

The assassin bug subfamilies Centrocnemidinae and Holoptilinae in Taiwan (Hemiptera: Heteroptera: Reduviidae)

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Abstract. The assassin bugs (Hemiptera: Heteroptera: Reduviidae) of the subfamily Centrocnemidinae and Holoptilinae of Taiwan are surveyed, the taxa are diagnosed, illustrated, and keyed. The nomenclature of the family group name Centrocnemidinae is discussed. Of this subfamily, the single species *Neocentrocnemis stali* (Reuter, 1881) is recognized, old records of *Centrocnemis deyrollii* Signoret, 1852 are considered as misidentifications of *N. stali*. The following synonymies are proposed: *Neocentrocnemis stali* (Reuter, 1881) = *N. formosana* (Matsumura, 1913), syn. nov., = *N. baudoni* Dispons, 1965, syn. nov. The male and female genitalia of *N. stali* are illustrated in detail, the morphology and homologies of the male intromittent organ are discussed. Of Holoptilinae, two genera and three species are recognized. The genus *Locoptiris* Villiers, 1943, described from the Afrotropical Region, is recorded for the first time from Taiwan; this record means also the first record of the genus in the Oriental Region. *Locoptiris taiwanensis* sp. nov. is described as new. *Ptilocerus pendleburyi* Miller, 1940, described from peninsular Malaysia, is transferred to *Locoptiris*. Species of *Locoptiris* are keyed, the relationships within the genus are discussed. *Ptilocerus immitis* Uhler, 1896, so far known only from Japan, is recorded for the first time from Taiwan.

Key words. Heteroptera, Reduviidae, Centrocnemidinae, Holoptilinae, taxonomy, nomenclature, new species, new records, morphology, genitalia, Taiwan

Introduction

In spite of their strikingly different external appearance, the assassin bug subfamilies Centrocnemidinae and Holoptilinae are closely related phylogenetically. Together with Phymatinae and Elasmodeminae, they form a monophyletic lineage within Reduviidae, usually called as

the 'phymatine complex' (CARAYON et al. 1958, DAVIS 1961, SCHUH & SLATER 1995, WEIRAUCH 2008, WEIRAUCH et al. 2011). Their close evolutionary relationship makes it reasonable to treat them together in this paper.

Members of Centrocnemidinae are medium-sized or large reduviids (13–30 mm) having highly tuberculate body and widely flattened humeral projections of the pronotum. The free labial segment I, separated from the head capsule by a distinct membrane, is characteristic for the subfamily (MILLER 1955, 1956), shared only by the Neotropical subfamily Hammacerinae within Reduviidae (WEIRAUCH 2008). Virtually no published data are available on their biology. The subfamily contains only 4 genera and about 30 described species, all of them occurring in South and Southeast Asia.

Species belonging to the subfamily of feather-legged assassin bugs or Holoptilinae are easy to recognize by their body, first of all the antennae and legs, being densely covered by more or less long setae, which usually endow them with a peculiar appearance (e.g., Fig. 41). The majority of the species (members of the tribe Holoptilini) are believed to be specialized predators of ants, attracting and paralyzing their preys through secretions released from their trichome, situated at the base of the abdominal venter (JACOBSON 1911, McKEOWN 1942, MALIPATIL 1985, WEIRAUCH & CASSIS 2006, WEIRAUCH et al. 2010). The subfamily is a moderately species-rich one among Reduviidae, comprising about 13 genera and almost 80 species. Most holoptilines are distributed in the tropical parts of the Old World, a few of them enter the neighbouring temperate areas, and a single recent genus (currently monotypical) occurs in South America. Nearly 30 species are known from the Oriental Region (MALDONADO CAPRILES 1990).

The authors are undertaking a revision of the Reduviidae of Taiwan in a series of papers; the subfamilies Saicinae and part of Emesinae have already been published (RÉDEI & TSAI 2009, 2010a,b). Based on specimens deposited in several institutions as well as those collected by us, the subfamilies Centrocnemidinae and Holoptilinae of Taiwan are surveyed in the present paper. One genus and one species of Centrocnemidinae, two genera and three species of Holoptilinae are recognized. The morphology of the male genitalia of *Neocentrocnemis stali* is discussed in detail. Of Holoptilinae, one species is reported as new to Taiwan, a new species of *Locoptiris* is described, and other taxonomical changes are proposed in this paper.

Material and methods

Examination of external structures were carried out using a stereoscopic microscope (Opton 475052-9901). Drawings were made by using a camera lucida. Male genitalia were dissected after careful heating in hypertonic KOH solution, stained with Chlorazol Black E if necessary, examined under a transparent microscope (XSZ-N107). For preparing Figs. 27–28, the phallosome was carefully removed using fine forceps and pins. Measurements were done using a micrometer eyepiece. Digital photographs of type specimens were provided by NHRS and MNHN. Depository and distribution data verified by us are marked with an exclamation point '!', specimens transferred from one collection to another by means of donation or exchange are indicated with '>' between the original and the final depository.

Abbreviations for depositories:

BMNH	Natural History Museum, London, United Kingdom;
DEIC	Deutsches Entomologisches Institut, Eberswalde, Germany;
EIHU	Entomological Institute, Hokkaido University, Sapporo, Japan;
HNHM	Hungarian Natural History Museum, Budapest, Hungary;
KUEC	Kyushu University, Entomological Collection, Fukuoka, Japan;
MHNG	Muséum d'Histoire Naturelle, Geneva, Switzerland;
MNHN	Muséum National d'Histoire Naturelle, Paris, France;
MRAC	Musée Royal de l'Afrique Centrale, Tervuren, Belgium;
NCHU	National Chung Hsing University, Taichung, Taiwan;
NHRS	Naturhistoriska Riksmuseet, Stockholm, Sweden;
NKUC	Institute of Entomology, Nankai University, Tianjin, China;
NMNS	National Museum of Natural Science, Taichung, Taiwan;
NTU	National Taiwan University, Taipei, Taiwan;
TARI	Taiwan Agricultural Research Institute, Taichung, Taiwan;
TFRI	Taiwan Forestry Research Institution, Taichung, Taiwan.

Taxonomic part

Subfamily Centrocnemidinae Miller, 1956

Centrocneminae Miller, 1956: 223. Type genus: *Centrocnemis* Signoret, 1852.

Centrocnemidinae: KERZHNER (1992: 47). Emendation.

Nomenclature. SIGNORET (1852) explicitly gave the etymology of *Centrocnemis*, the type genus of the subfamily, as follows: ‘de κεντρόν, éperon [= spine], et de κνήμη, jambe [= leg or calf (of leg)]’. The subfamily was established by MILLER (1956) as Centrocneminae. KERZHNER (1992) emended the spelling to Centrocnemidinae without any comment.

Although the generic name is derived from the Greek noun *κνήμη*, it was substituted with the Latin noun *cnemis*, in genitive singular *cnemidis*, which will result in the stem *cnemid-*. Therefore we consider Centrocnemidinae as the grammatically correct spelling. Kerzhner's (1992) act was a justified emendation under the third edition of the International Code of Zoological Nomenclature being in effect that time (cf. ICZN 1985, Articles 32b, 32c(iii): ‘An original spelling is an «incorrect original spelling» if [...] in the case of a family-group name, it [...] is based on the incorrectly formed stem of a generic name’; Article 32d: ‘An incorrect original spelling is to be corrected; it has no separate availability in the original form, and cannot, in that form, enter into homonymy or be used as a replacement name’). The same act must be considered as unjustified emendation under the current Code: in Article 32.5 (ICZN 1999) family names formed from an incorrectly formed stem of a generic name were not considered as incorrect original spelling, therefore it is to be preserved unaltered under Article 32.3. As a consequence of Article 86.3, although it was proposed in a code-compliant way, KERZHNER's (1992) act will become unjustified emendation from 1 January 2000. However, we consider retroactive application of Article 32 of the current Code undesirable and destabilizing.

After 1992 some of the authors used the spelling Centrocneminae (BISWAS et al. 1994, SCHUH & SLATER 1995, TOMOKUNI & CAI 2002, LIN 2003, AMBROSE 2006, WEIRAUCH 2008 and several morphological papers by the same author partly with coauthors, LI et al. 2009), others used

Centrocnemidinae (PUTSHKOV & PUTSHKOV 1996, POPOV & PUTSHKOV 1998, ISHIKAWA 2005, PUTSHKOV & PLUOT-SIGWALT 2008, TRUONG et al. 2010). Few papers that mention this subfamily have been published since 1992, and neither of the two spellings outweigh significantly the other in the number of occurrences. Therefore, it is impossible to recognize either of them as being in ‘prevailing usage’.

Since apparently Centrocnemidinae is the grammatically correct spelling, the original spelling was validly emended by KERZHNER (1992), and none of the alternative spellings seems to be in prevailing usage, we prefer to use Centrocnemidinae in favour of Centrocneminae.

Genus *Neocentrocnemis* Miller, 1956

Neocentrocnemis Miller, 1956: 245. Type species by original designation: *Centrocnemis signoreti* Stål, 1863.

References. DISPONS (1965): 92 (key to selected species); HSIAO (1974): 321 (diagnosis, key to species in China and Taiwan); HSIAO & REN (1981): 413 (diagnosis, revision of fauna of China and Taiwan); MALDONADO CAPRILES (1990): 16 (catalogue); PUTSHKOV & PUTSHKOV (1996): 148 (catalogue).

Diagnosis. Diagnosed within Centrocnemidinae by the combination of the following characters: antennal segment I shorter than anteocular part of head; anterior tibia simple, without ventral spur; connexivum armed with long, triangular spines.

Distribution and diversity. The genus currently contains 15 species, occurring in the Oriental Region from India through continental Southeast Asia to the Malay Archipelago. One species occurs in Taiwan.

Neocentrocnemis stali (Reuter, 1881)

(Figs. 1–40)

Centrocnemis stali [as *Stål*] Reuter, 1881: 65. LECTOTYPE (MILLER 1956: 267, by use of ‘holotype’) (♀): India: Darjeeling; NHRS!

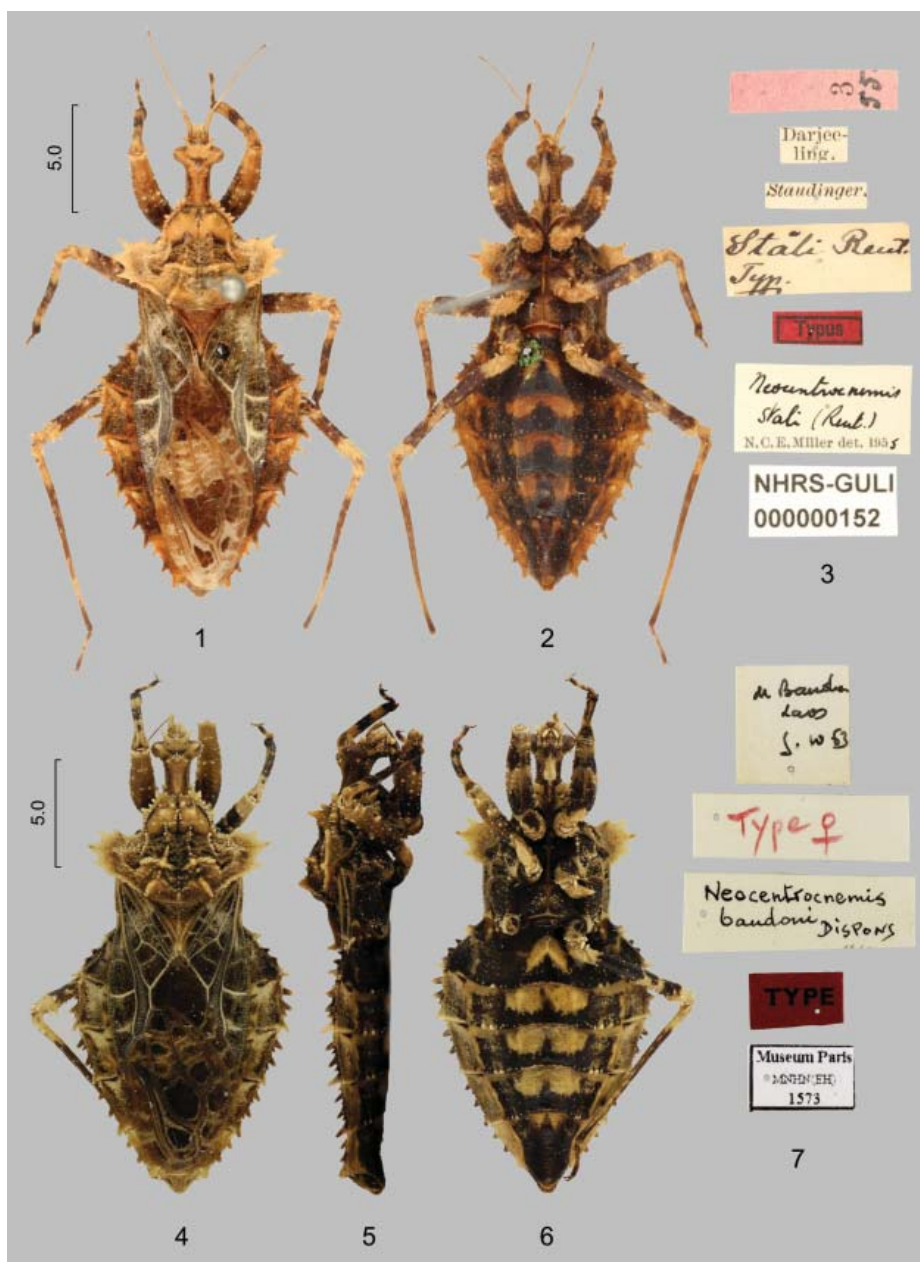
Centrocnemis formosana Matsumura, 1913: 161. HOLOTYPE (♀): ‘Formosa’ [= Taiwan]: ‘Arikan’ [= Likang, Pingtung County]; EIHU (TOMOKUNI & CAI 2002). Erroneously synonymized with *C. deyrollii* Signoret, 1852 by ESAKI (1926): 165. **Syn. nov.**

Centrocnemis deyrollii (non Signoret, 1852): BERGROTH (1914): 364. Misidentification.

Neocentrocnemis baudoni Dispos, 1965: 91. HOLOTYPE (♀): Laos; MNHN! **Syn. nov.**

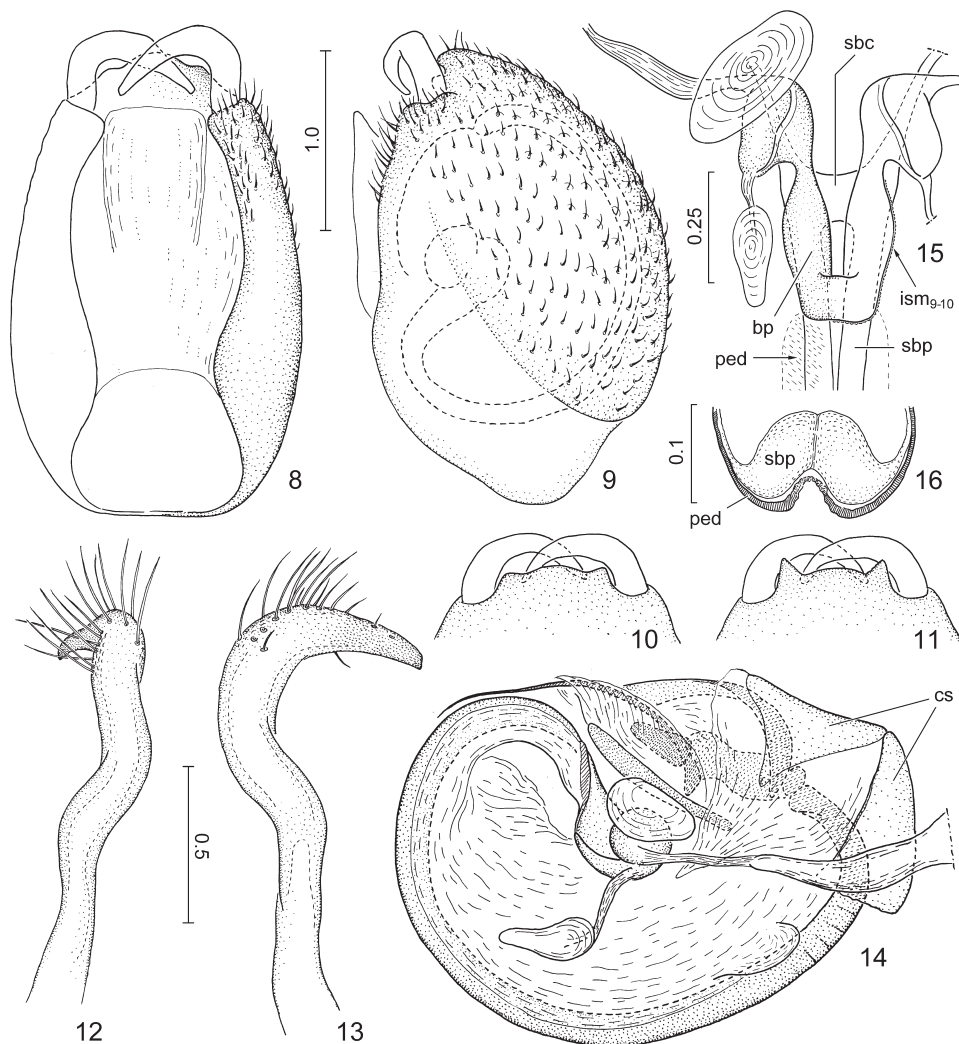
References. LETHIERRY & SEVERIN (1896): 96 (catalogue); DISTANT (1904): 246 (redescription, records); PAIVA (1919): 367 (record); MATSUMURA (1930): 182 (*formosana*, redescription, record, habitus); MATSUMURA (1931): 1207 (*formosana*, redescription, record, habitus); ESAKI (1932): 1655 (*deyrollei*, redescription, habitus); KATO (1933): [plate 22] (*deyrollei*, distribution, colour photo); CHINA (1940): 252 (listed); HOFFMANN (1944): 17 (record, distribution); MILLER (1956): 251 (*formosana*, new combination, type material, redescription, figures, records), 265 (type material, redescription, figures, records); DISPONS (1965): 94 (in key, distribution); HSIAO (1974): 321 (*stali* and *formosana*, in key); HSIAO & REN (1981): 414 (*stali* and *formosana*, redescription, figures, photos); REN (1985): 178 (redescription, habitus, habitat, distribution); MALDONADO CAPRILES (1990): 16 (*formosana* and *stali*, catalogue); BISWAS et al. (2004): 370, 379 (listed, record, distribution); PUTSHKOV & PUTSHKOV (1996): 148 (*formosana*, catalogue); HUA (2000): 209 (*formosana* and *stali*, listed, distribution); TOMOKUNI & CAI (2002): 102 (type material of *formosana*); LIN (2003): 128 (*formosana*, listed, distribution), 129 (*stali*, listed, distribution); YANG (2003): 129 (*formosana*, male genitalia); ISHIKAWA (2005): 26 (*formosana*, photo); AMBROSE (2006): 2395 (listed, distribution); PUTSHKOV & PLUOT-SIGWALT (2008): 152 (*baudoni*, type material); WEIRAUCH et al. (2011): 141 (molecular genetics).

Type material examined. *Centrocnemis stali* Reuter, 1881. LECTOTYPE (♀): ‘3 \ 55’ [light red square, printed + handwritten], ‘Darjee- \ ling.’ [printed], ‘*Staudinger*.’ [printed], ‘Stål Reut. \ Typ.’ [Reuter’s handwriting], ‘Typus’ [red



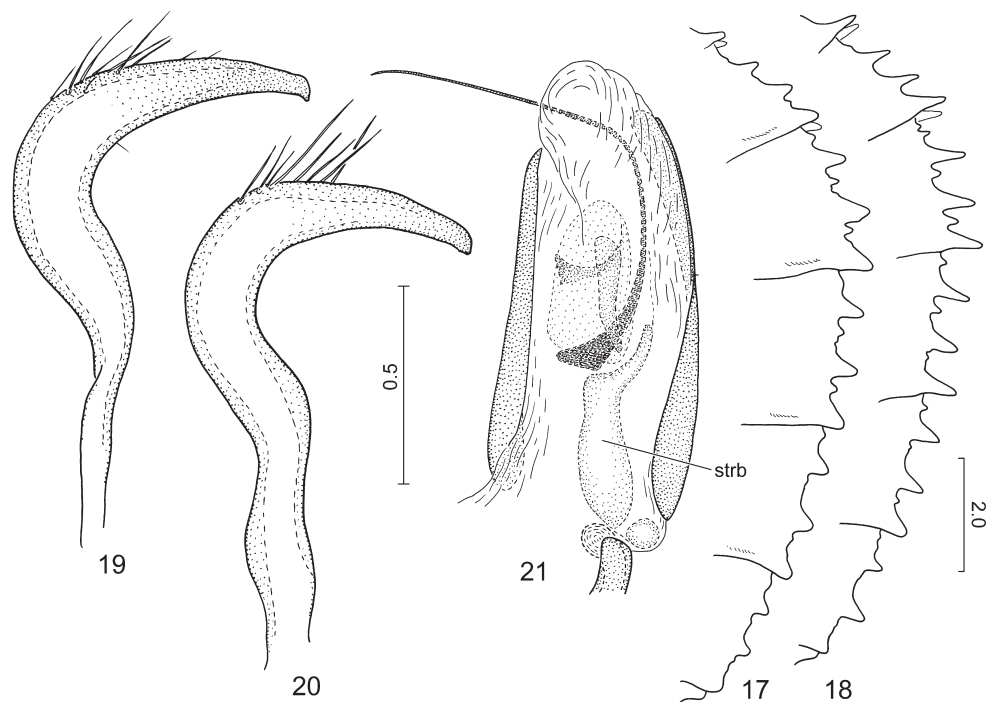
Figs. 1–7. *Neocentrocnemis* spp., type specimens and their labels. 1–3 – *N. stali* (Reuter, 1881), lectotype; 4–7 – *N. baudoni* Dispons, holotype. Scales in mm; labels not to scale. (Figs. 1–3: © NRMS, photographed by G. Lindberg; Figs. 4–7: © MNHN, photographed by L. Fauvre; published with permission).

square with black frame, printed], '*Neocentrocnemis \ stali* (Reut.) \ N.C.E. Miller det. 1955' [Miller's handwriting + printed], 'NHRS-GULI \ 000000152' [printed]; deposited in NHRS (Figs. 1–3). – *Neocentrocnemis baudoni* Dispos. 1965. HOLOTYPE (♀): 'M. Baudon \ Laos \ S. W 63' [handwritten], 'Type ♀' [handwritten in red], '*Neocentrocnemis \ baudoni* DISPONS' [handwritten], 'TYPE' [red square, printed], '**Museum Paris \ MNHN(EH) \ 1573**' [printed]; deposited in MNHN (Figs. 4–7).



Figs. 8–16. *Neocentrocnemis stali* (Reuter, 1881) (Taiwan), male genitalia. 8 – genital capsule, dorsal view; 9 – same, lateral view (right paramere omitted); 10–11 – superoposterior margin of genital capsule of two different specimens, posteroventral view; 12–13 – right paramere, two different aspects; 14 – phallus with cuplike sclerite, lateral view; 15 – articulatary apparatus; 16 – pedicel and support bridge prolongation, cross-section around middle of pedicel. Lettering: bp = basal plates; cs = cuplike sclerite; ism_{9-10} = inter-sternal membrane between segments IX–X; sbc = support bridge complex; sbp = support bridge prolongation. Scale bars in mm.

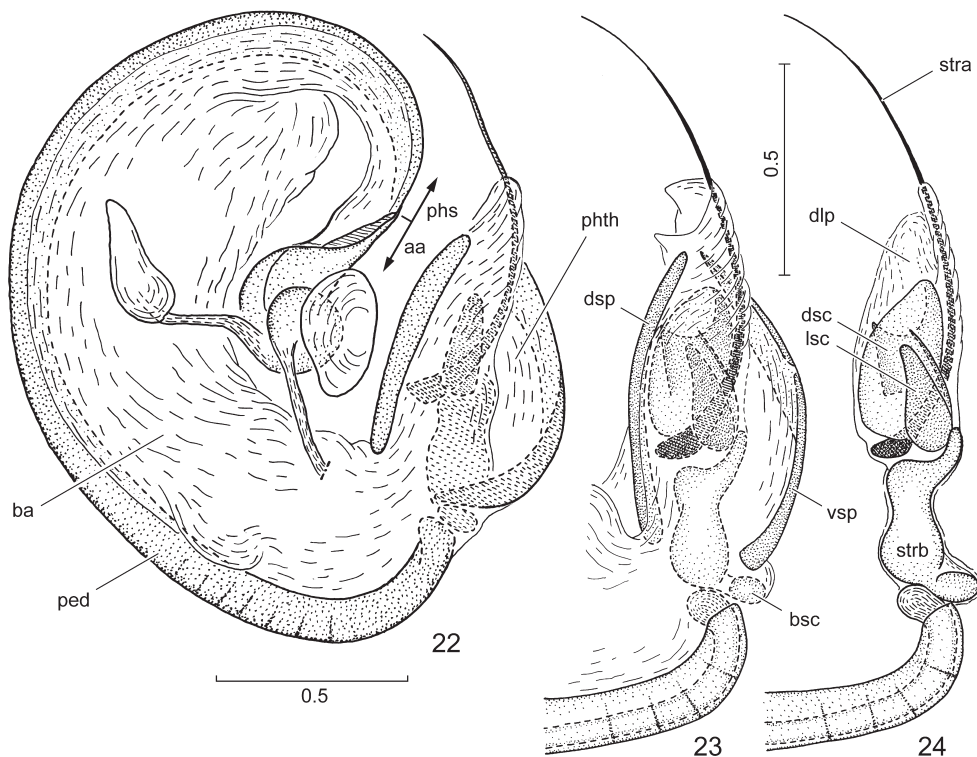
Specimens examined. TAIWAN: TAICHUNG COUNTY: Baxianshan National Forest Recreation Area, 13–15.vii.2006, leg. J. F. Tsai (1 ♂ 1 ♀, 1 L4, NCHU); same locality, 8.vii.2010, leg. T.J. Hsieh (1 ♂, NCHU); Guguan, 12.iv.2001, leg. Q.Z. Huang (1 ♀, NCHU). **NANTOU COUNTY:** Howangshan, 10.ix.2000, leg. C.C. Lo (2 ♀♀, NMNS, ENT 4463-123, ENT 4463-927); Huisun Forest Station, 31.vii.2008, leg. Y.M. Weng (1 ♀, NCHU); ‘ChipChip’ [= Jiji], ii.1909, leg. H. Sauter (1 ♂ 1 ♀, HNHM); Nanshanxi, 6.vii.2008, leg. H.Y. Lin (1 ♀, NCHU); ‘Polisha’ [= Puli], xii.1908, leg. H. Sauter (1 ♂ [identified as ‘*Centrocnemis deyrollei* Sign.’ by G. Horváth], 2 ♀♀, HNHM); ‘Hori (Puli, Polisia [= Polisha])’ [= Puli], 800 m, 23.viii.[19]47, leg. L. Gressitt (1 ♀ [identified as ‘*Neocentrocnemis formosana* (Mats.)’ by T.Y. Hsiao, photographed by HSIAO & REN (1981: plate 57, fig. 571)], NKUC); ‘Fuhosho’ [= Wucheng], iv.1909, leg. H. Sauter (1 ♂, HNHM); same locality and collector, vii.1909 (1 ♂ 5 ♀♀, HNHM); same locality and collector, viii.1909 (1 ♂, HNHM); same locality and collector, ix.1909 (8 ♂♂ 9 ♀♀, HNHM); same locality and collector, x.1909 (2 ♀♀, HNHM). **CHIAI COUNTY:** ‘Chikutoge’ [= Jhuci], V. 1909, leg. H. Sauter (1 ♀, HNHM); Shanmei, 600 m, 23.v.1977, leg. J. & S. Klapperich (1 L5, coll. E. Heiss, Innsbruck). **KAOHSIUNG COUNTY:** ‘Kosempo’ [= Jiasian], iv.1909, leg. H. Sauter (1 ♀, HNHM); same locality and collector, vii.1909 (1 ♂ 1 ♀, HNHM); same locality and collector, ix.1909, leg. H. Sauter (1 ♀, HNHM); same locality and collector, x.1909 (1 ♀, HNHM); same locality and collector, 7.vii.1911 (1 ♀ [identified as ‘*Centrocnemis deyrollei* Sign.’ by E. Bergröth, as ‘*Neocentrocnemis formosana* (Mats.)’ by N.C.E. Miller, 1955], DEIC). **COUNTY UNCERTAIN:** ‘Formosa’, leg. H. Sauter (1 ♂, HNHM). **CHINA: HAINAN:** Jianfengling, 8.iv.1983, leg. M. B. Gu (1 ♂, NKUC). **VIETNAM. BẮC KẠN PROV.:** Ba Bê National Park, near headquarters, from bark and litter, 1.v.2007, leg. G. Csorba (HNHM). **HÀ TÂY PROV.:** Mt. Bavi, 800–1000 m, vii.1941, leg. A. de Cooman (1 ♂ [photographed by HSIAO & REN (1981: plate 57, fig. 570)], Musée Heude > NKUC). **HỒA BÌNH PROV.:** Hòa Bình, leg. A. de Cooman (1 ♂ [identified as ‘*Centrocnemis deyrollei* Sign.’ by T.Y. Hsiao, 1966], 2 ♀♀, NKUC).



Figs. 17–21. *Neocentrocnemis stali* (Reuter, 1881), diagnostic characters. 17 – right margin of abdomen (female, Taiwan); 18 – same (female, Vietnam); 19 – right paramere (Vietnam); 20 – same, another specimen (Vietnam); 21 – apical portion of the phallus, lateral view (same specimen as in Fig. 19). Lettering as in Fig. 24. Scale bars in mm.

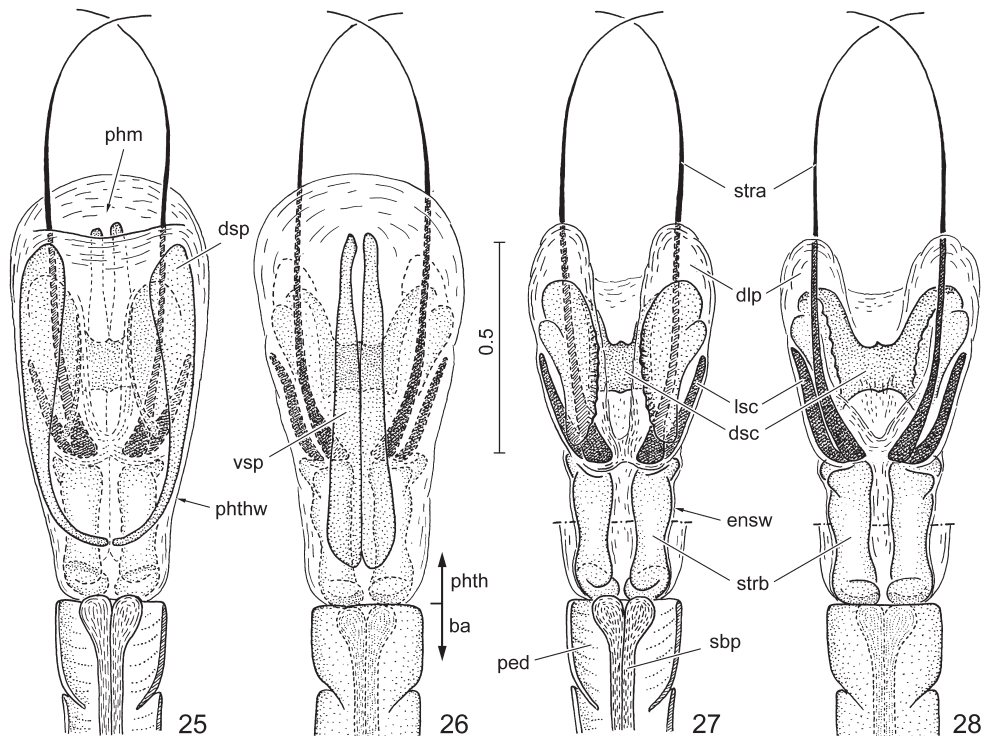
Diagnosis. Recognized within the genus by the combination of the following characters: body relatively small, total length 19–24 mm; flattened humeral projections of the pronotum relatively short, their apical triangular processes short and wide; disk of posterior lobe of pronotum with 1+1 short and stout spine-like tubercles; corium of fore wing gray with whitish venation, membrane greatly smoky gray, basal angle as well as an apical spot in each membranal cells blackish; posterolateral angle of connexival segments II–III each with 2 processes, that of segments IV–VI each with a single process (Figs. 17–18). For facilitating the recognition of the species, the male and female genitalia are described and illustrated in detail.

Description of male genitalia. *Genital capsule* (Figs. 8–9) elongate, dorsally membranous, anterior and posterior apertures not separated by distinct dorsal sclerotized bridge-like portion therefore seemingly confluent; superoposterior margin with a broad triangular median projection and 1+1 broad lateral projections of variable shape (Figs. 10–11); sternite IX with a partly sclerotized, mobile *cuplike sclerite* within genital cavity surrounding apical portion of phallus in repose (Fig. 14: cs). *Parameres* (Figs. 12–13, 19–20) symmetrical, apical portions



Figs. 22–24. *Neocentrocnemis stali* (Reuter, 1881). 22 – phallus, lateral view; 23 – phallotheca, lateral view; 24 – endosoma, lateral view (phallotheca wall removed). Lettering: aa = articulatory apparatus; ba = basal aulla; bsc = basal sclerite; dlp = dorsolateral projection of endosoma; dsc = dorsal sclerite of endosoma; dsp = dorsal sclerotized plate of phallotheca; lsc = lateral sclerite of endosoma; ped = pedicel; phs = phallosoma; phth = phallotheca; stra = apical portion of strut; strb = basal portion of strut; vsp = ventral sclerotized plate of phallotheca. Scale bars in mm.

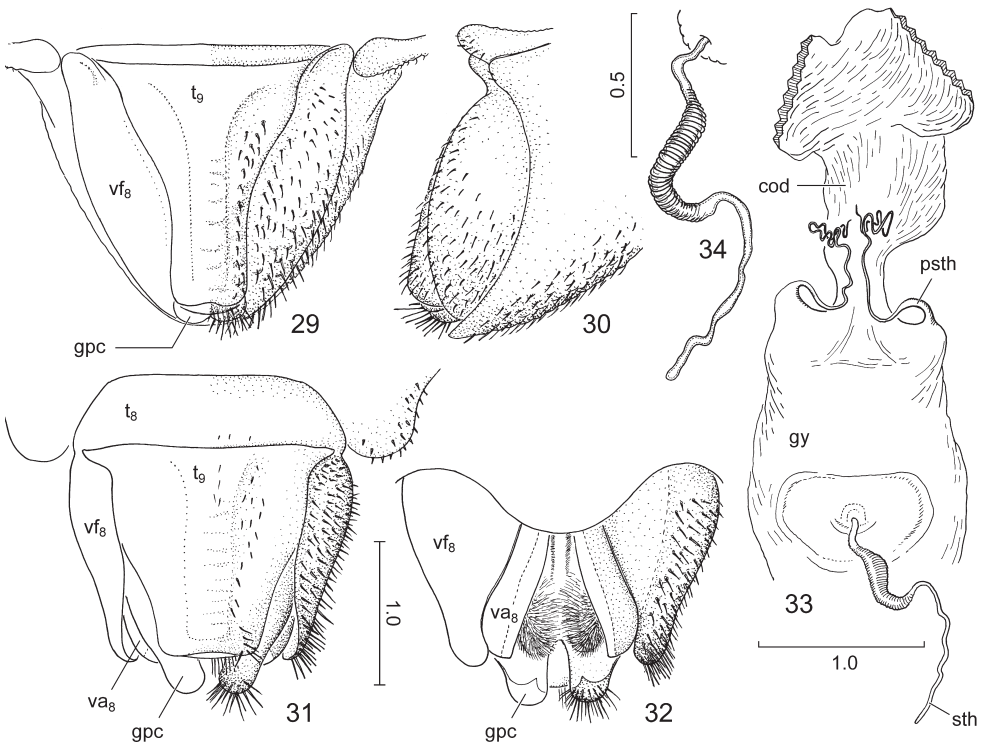
strongly curved, hook-like, crossing each other in resting position (Fig. 8). *Phallus* (Fig. 14, 21–28): artulatory apparatus (Fig. 22: aa; Fig. 15) small, restricted to the extreme base of the phallus; basal plates (Fig. 15: bp [dotted]) short, U-shaped, longitudinal arms thickened around middle; support bridge complex (Fig. 15: sbc) with a thick ponticulus transversalis and with 2+2 capitate processes of lateral position, continued in 1+1 greatly elongate, narrow support bridge prolongations (Fig. 15: sbp) narrowly separated at their base but fused at most of their length, bulbously thickened apically; ductus seminis could not be traced; phallosoma with a large, membranous basal aula (Fig. 22: ba) provided with a pedicel (Fig. 22: ped); phallosoma (Figs. 23, 25–26) short, simple, tubular, apically broadly rounded, with 1+1 dorsal (Figs. 23, 25: dsp) and 1+1 ventral (Figs. 23, 25: vsp) narrow, band-like sclerotized plates, dorsal ones arched and widely separated, ventral ones parallel and adjacent; phallosoma mouth (Fig. 25: phm) broad; endosoma (Figs. 24, 27–28) tubular, membranous, impossible to inflate because of rigid sclerotized elements in its wall, with processes as follows: 1+1 struts subdivided into two portions: basal portions (Figs. 24, 27–28: strb) thick, stout, apically tumid, provided with a ventroapical finger-like projection, apical portions (Figs. 24, 26–28: stra) whip-like, thick basally, strongly narrowing towards apex, apical four-fifth thin, protruding from phallosoma



Figs. 25–28. *Neocentrocnemis stali* (Reuter, 1881), apical portion of the phallus. 25 – dorsal view; 26 – ventral view; 27 – dorsal view, phallosoma removed; 28 – ventral view, phallosoma removed. Lettering as in Figs. 22–24, furthermore ensw = wall of endosoma; phm = phallosoma mouth; phthw = wall of phallosoma. Scale bars in mm.

ca; 1+1 membranous dorsolateral projections (Figs. 24, 27–28: dlp); with a dorsal sclerite provided with 1+1 lobe-like protrusions laterally (Fig. 24, 26–28: dsc); with 1+1 elongate, plate-like lateral sclerites (Figs. 24, 26–28: lsc); 1+1 small and thick basal sclerites (Fig. 24: bsc) at the base of the basal portions of the struts.

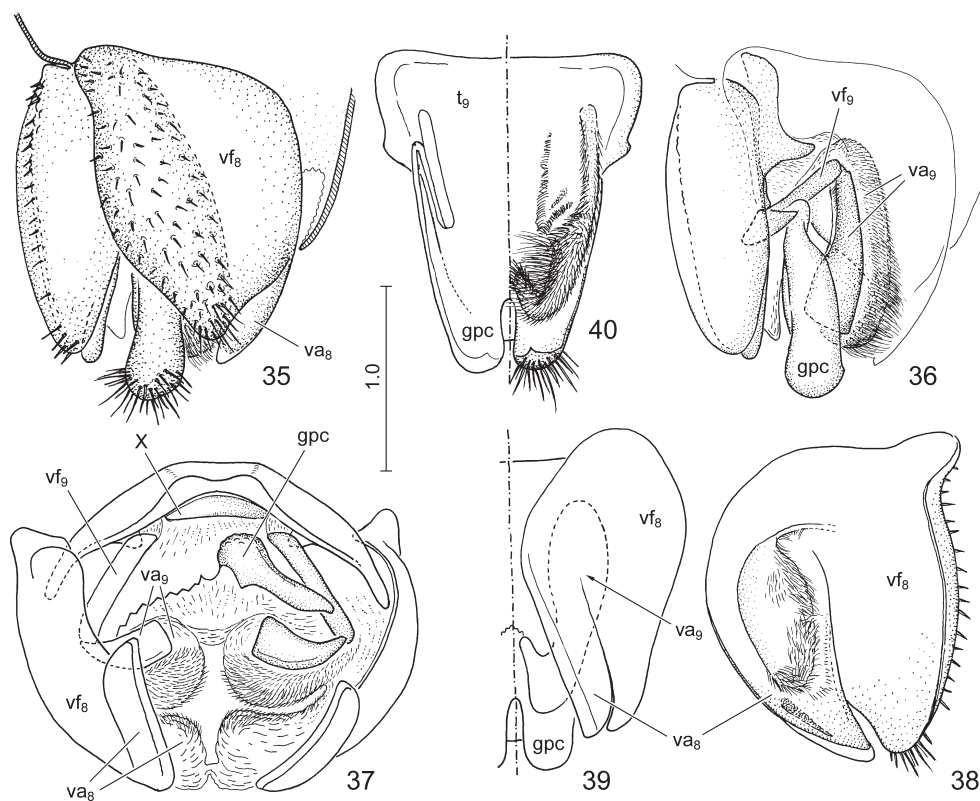
Description of female genitalia. *Segment VIII. Tergite VIII* (Fig. 31: t_8) short, transversal, nearly horizontal, lacking spiracles; with 1+1 obtuse longitudinal ridges, the broad, obliquely declivous portions laterad of these ridges are possibly homologous with laterotergites VIII. *Valvifer VIII* (= first valvifer, first gonocoxa) (Figs. 29, 31–32, 35, 37–39: vf_8) large, plate-like. *Valvula VIII* (= first valvula, first gonapophysis) (Figs. 31–32, 35, 37–39: va_8): external portion narrow, separated from the ipsilateral valvifer VIII by a narrow suture, its median margin membranous; median portion membranous, provided with dense, long pilosity. *Segment IX. Valvifer IX* (= second valvifer, second gonocoxa) (Fig. 36–37: vf_9) rod-like, articulated with the ipsilateral *valvula IX* (= second valvula, second gonapophysis) (Figs. 36–37: va_9), latter greatly membranous, median surface with dense, long pilosity, lateral wall provided with a plate-like, elongate, apically truncate sclerite. *Gonoplac* (= styloid, = 'valvula 3' of authors;



Figs. 29–34. *Neocentrocnemis stali* (Reuter, 1881), female genitalia. 29 – apex of abdomen, posterior view; 30 – same, lateral view; 31 – same, dorsal view, ovipositor slightly opened; 32 – same, ventral view; 33 – gynatrium; 34 – spermatheca. Lettering: cod = common oviduct; gpc = gonoplac; gy = gynatrium; psth = pseudospermatheca; sth = spermatheca; t_9 = tergite IX; va_8 = valvula VIII; vf_8 = valvifer VIII. Scale bars in mm.

the individualized apical portion of valvifer IX, cf. SNODGRASS 1935, SCUDDER 1957, ŠTYS 1959) (Figs. 29, 31–32, 36–37, 39–40: gpc) thick, sclerotized dorsally, apically rounded with a small marginal tooth projecting ventrad, greatly membranous ventrally; connected to its contralateral counterpart by a membrane except of apical portion. *Ectodermal genital tracts*. *Gynatrium* (= vagina) (Fig. 33: gy) sheath-like, broad, abruptly narrowed apically; extreme apex of gynatrium with 1+1 simple, thread-like, apically strongly tortuous *pseudospermathecae* (= lateral spermathecae) (Fig. 33: psth); *spermatheca* (= ‘vermiform gland’) (cf. DAVIS 1966, WYGODZINSKY 1966) (Fig. 33: sth; Fig. 34) simple, tubular, basal half thicker, with cross-striate wall, apical half thin, with simple wall; a *common oviduct* (Fig. 33: cod) broad, its short basal portion strongly narrowed.

Distribution. This is a widely distributed species occurring all over the continental South and Southeast Asia. It is recorded as new to Vietnam. The southeastern border of its area should



Figs. 35–40. *Neocentrocnemis stali* (Reuter, 1881), female genitalia. 35 – apex of abdomen, lateral view, ovipositor slightly opened; 36 – same, right valvifer VIII and valvula VIII removed; 37 – same, posterior view, ovipositor opened, left gonoploc removed; 38 – right valvifer VIII and valvula VIII, inner surface; 39 – left half of ovipositor, ventral view, schematic; 40 – ovipositor in ventral view, valvifer VIII and valvula VIII removed. Lettering as in Figs. 29–32, furthermore: va₉ = valvula IX; vf₉ = valvifer IX; X = segment X. Scale bar in mm.

be clarified as we have seen specimens from Sumatra probably belonging to this species. — Pakistan (DISPONS 1965); India: Assam: Khasi Mts. (DISTANT 1904), Meghalaya: 'Tura' (PAIVA 1919), 'Sikhim' [= Sikkim] (DISTANT 1904), West Bengal: Darjeeling!; Sri Lanka (HSIAO & REN 1981); Bangladesh: Sylhet (MILLER 1956); Myanmar (Burma): 'N. Khasia' (HOFFMANN 1944); Laos: Luang Prabang Prov., 'Lak Mune' (HOFFMANN 1944); Vietnam: Bắc Kạn Prov.!, Hòa Bình Prov.!, China: Hainan!; Taiwan!.

Biology. This species is generally rare in collections, however, apparently it is relatively frequent in Taiwan. Specimens in Taiwan and Vietnam were observed to hide in tree holes, bark crevices, or on the bark of various trees (J. F. Tsai, pers. observ.; R. J. Chen, G. Csorba, pers. comm.). A specimen was observed to feed on a female of *Aegus laevicollis formosae* Bates, 1866 (Coleoptera: Lucanidae) (J. F. Tsai, pers. observ.).

Synonymy. *Centrocnemis formosana* was described by MATSUMURA (1913) based on a single female holotype from Taiwan; subsequently the species occurring in Taiwan was cited under this name in the literature. The species was transferred to *Neocentrocnemis* by MILLER (1956). All material from Taiwan seen by us was conspecific, and the specimens fully agree with the original description and illustrations, and the several redescrptions and illustrations (MATSUMURA 1930, 1931; ESAKI 1932 [as *deyrollei*]; MILLER 1956; HSIAO & REN 1981; ISHIKAWA 2005) of *N. formosana*. The lectotype (a female) of *N. stali* and several additional specimens of the same appearance collected in Vietnam, China: Hainan Island, and Taiwan were examined. Virtually no external difference could be observed among them. Specimens from Taiwan have usually conspicuously short marginal processes of the abdomen (Fig. 17), whilst specimens from the mainland of Asia can have similar, much longer (Fig. 18), or intermediate spines; these differences are of no diagnostic value. Similarly, the 1+1 short transverse carinae of the posterior lobe of the pronotum, used as a diagnostic character for separating the two species by MILLER (1956: 246) and HSIAO & REN (1981: 414), show strong intraspecific variability even among long series collected at the same locality, and certainly are of no taxonomic value. The genitalia of several males from Taiwan (Figs. 8–15, 22–28) and two males from northern Vietnam (Figs. 19–21) were examined and compared. Specimens from Taiwan showed only small intraspecific variability; the phallus of one of the males from Vietnam was identical with specimens from Taiwan, the other was slightly different in the shape of the sclerotized elements of the wall of the endosoma (Fig. 21). Females from Taiwan and the Asian mainland are indistinguishable from each other and the female lectotype. As a consequence, *N. formosana* is hereby sunk as synonym of *N. stali*. Based on re-examination of the holotype, *N. baudoni* is also synonymized with the latter.

Examining various Oriental specimens belonging to *Neocentrocnemis* and a few holotypes of taxa described by N. C. E. Miller, we are convinced that the descriptions and illustrations of this author are insufficient for acceptable and adequate species definition. By a careful study of his species descriptions and identification keys it is clear that his species are based mostly on insignificant and obscure differences, and probably many of them are also synonyms of *N. stali*. This problem is not examined further now.

BERGROTH (1914: 364) reported *Centrocnemis deyrollei* Signoret, 1852 from Taiwan: 'Fuhosho' (currently Wucheng). Re-examination of a specimen studied by Bergroth, deposited in DEIC (based on photos received from Stephan Blank) concluded that it belongs to *N. stali*,

just like several other specimens collected at the same locality by the same collector which were directly examined by us. ESAKI (1926) synonymized *C. formosana* with *C. deyrollii* and later he provided a redescription of the species under the latter name (ESAKI 1932). As it is clear from the text and habitus illustration of the latter work, this is in fact misidentification of *C. stali*. No specimens of *Centrocnemis* Signoret, 1852 were examined during the present study from Taiwan, therefore the genus *Centrocnemis* and the species *C. deyrollii* are deleted from the checklist of the Reduviidae of this country.

The external male genitalia of *Neocentrocnemis*

The male genitalia of *N. stali* (as *N. formosana*) was illustrated and its homologies were discussed in detail by YANG & CHANG (2000) and YANG (2003). Since the later paper contains considerable differences from the earlier, and the author himself expressed us that he regards his first interpretation erroneous (C.T. Yang, pers. comm.), only the later paper is considered here. We disagree with some of the conclusions of these papers, therefore we present an alternative interpretation of the phallic structures of *Neocentrocnemis*. More detailed discussion of the structures and the applied terminology is presented by TSAI et al. (2011).

The phallus is held by a mobile sclerite derived from the infolding of sternite IX within the genital chamber. Such a structure occurs in the majority of reduviid subfamilies, mobile in some species, but immovably fused with the infolding of the ventral rim of the genital capsule in others. We recognize it as being homologous with the *cuplike sclerite* sensu SCHAEFER (1977). A more or less similar structure occurs in several families of Heteroptera, and it was termed variously by different authors, e.g. 'genital embracer' (YANG 1938 [Urostylididae], 1940 [Dinidoridae]), 'aedeagal support' (LESTON 1953 [Phloeidae]); 'aedeagal strut' (LESTON 1954 [Cydnidae], 1955 [Aradidae]); 'Subgenitalplatte' (KULLENBERG 1947 [Miridae]); 'membrane sous-génitale' (SCHMITZ 1968 [Miridae]); 'diafragma' (LENT & JURBERG 1968, 1975 [Reduviidae]). The homology between the similar structures of Cimicomorpha (e.g. Miridae, Nabidae) and Pentatomomorpha (e.g. Pentatomidae) is supported by their similar relative position (associated with the edge of the infolding of ventral rim of the genital capsule) and their function as pivoting the phallus through the suspensory apparatus (cf. KULLENBERG 1947).

The *articulatory apparatus* is restricted to the extreme base of the phallus (Fig. 22: aa; Fig. 15); the basal plates and the support bridge complex are clearly distinguishable. The main body of the phallus is formed by the *phallosoma s. lato*, including the endosoma.

The basal portion of the phallosoma *s. lato*, occupying nearly the three-fourth of its total length, is large and membranous, and ventrally it is associated with the pedicel (see below). DAVIS (1966) applies the term 'phallobase' for it, whilst YANG (2003) uses the term 'phallobase' in a broader sense, designating the whole external part of the phallosoma *sensu* authors. The term phallobase *sensu* DAVIS (1966) does not reflect the homologies of this part, and especially it is inadvisable because it includes the articulatory apparatus. This structure clearly corresponds with the *basal aula* sensu Cobben (Figs. 22, 26: ba) of Leptopodomorpha (COBBEN 1965) and Cimicomorpha (COBBEN 1978) and we use this term for it.

In *Neocentrocnemis* and other Reduviidae the ventral wall of the basal aula contains a flattened, narrow, ribbon-like, pigmented sclerite called *pedicel* (Figs. 15–16, 22, 27: ped)

(cf. DAVIS 1966). This structure was considered as a median extension of the basal plates and accordingly called as 'basal plate extension' by various authors (e.g. LENT & JURBERG 1965, 1967, 1968, 1970, 1971, 1975, as 'extensão mediana da placa basal'; WYGODZINSKY 1966; WEIRAUCH 2008), however, it is not derived from the basal plates (cf. CARRERA & OSUNA 1996). The basal plates in Reduviidae are restricted to the extreme base of phallus and bordered by the intersegmental membrane between segments IX–X (Fig. 15).

The 1+1 unpigmented, apically bulbous *support bridge prolongations* (Figs. 15–16, 27: sbp), well stainable with Chlorazol Black E, are closely associated with the inner surface of the pedicel. No *ductus seminis* could be traced (cf. Figs. 15–16): the ductus ejaculatorius probably terminates at the medioventral area of the support bridge complex, the ductus seminis is apparently lacking, or perhaps indistinguishably fused with the support bridge prolongation; the sperm is probably transferred in the ventral concavity between the 1+1 support bridge prolongations. The voluminous inner lumen of the basal aula transfers the erection fluid.

The support bridge prolongation sensu YANG (2003: 128, Fig. 1F: sub) corresponds to the pedicel, whilst his 'ejaculatory duct' (= ductus seminis) apparently corresponds with the support bridge prolongation.

The apical portion of the phallosoma *s. lato* in repose (Figs. 22, 26: phth), occupying about one-fourth of its total length, surrounding the complex inner sclerites and membranes, was recognized by YANG (2003: 128, Fig. 1F) as the 'phallobasal conjunctiva' (= conjunctiva sensu authors) and its processes. Unfortunately this drawing shows the phallus after removal of the external wall of the phallosoma (corresponding with Fig. 27 of the present paper), therefore this interpretation is clearly erroneous. The apical portion of the phallosoma is apparently homologous with the *phallotheca* of Pentatomoidea, and it was termed as such by DAVIS (1966); this term is also applied by us for this structure.

The *endosoma* (corresponding to the endophallus sensu SNODGRASS (1935)) is an apical membranous invagination of the phallosoma connected to the apex of the ductus seminis. In YANG (2003: 128, fig. 1F: ejd) the ductus seminis is clearly present within his 'phallobasal conjunctiva' (= the basal part of the endosoma). By removing the phallotheca wall, opening the inner membranes of the phallus, and staining with Chlorazol Black E, it was impossible to trace any similar narrow ducts within the phallotheca, no matter with or without sclerotized rings in its wall. However, the endosoma and its various appendages are possible to stain and identify (Figs. 23–28). At the apex of the pedicel the seminal fluid gets into and is transferred within the lumen of the endosoma, as in other reduviids. The endosoma of *Neocentrocnemis* cannot be inflated, partly because it is short (not longer than the phallotheca), partly because its wall is fixed in its position by various sclerotized elements.

The endosoma is associated with various *endosomal appendages* and *sclerites*, the terms used above for designating them are purely descriptive. Among them, 1+1 rod-like sclerites articulated with the apex of the pedicel deserve more attention. These parts are the so-called 'struts' (sensu SINGH-PRUTHI 1925, CARAYON et al. 1958, DAVIS 1966) in various groups of Reduviidae. The paired sclerites at the base of the phallotheca are very different in the phymatine complex compared to the remaining clades of Reduviidae (apparently surrounded by the endosomal wall in the phymatine complex, but running within the phallothecal lumen in the remaining clades), and it has never been convincingly demonstrated that they are homolo-

gous within the family; however, tentatively we use the term ‘struts’ for designating them in Centrocneminae too. The 1+1 thick sclerites at the base of the phallotheca (Figs. 24, 27–28: strb) and the 1+1 apical whip-like structures protruding from the phallosoma (Figs. 24, 27–28: stra) of *Neocentrocnemis* are considered as individualized parts of the struts (cf. CARAYON et al. 1958, DAVIS 1966); this is apparently supported by the fact that in some members of Holoptilinae: Dasyncnemini the basal and apical portions are not separated (cf. Fig. 52: strda). The struts of Reduviidae were derived from the basal plate bridge (= ductifer of other authors) by SINGH-PRUTHI (1925), from the support bridge by YANG (2003), and from the dorsal wall of the endosoma by DAVIS (1966). The origin of the struts is difficult to decide, but the fact that the basal struts (Figs. 24, 27–28: strb) of *Neocentrocnemis* are clearly surrounded by a thin membrane (Fig. 27: ensw) makes it probable that these structures are appendages of the endosoma at least in this genus.

YANG (2003) recognized the individualized apical portions of the struts (Figs. 24, 27–28: stra) as the aedeagus *sensu* Yang; this term corresponds to the vesica *sensu* authors (cf. YANG & CHANG 2000). Other authors (LENT & JURBERG 1965, 1967, 1968, 1970, 1971, 1975; LENT & WYGODZINSKY 1979) also recognized ‘vesica’ in various other reduviids. Undoubtedly none of these structures are homologous with the vesica occurring in other heteropteran families. During the postembryonic development the vesica *sensu* authors (= aedeagus *s. str. sensu* TSAI et al. 2011) of Pentatomomorpha develops from a secondary delamination of the inner side of the mesomere lobes (the aedeagal primordia) (the outer side of the mesomere lobes develops into the phallosoma), represents the distalmost part of the phallus, and apically forms an aperture through which the lumen of the endophallic duct opens to the exterior. Such a structure is definitely not differentiated in any Reduviidae (the apical portions of the struts do not serve for transmitting sperm, the seminal fluid passes through the inner lumen of endosoma and it is ejaculated through the phallotheca mouth (Fig. 25: phm)). The bulbous ‘vesica’ of Miridae, or the thread-like ‘vesica’ of Nepidae and Corixidae are also apparently not present in any reduviids. The vesica *sensu* Lent and co-workers is nothing else than various more or less sclerotized appendages of the apical part of the phallosoma or the endosoma close to the phallotheca mouth.

Subfamily Holoptilinae Amyot & Serville, 1843

Genus *Locoptiris* Villiers, 1943

Locoptiris Villiers, 1943: 227. Type species by original designation: *Locoptiris burgeoni* Villiers, 1943.

References. WYGODZINSKY & USINGER (1963): 51 (diagnostic characters, notes); VILLIERS (1986): 216 (diagnostic characters of included species); MALDONADO CAPRILES (1990): 336 (catalogue).

Diagnosis. Distinguished from all other genera of the subfamily Holoptilinae by the combination of the following characters: body very small (2.5–3.5 mm); antenna and hind tibia densely clothed with stiff setae much longer than diameter of respective segments; antennal segments III and IV fused, therefore antenna 3-segmented, segment II not produced beyond base of segment III+IV; abdominal trichome absent.

Notes. *Locoptiris* currently contains two species, *L. burgeoni* Villiers, 1943 and *L. couturieri* Villiers, 1986, both occurring in tropical Africa. WYGODZINSKY & USINGER (1963: 51) noted

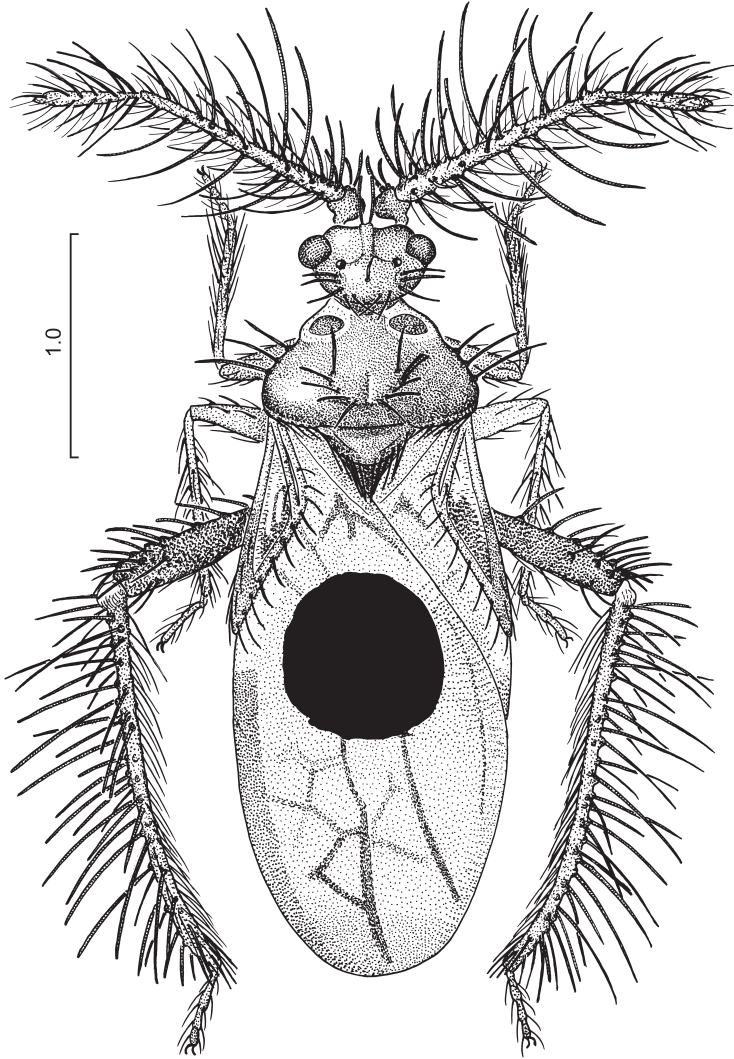


Fig. 41. *Locoptiris taiwanensis* sp. nov., male. Scale in mm.

that *Ptilocerus pendleburyi* Miller, 1940, described from the Malay Peninsula, shows very close resemblance to *Locoptiris* and may belong to this genus; however, they pointed out that the African species differs from *P. pendleburyi* in a few characters probably of generic importance. Consequently, apparently largely based on zoogeographical considerations too, they did not make any formal change in the placement of the latter species.

Re-examination of the type material of *P. pendleburyi* and *L. couturieri*, examination of several specimens of *L. burgeoni*, and direct comparison of the holotype of *L. taiwanensis*

to both African species lead the first author to the following conclusion. The two African species, *Ptilocerus pendleburyi*, and *L. taiwanensis* sp. nov. described below are strikingly similar morphologically, and apparently closely related phylogenetically. Although a few characters could be observed to separate the African and the Asian forms (Table 1), none of them are considered as of genus level importance. Since it seems unjustified to separate the taxa at genus level, we regard all the four species as congeneric, and therefore we place the new species to *Locoptiris*, furthermore we propose the following new combination: *Locoptiris pendleburyi* (Miller, 1940), **comb. nov.** We define the following, apparently monophyletic species groups within *Locoptiris*: *L. burgeoni* species group (*L. burgeoni*, *L. couturieri*), and *L. pendleburyi* species group (*L. pendleburyi*, *L. taiwanensis* sp. nov.).

Table 1. Diagnostic characters of the species groups of *Locoptiris* Villiers, 1943.

<i>L. burgeoni</i> species group	<i>L. pendleburyi</i> species group
1. Lateral margin of posterior lobe of pronotum with one spine-like seta before humeral angle; disc of posterior lobe of pronotum with at most 2 pairs of spine-like setae at median furrow	Lateral margin of posterior lobe of pronotum with 2–3 spine-like setae before humeral angle; disc of posterior lobe of pronotum with 4–6 pairs of spine-like setae at median furrow, arranged in U-shaped line (Fig. 42)
2. Fore wings only with simple longitudinal veins	Longitudinal veins of fore wings ramifying (Fig. 65)
3. Membrane of fore wing rather uniformly whitish or light gray	Membrane with a distinct, large, more or less rounded, dark spot centrally (Fig. 65)

***Locoptiris taiwanensis* sp. nov.**

(Figs. 41–53, 65)

Type locality. Taiwan: Yilan County, Fushan Botanical Garden.

Type material. HOLOTYPE: ♂, 'TAIWAN: Yilan Co., Fushan \ Bot. Garden ([‘Fushan Botanical Garden’, in Chinese script]) \ N24°45.377' E121°35.678' \ 640 m, forest edge' [printed]; 'from ferns growing on trees \ 2007. IX. 16. \ leg. Rédei D & Tsai JF' [printed] (mounted on card, in intact condition; deposited in HNHM). PARATYPE: ♂, 'Taiwan Pin[g]tung [County] \ Hengchun Kenting Park \ No : II Sampling plots' [printed]; 'X/3---X/31/2007 \ C.S.Lin & W.T.Yang \ Malaise trap (KCN)' [printed] (mounted on card, left and right antennal segments III+IV and pregenital abdomen glued on card separately, male genitalia dissected, preserved in plastic microvial with glycerine, pinned with the specimen; deposited in NMNS).

Description. *Macropterous male.* *Colour.* Head, antenna, and labium ochraceous, ocelli surrounded by dark spot; pronotum ochraceous, posterior lobe gradually darkened posteriorly; scutellum brownish ochraceous; thoracic pleura ochraceous, supracoxal lobes whitish; veins of corium ochraceous, cells of corium, and clavus hyaline, membrane semitransparent with veins and anterior margin widely gray, basal half with a large, rounded, piceous spot reaching nearly to fusion point of Cu and AA₁₊₂; coxae, trochanters, and basal third of femora whitish, middle third of femora brown, apical third ochraceous; tibiae and tarsi ochraceous; abdominal venter dark brown, hypopleurites ochraceous. *Body surface and vestiture.* Body smooth, subshining, covered with scattered long, thick, stiff, serrate, brown setae, originating from wart-like basal tubercles; antenna densely covered with stiff, serrate setae intermixed with long, fine, simple, whitish setae; anterior lobe of pronotum covered with dense, adpressed, tomentose, white pubescence; femora and tibiae covered with stiff, serrate setae originating

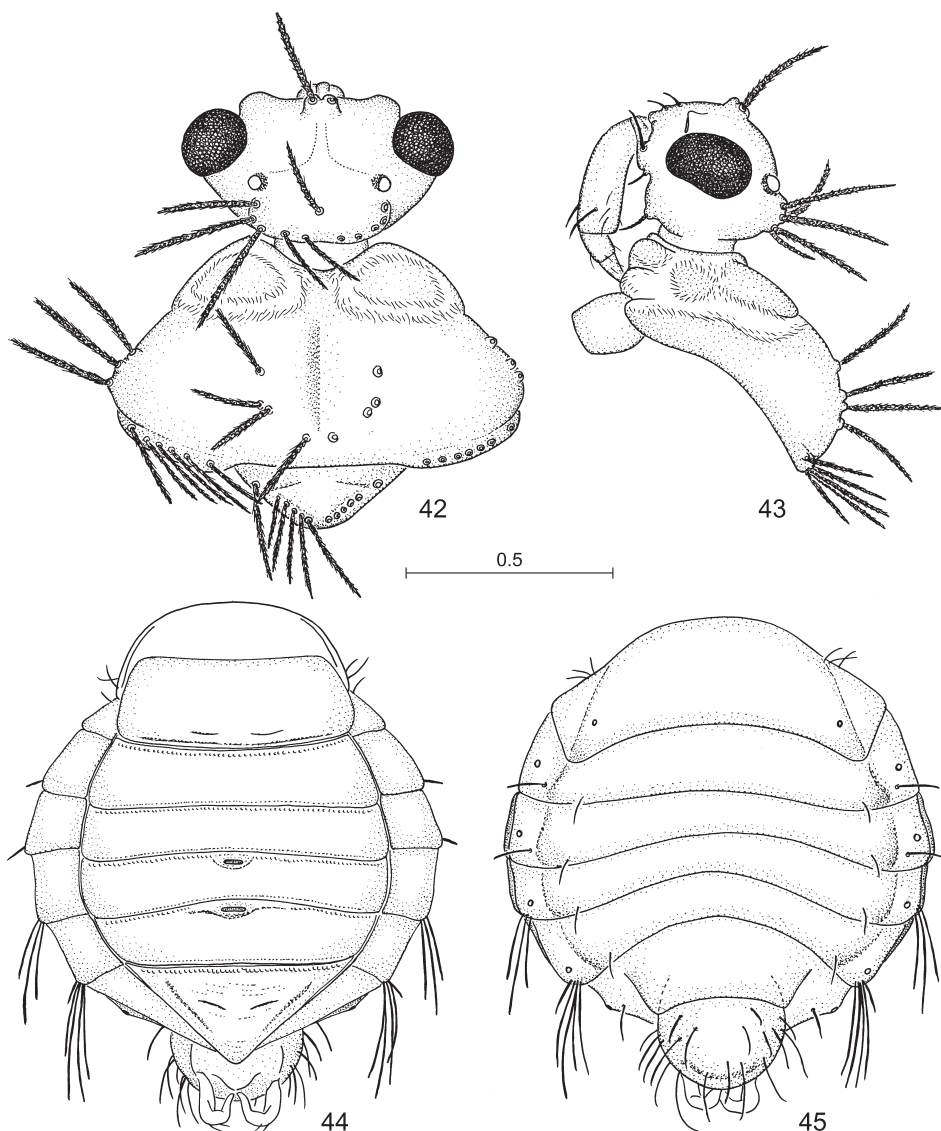
from tubercles; base of hind tibia with a brush-like tuft of serrate, whitish setae; abdomen only with a few scattered setae (Figs. 44–45), posterolateral angles of hypopleurites V and VI each with a tuft of 3–5 thick, serrate setae.

Structure. Head (Figs. 42–43) short, transverse in dorsal view, 1.65–1.7 as wide as long, almost vertically declivent before antenniferous tubercles, widely rounded posteriad to eyes; eyes relatively small, semiglobular, protruding, width of head across eyes about 1.75 times as wide as interocular distance; antenniferous tubercles situated close to eyes, opening ventrally; frons with a median tubercle anteriorly bearing 1+1 serrate setae apically; postocular part elevated, with 5+5 serrate setae arranged in U-shaped line and a single central serrate hair; bucculae with 1+1 serrate setae at posterior angle; gula produced into 1+1 tubercles posteriorly each bearing a serrate hair apically. *Labium* (Fig. 43) thick, basal segment (segment II) cylindrical, reaching apex of prosternum, about twice as long as combined lengths of segments III+IV. *Antenna*. Segment I short and stout, narrowly pedunculate at extreme base; segment II curved, about 1.1 times as long as humeral width of pronotum, about 2.5 times as long as fused segments III+IV.

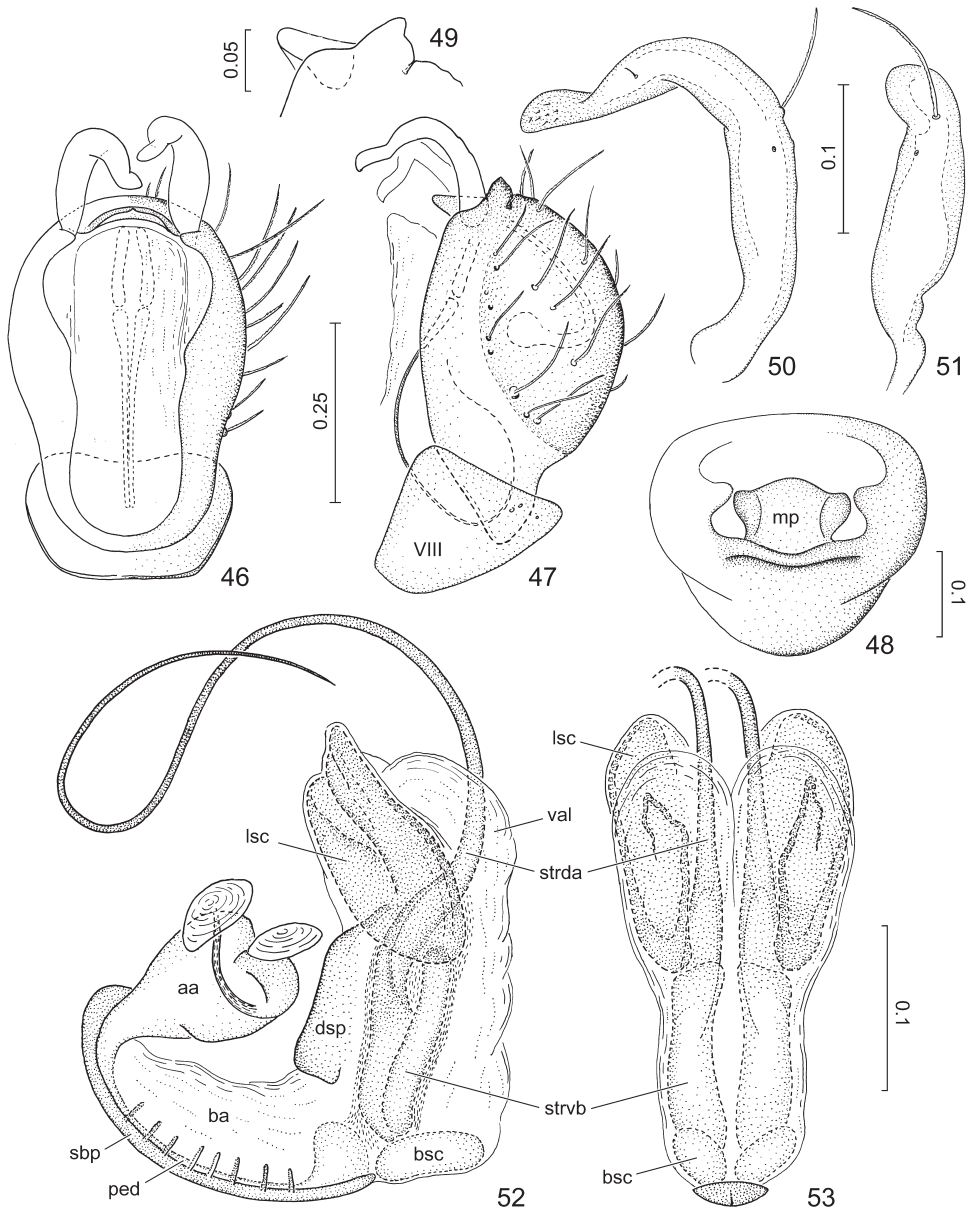
Pronotum (Figs. 42–43) 1.9–2.0 times as wide as median length, anterior and posterior lobes indistinctly separated; anterior lobe much shorter than posterior lobe, adpressed tomentose pubescence forming 1+1 rings in dorsal view; posterior lobe about 1.6 times as wide as anterior lobe, with a median longitudinal furrow, disc with (4–6)+(4–6) serrate setae arranged in U-shaped line, lateral margin with 3 serrate setae anterior of humeral angle; posterior margin straight anterior of scutellum, narrowly explanate and bearing 6 serrate setae laterad to scutellum. *Scutellum* (Fig. 42) subtriangular, with 1+1 serrate setae at basal angle and 5+5 serrate setae along lateral margin. *Fore wing* (Fig. 65) wide, surpassing abdomen by nearly its apical half; corium about 0.4 times as long as total length of fore wing; posterior cell of corium very narrow, approximately as wide as the diameter of the two veins delimiting it; Cu+AA₁₊₂ and M approaching margin of membrane; apical half of M ramifying, forming closed cells and short free branches. *Legs* stout; fore and mid legs relatively short, covered with relatively narrow serrate setae originating from relatively small tubercles; hind femur thick, curved at base; hind tibia long, gradually narrowing towards apex, apical part strongly curved; hind femur and tibia with thick and long serrate setae originating from large tubercles, erect in dorsal surface, more gracile and more declivous in ventral surface of tibia; base of hind tibia with a brush-like tuft of serrate, whitish setae.

Pregenital abdomen (Figs. 44–45) rounded in dorsal view; tergite VII broadly triangular; segment VIII of male (Fig. 47: VIII) membranous dorsally. *Male genitalia. Genital capsule* (Figs. 46–49) elongate, dorsally membranous, anterior and posterior apertures not separated by distinct dorsal sclerotized bridge-like portion therefore seemingly confluent; ventral rim forming a thick transverse ridge posteriorly, infolding of ventral rim with a flattened, broadly trilobed median projection (Fig. 48: mp). *Parameres* (Figs. 50–51) symmetrical, strongly curved, hook-like, their extreme apices slightly broadened (most of the hair sensilla were broken off in the examined specimen!). *Phallus* (Figs. 52–53): articulatory apparatus small, restricted to the extreme base of the phallus; basal plates short, thick; support bridge complex with 2+2 capitate processes of lateral position, continued in 1+1 greatly elongate, narrow support bridge prolongations (Fig. 52: sbp) but fused at most of their length, apically

strongly bulbous; phallosoma with a large, membranous basal aula (Fig. 52: ba) provided with a pedicel (Fig. 52: ped); phallotheca relatively short, with a dorsal sclerotized plate (Fig. 52: dsp); phallotheca mouth opening between 1+1 large, thick ventroapical membranous lobes (Figs. 52: val); endosoma tubular, membranous, impossible to inflate because of rigid sclerotized elements in its wall, with processes as follows: 1+1 short and thick basal sclerites



Figs. 42-45. *Locoptiris taiwanensis* sp. nov., male. 42 – head, pronotum, and scutellum, dorsal view; 43 – head and pronotum, lateral view; 44 – abdomen, dorsal view; 45 – same, ventral view. Scales in mm.



Figs. 46–53. *Locoptiris taiwanensis* sp. nov., male genitalia. 46 – segment VIII and genital capsule, dorsal view; 47 – same, lateral view; 48 – same, posterior view, hairs omitted; 49 – apex of genital capsule, lateral view; 50–51 – left paramere, two different aspects; 52 – phallus, lateral view; 53 – same, ventral view. Legends as in Figs. 22–24, furthermore: mp = median projection of infolding of ventral rim of pygophore; strvb = ventrobasal portion of struts; strda = dorsoapical portion of struts; val = ventroapical lobe; VIII = segment VIII. Scales in mm.

(Figs. 52–53: bsc); 1+1 struts subdivided into two portions, both articulated with the apex of support bridge prolongations: ventrobasal portions (Figs. 52–53: strvb) thick, extending to about middle of phallosheca, dorsoapical portions (Figs. 52–53: strda) elongate, whip-like, narrowing towards apex, far protruding from phallosheca; 1+1 elongate, folded lateral sclerites (Figs. 52–53: lsc).

Measurements (holotype ♂ / paratype ♂) (in mm). Body length to apex of fore wing 3.2 / 3.1, to apex of abdomen 1.9 / 1.9. Length of head 0.37 / 0.35, width across eyes 0.62 / 0.60, interocular distance 0.36 / 0.34, interocellar distance 0.22 / 0.22; lengths of antennal segments I, II, and III+IV as 0.19 / 0.19, 1.07 / 1.05, and 0.42 / 0.42; lengths of labial segments II, III, and IV (visible segments I, II and III) as 0.25 / 0.27, 0.08 / 0.08, and 0.09 / 0.10; length of pronotum along meson 0.48 / 0.48, humeral width 0.95 : 0.93; length of scutellum 0.18 : 0.15, basal width 0.37 / 0.37; length of fore wing 2.33 / 2.32, greatest width 0.98 / 1.10; lengths of femur, tibia, and tarsus of fore leg as 0.51 / 0.46, 0.66 / 0.59, and 0.24 / 0.20; of mid leg as 0.59 / 0.52, 0.88 / 0.80, and 0.22; of hind leg as 0.73 / 0.71, 1.80 / 1.70, and 0.29 / 0.25, respectively.

Etymology. The specific epithet is a toponymical adjective derived from Taiwan (terra typica).

Habitat notes. A single male (the holotype) was obtained in the Fushan Botanical Garden by a canopy net through sweeping tufts of ferns growing on a tree about 4 meters above the ground. The habitat was a regularly cut meadow scattered with trees, surrounding a main road in the Botanical Garden, close to a forest edge. The paratype was captured by Malaise trap which infers the ability of the species to fly.

Distribution. Taiwan.

Comparative notes. *Locoptiris taiwanensis* sp. nov. is closely related to *L. pendleburyi* (Miller, 1940) described from Kuala Lumpur, the holotype of which has been examined by the first author. The two species are very similar externally, but *L. pendleburyi* is slightly smaller, its general colouration is darker, and the central spot on the fore wing is smaller. The unique holotype has not been dissected. Two additional specimens apparently representing *L. pendleburyi* and tentatively identified as such from Borneo have been examined, one of them has been dissected; its male genitalia are much different from those of *L. taiwanensis* sp. nov. Data of the dissected specimen: Malaysia, Sabah, Mt. Kinabalu, Pouring Hot Springs (43 km E of Park Headquarters), 'Langanan Trail', trail to Kipungit Falls and Bat Caves, 530–650 m, 21.iii.1983, leg. C. Lienhard (Pal-83/41, MHNG).

Species of *Locoptiris* can be distinguished by the following key.

Key to the species of *Locoptiris* Villiers, 1943

- 1 Fore wings with simple longitudinal veins; membrane of fore wing rather uniformly whitish or light gray. Afrotropical Region (*Locoptiris burgeoni* species group). 2
- Longitudinal veins of fore wings ramifying apically; membrane with a large dark spot centrally. Oriental Region (*Locoptiris pendleburyi* species group). 3
- 2 Hind leg testaceous, femoro-tibial articulation widely black; body length about 3.5 mm. Democratic Republic of Congo, Ivory Coast. *L. burgeoni* Villiers, 1943

- Hind leg testaceous, femur with two brown annuli, one apical and one around middle, tibia rather uniformly testaceous; body length about 2.6 mm. Ivory Coast. *L. couturieri* Villiers, 1986
- 3 Infolding of ventral rim with a flattened, dorsally broadly convex process; basal sclerite of endosoma large, about as long as ventrobasal portion of struts; lateral sclerite of endosoma nearly twice as long as ventrobasal portion of struts. Malay Peninsula, Borneo. *L. pendleburyi* (Miller, 1940)
- Infolding of ventral rim with a flattened, dorsally broadly trilobed process (Fig. 48); phallus as in Figs. 52–53, basal sclerite of endosoma (Figs. 52–53: bsc) small, much shorter than ventrobasal portion of struts, restricted to extreme base of phallosome; lateral sclerite of endosoma (Fig. 52: lsc) slightly longer than ventrobasal portion of struts (Fig. 52: strvb). Taiwan. *L. taiwanensis* sp. nov.

Genus *Ptilocerus* Gray, 1831

Ptilocerus Gray, 1831: 34. Type species by monotypy: *Ptilocerus fuscus* Gray, 1831.

Maotys Amyot & Serville, 1843: 318. Unnecessary new name for *Ptilocerus* Gray, 1831 (cf. STAL 1874: 5).

References. LETHIERRY & SEVERIN (1896): 93 (catalogue); KIRKALDY (1902): 137 (synonymy); DISTANT (1903): 198 (redescription, fauna of India); MONTANDON (1907): 416 (key to selected species); OSHANIN (1908): 522 (catalogue, Palaearctic); OSHANIN (1912): 50 (catalogue, Palaearctic); FUKUI (1926): 9 (redescription, fauna of Japan); STICHEL (1960): 367 (catalogue, Palaearctic); STICHEL (1962): 106 (catalogue, Palaearctic); HSIAO & REN (1981): 411 (redescription, fauna of China and Taiwan); MALIPATIL (1989): 284 (in key); PUTSHKOV & PUTSHKOV (1996): 171 (catalogue, Palaearctic); MALDONADO CAPRILES (1990): 339 (catalogue, world).

Diagnosis. Distinguished from other genera of the subfamily Holoptilinae by the combination of the following characters: antenna and hind tibia densely clothed with fine setae much longer than diameter of respective segments; postocular part of head lacking a radiating cluster of setae situated on a central elevation; antenna 4-segmented, apex of segments II and III not produced beyond base of segments III and IV, respectively; corium with 3 distinct cells; hind tarsus 2-segmented; abdominal trichome present.

Distribution and diversity. The genus currently contains 16 species occurring from South Asia through the Malay Archipelago to northern Australia; *Ptilocerus immitis* Uhler, 1896 also enters the marginal areas of the Palaearctic Region (Japan). Two species are recognized in Taiwan.

Ptilocerus immitis Uhler, 1896

(Fig. 67)

Ptilocerus immitis Uhler, 1896: 269. HOLOTYPE: Japan; USNM.

References. OSHANIN (1908): 522 (catalogue, distribution); OSHANIN (1912): 50 (catalogue, Palaearctic); MATSUMURA (1913): 159 (as *immitis* [lapsus], redescription, record, habitus illustration); FUKUI (1926): 9 (redescription, record); MATSUMURA (1930): 181 (redescription, record, habitus illustration); MATSUMURA (1931): 1212 (redescription, record, habitus illustration); ESAKI (1932): 1654 (redescription, habitus illustration); ISHIHARA (1941): 19 (prey); ESAKI (1959): 246 (redescription, habitus illustration); GYOTOKU (1960): 56 (record, habitat); STICHEL (1960): 367 (catalogue, distribution); MIYAMOTO (1961): 218 (alimentary tract); STICHEL (1962): 106 (catalogue, distribution); MIYAMOTO & YASUNAGA (1989): 171 (listed, distribution); MALDONADO CAPRILES (1990): 339 (catalogue, distribution); PUTSHKOV & PUTSHKOV (1996): 171 (catalogue, distribution); ISHIKAWA (2005): 23 (photo).

Specimen examined. TAIWAN: TAICHUNG COUNTY: Taichung, '6. 16.' [= vi.1916?], leg. [S.] Matsumura (1 ♀, identified as *Ptilocerus* sp. n. by T. Shiraki, NTU).

Diagnosis. The species can be distinguished from other species of *Ptilocerus* by the combination of the following characters: pronotum narrow, humeral angles not broadly dilated; fore wing (Fig. 67) with corium relatively long, occupying more than one third of total length of wing; anterior margin of membrane evenly curved, apices of membranes of the two wings directed caudad and overlapping in resting position of wings; membrane with two large dark spots (one neighbouring apex of corium, the other apex of clavus), without scattered small light spots; venation simple, without reticulate veins. It is readily identified by the illustrations provided by ESAKI (1939, 1952) and ISHIKAWA (2005).

Biology. The species seems very rare, it has not been recorded since 1960. Its biology is virtually unknown. ISHIHARA (1941) noted that it feeds on ants. In Fukuoka Prefecture, Kyūshū, Japan, adults and larvae were collected under the bark of an old specimen of Japanese red pine (*Pinus densiflora* Siebold & Succ., Pinaceae) at about 100–170 cm from the ground, together with specimens of the ant species *Pheidole noda* Smith, 1874 (Formicidae) (GYOTOKU 1960).

Distribution. Japan: Honshū: Gifu (MATSUMURA 1913), Kyūshū (ESAKI 1959): Yoshii [now part of Ukiha] (GYOTOKU 1960); Taiwan! (new record).

Ptilocerus kanoi Esaki, 1931

(Figs. 54–64, 66)

Ptilocerus kanoi Esaki, 1931: 261. HOLOTYPE: ♂, [Taiwan:] 'Urai' [= Wulai]; KUEC.

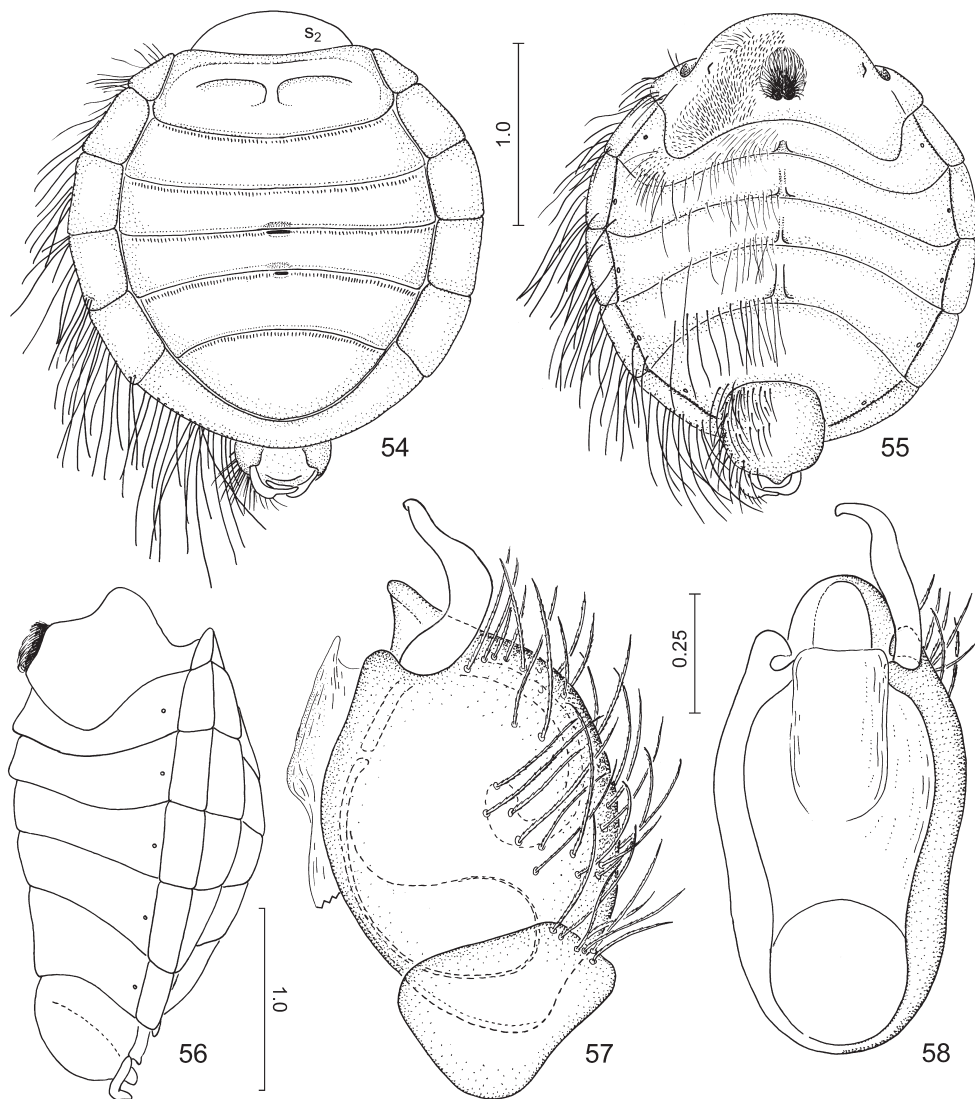
References. ESAKI (1932): 1655 (redescription, habitus illustration); KATO (1933): [plate 22] (colour photo); HSIAO & REN (1981): 411 (redescription); MALDONADO CAPRILES (1990): 339 (catalogue, distribution); PUTSHKOV & PUTSHKOV (1996): 171 (catalogue, distribution); LIN (2003): 128 (listed, distribution).

Specimens examined. TAIWAN: TAIPEI CITY: 'Sōzan' [= Yangmingshan], 16.v.1937, leg. M. Chujo (1 ♀, NTU). TAIPEI COUNTY: 'Taihoku' [= Taipei], 27.iv.1931, leg. J. Sonan (1 ♂ [Figs. 54–60], NTU); same locality, 19.iv.1932, leg. R. Takahashi (1 ♂ [Figs. 61–64], NTU); same locality, 1. iv.1940, leg. Musayama (1 ♂, NTU); 'Wulai, Taipei', 20.iii.1963, leg. K.S. Lin (1 ♂, TARI). NANTOU COUNTY: Lienhuachih, 31.vii.2008, leg. H.T. Shih (1 ♂, TARI).

Diagnosis. The species can be distinguished from other species of *Ptilocerus* by the combination of the following characters: pronotum broad, humeral angles dilated; fore wing (Fig. 66) with corium short, occupying about one fourth of total length of wing; anterior margin of membrane nearly straight, apices of membranes of the two wings directed caudolaterad and not overlapping in resting position of wings; membrane with several irregularly distributed, small, rounded, light spots; venation simple, without reticulate veins. The species seems related to *P. guttifer* (Walker, 1873) (Borneo) and *P. venosus* (Walker, 1873) (Singapore) by the structure of the wing (anterior margin of membrane straight, corium very short), but it is easy to distinguish from these by the simple venation and the strongly different colour pattern of the wing.

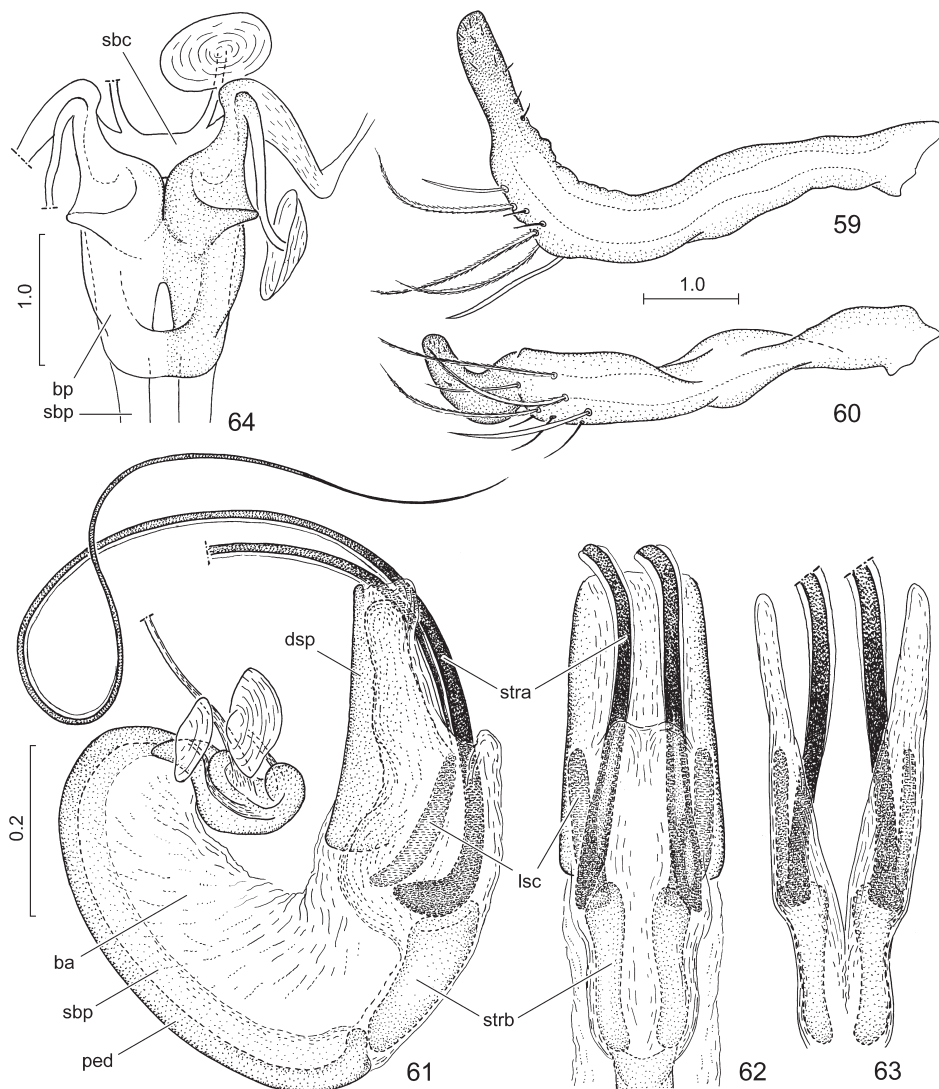
Redescription of pregenital abdomen and genitalia. *Pregenital abdomen* (♂, ♀) rounded in dorsal view (♂: Fig. 54), sternites III–VI each with a short median longitudinal ridge (Fig. 55); epipleurites VII of male fused along midline posteriad to tergite (= mediotergite) VII;

segment VIII of male membranous dorsally. *Male genitalia*. *Genital capsule* (Figs. 57–58) elongate, dorsally membranous, anterior and posterior apertures not separated by distinct dorsal sclerotized bridge-like portion therefore seemingly confluent. *Parameres* (Figs. 59–60) curved, curved portion provided with hair sensilla, apical one-fourth forming an elongate, apically obtusely truncate process. *Phallus* (Figs. 61–64): artulatory apparatus (Fig. 64)

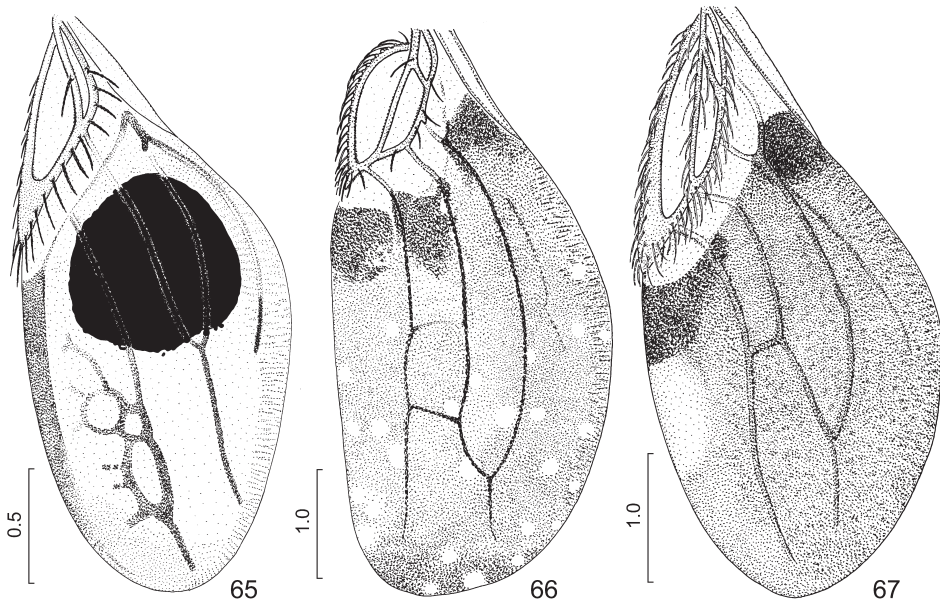


Figs. 54–58. *Ptilocerus kanoi* Esaki, 1931, male. 54 – abdomen, dorsal view; 55 – same, ventral view; 56 – same, lateral view; 57 – genital capsule with segment VIII, lateral view; 58 – genital capsule, dorsal view. Legend: s_2 = sternite II. Scales in mm.

small, restricted to the extreme base of the phallus; basal plates short, thick; support bridge complex with 2+2 capitate processes of lateral position, continued in 1+1 greatly elongate, narrow support bridge prolongations (Fig. 64: sbp) separated at base but adjacent at most of their length; phallosoma with a large, membranous basal aula (Fig. 61: ba) provided with a pedicel (Fig. 61: ped); phallosome elongate, with a dorsal sclerotized plate (Fig. 61: dsp);



Figs. 59–64. *Ptilocerus kanoi* Esaki, 1931, male genitalia. 59–60 – left paramere, two different aspects; 61 – phallus, lateral view; 62 – same, ventral view; 63 – endosoma, dorsal view; 64 – articulatory apparatus, anterior view. Legends as in Figs. 15, 22–24. Scales in mm.



Figs. 65–67. Left fore wings of Holoptilinae spp. 65 – *Locoptiris taiwanensis* sp. nov.; 66 – *Ptilocerus kanoi* Esaki, 1931; 67 – *P. immitis* Uhler, 1896. Scales in mm.

phallotheca mouth situated ventrally, relatively far from the apex of the phallotheca; endosoma tubular, membranous, with processes as follows: 1+1 struts subdivided into two portions: basal portions (Figs. 61–62: strb) thick, broadened towards apex, apical portions (Figs. 61–62: stra) articulated to apex of basal portions of struts, thickened and curved basally, elongate, whip-like, narrowing towards apex, far protruding from phallotheca; 1+1 elongate lateral sclerites (Figs. 61–62: lsc); 1+1 elongate, membranous lobes, their basal portions surrounding bases of apical portions of struts (Fig. 63).

Distribution. Taiwan!

Key to the species of Holoptilinae from Taiwan

- 1 Abdominal trichome absent (Figs. 45) (tribe Dasyncnemini). Body small (about 3 mm); antenna 3-segmented; head elevated behind ocelli, with a radiating cluster of long serrate setae (Fig. 42); corium with two distinct cells (Fig. 65). Genus *Locoptiris* Villiers, 1943. *Locoptiris taiwanensis* sp. nov.
- Abdominal trichome present (Figs. 55–56) (tribe Holoptilini). Body much larger (about 7 mm); antenna 4-segmented; head not elevated behind ocelli, without such cluster of setae; corium with three distinct cells (Fig. 66–67). Genus *Ptilocerus* Gray, 1831. 2
- 2 Corium occupying about basal one-fourth of total length of fore wing; anterior margin of membrane almost straight; membrane with several small rounded light spots (Fig. 66) *Ptilocerus kanoi* Esaki, 1931

- Corium occupying more than basal one-third of total length of fore wing; anterior margin of membrane evenly arched; membrane without small rounded light spots (Fig. 67).
..... *Ptilocerus immitis* Uhler, 1896

Notes on the male intromittent organ of Holoptilinae

The phallus of Holoptilinae is poorly studied; VILLIERS (1948), CARAYON et al. (1958), DISPONS (1964), DAVIS (1966), MALIPATIL (1983a,b, 1985), and MOULET (2006) provided illustrations of various members of this subfamily.

Most parts of the phallus of Holoptilinae can clearly be homologized with structures occurring in Centrocnemidinae. The species of the tribes Holoptilini and Aradellini of which the phalli have been examined so far share the following characters with Centrocnemidinae: endosoma with 1+1 struts subdivided to basal and apical portions, apex of basal portions of struts articulated with 1+1 lateral sclerites.

Of the tribe Dasyncemini, *Putoniola kermana* Dispons, 1964 have basically similar phallus than the examined Holoptilini and Aradellini (DISPONS 1964). MOULET (2006), however, described and illustrated a different structure in *Dasyncnemus sahlbergi* Bergroth, 1898, and similar was observed in *Locoptiris taiwanensis* sp. nov. in the present study. In *L. taiwanensis* 2+2 elongate sclerites are articulated to the apex of support bridge prolongations (Fig. 52: strda, strvb); in *D. sahlbergii* the situation is basically similar but both of these pairs are subdivided into further portions (cf. MOULET 2006: 323, Fig. 7). The origin of these sclerites are problematic, tentatively we hypothesize that these can be derived partly from fusions, partly from secondary subdivisions of the basal and apical portions of the struts occurring in other groups of the so-called phymatine complex. The thick ventrobasal sclerite (Figs. 52–53: strvb) is probably the result of a horizontal subdivision of the basal portion of the struts (cf. *Ptilocerus*, Figs. 61–62: strb); the elongate, whip-like sclerite far protruding from the phallotheca (Fig. 52–53: strda) is probably derived from the fusion of the following two pieces: (1) the dorsal sclerite resulting from the horizontal subdivision of the basal portion of the struts, and (2) the apical portion of the struts (cf. *Ptilocerus*, Figs. 61–62: stra). This hypothesis is apparently supported by the position of the 1+1 possibly homologous lateral sclerites which appear to articulate with the apex of the ventroapical finger-like projection of the basal portion of the struts in *Neocentrocnemis*, but with the apex of the ventrobasal sclerite in *Locoptiris*. It is difficult to decide which condition is apomorphic and which is plesiomorphic, but since the condition described in detail in *Neocentrocnemis* is found in Elasmodeminae (WYGODZINSKY 1944, CARAYON et al. 1958) and the majority of Holoptilinae, and more or less similar situation is found in Phymatinae (CARAYON et al. 1958, DAVIS 1957), the above described condition of Dasyncemini *partim* (*Locoptiris*, *Dasyncnemus*) is apparently apomorphic.

Acknowledgements

We are grateful to the following persons: Eric Guilbert, Dominique Pluot-Sigwalt, Laurent Fauvre (MNHN) and Gunvi Lindberg (NHRS) for their help and hospitality during the first author's visit to Paris and Stockholm and for providing digital photos of type specimens;

Wen-Jun Bu and several other colleagues (NKUC) for constant help and allowing us access to their collections; Man-Miao Yang (NCHU), Chin-Ling Wang, Shu-Pei Chen, Hsien-Tzung Shih, and Chi-Feng Lee (TARI), Cheng-Shing Lin and Mei-Ling Chan (NMNS), Wen-Jer Wu, Chiun-Cheng Ko and Ming-Yu Tsai (NTU) for their assistance during our visit to their respective institutions and for providing materials; Stephan Blank (DEIC) for providing us information about the collection under his care; Dimitri Forero (University of California, Riverside, U.S.A.) for several constructive comments to the manuscript; Petr Kment (National Museum, Prague, Czech Republic) and Pavel Štys (Charles University, Prague, Czech Republic) for comments on nomenclature; the staff of Fushan Botanical Garden for providing permissions for collecting in the territories under their care; Zhe-Yuan Liu and Tai-Chuang Wang, our partners during our field trips in 2007, for their contribution to the successful collecting activity; Ren-Jye Chen (Kaohsiung) and Gábor Csorba (HNHM) for sharing their field observations; Kazutaka Yamada (Tokushima Prefectural Museum, Tokushima, Japan) for translating Japanese literature. The first author's visits to Taiwan were supported by the National Science Council, Taiwan, R.O.C. and the Hungarian Academy of Sciences (grant Nos. NSC 96-2911-I-005-006-2 and NSC 97-2911-I-005-002), we are grateful to Man-Miao Yang for her assistance. The first author's studies on the Heteroptera of Taiwan were also supported by the János Bolyai Research Scholarship of the Hungarian Academy of Sciences, and the manuscript was partly completed during his EU Science and Technology Fellowship in China.

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