvalho, 1987 – Papua New Guinea

Prolygus kandanus Carvalho, 1987 – Papua New Guinea

Prolygus kebarensis Carvalho, 1987 – Papua New Guinea

Prolygus maai Carvalho, 1987 – Papua New Guinea

Prolygus nakanaiensis Carvalho, 1987 – Papua New Guinea

Prolygus punctialbus Carvalho, 1987 – Papua New Guinea

Prolygus quatei Carvalho, 1987 – Papua New Guinea

Prolygus stali (Poppius, 1914) – Papua New Guinea

Prolygus watutensis Carvalho, 1987 – Papua New Guinea

Additional species treated in this study

- Anthophilolygus alaneylesi* sp. nov. – Thailand
Apolygopsis eoa (Poppius, 1915) comb. nov. – Taiwan
Apolygopsis fuhoshoensis (Poppius, 1915) comb. nov. – P. R. China, Taiwan
Micromimetes rubrotinctus (Carvalho, 1956) comb. nov. – Mariana Islands (Saipan)
Micromimetes sunweni sp. nov. – Taiwan
Miyamotolygus bui (Lu & Zheng, 1998) comb. nov. – Nepal, P. R. China, Taiwan, Thailand
Miyamotolygus pictus (Lu & Zheng, 1998) comb. nov. – P. R. China
Miyamotolygus rufilorum (Lu & Zheng, 1998) comb. nov. – Japan, Nepal, P. R. China, Taiwan, Thailand

Nomen dubium

Lygus sacchari Matsumura, 1910 – Taiwan

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References

- AUKEMA B., RIEGER CH. & RABITSCH W. 2013: *Catalogue of the Heteroptera of the Palearctic Region. Vol. 6. Supplement*. The Netherlands Entomological Society, Amsterdam, xxiv + 629 pp.
- BUTLER A. G. 1877: Account of the Zoological Expedition made during the visit of H. M. S. Petrel to the Galapagos Islands. X. Lepidoptera, Orthoptera and Hemiptera. *Proceedings of the Zoological Society of London* **1877**: 86–91.
- CARVALHO J. C. M. 1956: Heteroptera: Miridae. *Insects of Micronesia* **7(1)**: 2–100.
- CARVALHO J. C. M. 1959: A catalogue of the Miridae of the world. Part IV. *Arquivos do Museu Nacional (Rio de Janeiro)* **48**: 1–384.
- CARVALHO J. C. M. 1980: Analecta Miridologica, IV: observations on type specimens in the National Museum of Natural History, Budapest, Hungary (Hemiptera, Miridae). *Revista Brasileira de Biologia* **40**: 649–658.
- CARVALHO J. C. M. 1987: *Prolygus* n. gen. with descriptions of new species and redescription of known ones from Papua New Guinea (Hemiptera, Miridae). *Revista Brasileira de Biologia* **47**: 137–153.
- CARVALHO J. C. M. & FONTES A. V. 1983. Mirideos neotropicais, CCXXXIII: Genero Dagbertus Distant. – Descrições de espécies e revisao das que ocorrem na regio (Hemiptera). *Revista Brasileira de Biologia* **43**: 157–176.
- CARVALHO J. C. M. & GAGNÉ W. C. 1968: Miridae of the Galapagos Islands (Heteroptera). *Proceedings of the California Academy of Sciences* **36**: 147–219.
- CLAYTON R. A. 1982: *A phylogenetic analysis of Lygocoris Reuter (Heteroptera: Miridae) with notes on life histories and zoogeography*. M.S. Thesis, University of Connecticut, Storrs, 78 pp.
- DISTANT W. L. 1904a: Rhynchotal Notes. XXI. Heteroptera, fam. Capsidae (Part II). *Annals and Magazine of Natural History, Series 7* **13**: 194–206.
- DISTANT W. L. 1904b: Rhynchota. – Vol. II. (Heteroptera). Pp. 243–503. In: BLANFORD W. T. (ed.): *The fauna of British India, including Ceylon and Burma*. Taylor & Francis, London, xvii + 503 pp.
- EYLES A. C. 1999: New genera and species of the *Lygus*-complex (Hemiptera: Miridae) in the New Zealand subregion compared with subgenera (now genera) studied by LESTON (1952) and Niastama Reuter. *New Zealand Journal of Zoology* **26**: 303–354.
- ISHIKAWA T. & HAYASHI M. 2012: In memoriam Syoiti Miyamoto (1913–2010). *Rostria* **54**: 4–5.
- KELTON L. A. 1955: Genera and subgenera of the *Lygus*-complex (Hemiptera: Miridae). *Canadian Entomologist* **87**: 277–301.
- KERZHNER I. M. & JOSIFOV M. 1999: Family Miridae Hahn, 1833. Pp. 1–576. In: AUKEMA B. & RIEGER CH. (eds.): *Catalogue of the Heteroptera of the Palearctic Region. Vol. 3. Cimicomorpha II*. The Netherlands Entomological Society, Amsterdam, xiv + 577 pp.
- LU N. & ZHENG L. Y. 1998a: New species of the genus *Lygocoris* (subgenus *Neolygus*) from China (Heteroptera: Miridae). *Entomologische Berichten* **58**: 1–10.
- LU N. & ZHENG L. Y. 1998b: Identity of some 'Lygus' species described from Taiwan by Poppius (Heteroptera: Miridae). *Tijdschrift voor Entomologie* **140**: 185–189.
- MATSUMURA S. 1910: *Die schädlichen und nützlichen Insekten vom Zuckerrohr Formosas*. Keiseisha, Tokyo, 52 pp.
- MIYAMOTO S. 1975: Miscellaneous notes on mirid-bugs (4). *Rostria* **24**: 133 (in Japanese).
- NOZAKI T., NOZAKI Y., UKI K. & TSUKADA T. 2015: The heteropteran fauna of Shimokoshiki Island, Kagoshima Prefecture, Japan. *Rostria* **58**: 1–40 (in Japanese).

- NOZAKI T., NOZAKI Y., UKI K. & TSUKADA T. 2016: The heteropteran fauna in the Ushibuka area of the Amakusa Islands, Kumamoto Prefecture, Japan. *Rostria* **60**: 67–96 (in Japanese).
- POPPIUS B. 1914: Zur Kenntnis der Indo-Australischen Lygus-Arten. *Annales Historico-Naturales Musei Nationalis Hungarici* **12**: 337–398.
- POPPIUS B. 1915: H. Sauter's Formosa-Ausbeute: Nabidae, Anthocoridae, Teratophyllidae, Miridae, Isometopidae und Ceratocombidae (Hemiptera). *Archiv für Naturgeschichte* **80A(8)** [1914]: 1–80. [Published in March 1915].
- REUTER O. M. 1885: Species Capsidarum quas legit expeditio danica Galateae descripsit. *Entomologisk Tidskrift* **5**: 195–200.
- SCHUH R. T. 1995: *Plant bugs of the world (Insecta: Heteroptera: Miridae)*. Systematic catalog, distributions, host list and bibliography. The New York Entomological Society, New York, xii + 1329 pp.
- SCHUH R. T. 2013: *On-line Systematic Catalog of Plant Bugs (Insecta: Heteroptera: Miridae)*. <http://research.amnh.org/pbi/catalog/> (Last accessed: July 27, 2018.)
- SCHWARTZ M. D. & CHÉROT F. 2005: Miscellanea Miridologica (Insecta: Heteroptera). *Zootaxa* **814**: 1–24.
- SCHWARTZ M. D. & FOOTITT R. G. 1998: Revision of the Nearctic species of the genus *Lygus* Hahn, with review of the Palearctic species (Heteroptera: Miridae). *Memoirs on Entomology International* **10**: i–vii + 1–428 pp.
- SCHWARTZ M. D. & KERZHNER I. M. 1997: Type specimens and identity of some Chinese species of the “Lygus-complex” (Heteroptera: Miridae). *Zoosystematica Rossica* **5**: 249–256.
- SHIRAKI T. 1913: Investigations upon general insect pests. *Special Report of the Formosa Agricultural Experiment Station* **8**: 186–187 (in Japanese).
- YASUNAGA T. 1991: A revision of the plant bug genus *Lygocoris* Reuter from Japan, Part I (Heteroptera, Miridae, Lygus-complex). *Japanese Journal of Entomology* **59**: 435–448.
- YASUNAGA T. 2001: Family Miridae Hahn, plant bugs. In: YASUNAGA T., TAKAI M. & KAWASAWA T. (eds.): *A Field Guide to Japanese Bugs II*. Zenkoku Noson Kyoiku Kyokai Publ. Co. Ltd., Tokyo, pp. 2–96, 111–351 (in Japanese).
- YASUNAGA T. & SCHWARTZ M. D. 2007: Revision of the mirine plant bug genus *Philostephanus* Distant and allies (Heteroptera: Miridae: Mirinae: Mirini). *Tijdschrift voor Entomologie* **150**: 100–180.
- YASUNAGA T. & TAKAI M. 2014: Notes on some Japanese plant bugs recently expanding their distributions northward, possibly due to global warming. *Rostria* **57**: 42.
- YASUNAGA T., DUWAL R. K. & SCHWARTZ M. D. 2012: First record and a new species of *Neolygus* Knight (Heteroptera: Miridae: Mirinae) from Nepal, with a checklist of Old World species of *Neolygus*. *Zootaxa* **3413**: 44–54.
- YASUNAGA T., MIYAMOTO S. & KERZHNER I. M. 1996: Type specimens and identity of the mirid species described by Japanese authors in 1906–1917 (Heteroptera: Miridae). *Zoosystematica Rossica* **5**: 91–94.
- YASUNAGA T., SCHWARTZ M. D. & CHÉROT F. 2002: New genera, species, synonymies, and combinations in the “Lygus-complex” from Japan, with discussion of *Peltdolygus* Poppius and *Warrisia* Carvalho (Heteroptera: Miridae: Mirinae). *American Museum Novitates* **3378**: 1–26.
- ZHENG L.Y., LU N., LIU G. & XU B. 2004: *Hemiptera, Miridae, Mirinae. Fauna Sinica, Insecta. Vol. 33*. Science Press, Beijing, xix + 797 pp., 8 pls. (in Chinese, with English keys and descriptions of new taxa).

