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A new species of the genus *Lycocerus* from Taiwan (Coleoptera: Cantharidae)

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Abstract. A new species of the genus *Lycocerus* Gorham, 1889, *L. wenchuani* sp. nov., which is related to *L. rhagonychiformis* (Wittmer, 1983) is described from Taiwan. *Lycocerus rhagonychiformis* is redescribed in detail, with the first description of female. Each species is provided with illustrations of genitalia of both sexes and abdominal ventrite VII of female. A distribution map is also presented. In addition, a new species-group including both species is herein proposed.

Key words. Coleoptera, Cantharidae, soldier beetles, new taxa, species-group, Taiwan

Introduction

The genus *Lycocerus* Gorham, 1889 became a highly speciose genus of Cantharidae in Asia after Okushima (2005) synonymized *Athemus* Lewis, 1895, *Athemellus* Wittmer, 1972, *Mikadocantharis* Wittmer & Magis, 1978, *Andrathemus* Wittmer, 1978 and *lsathemus* Wittmer, 1995 with *Lycocerus*. To avoid resulting systematic problems, Okushima (2005) adopted the concept of informal species-group to propose several species-groups and subgroups instead of establishing new genera or subgenera in haste without good sampling size and proper phylogenetic analysis.

To date, thirty-six species of *Lycocerus* have been described from Taiwan, but only a few were attributed to any species-group (Okushima 2005, 2007; Okushima & Yang 2013; Hsiao & Okushima 2015; Hsiao et al. 2016). *Lycocerus rhagonychiformis* (Wittmer, 1983) is a small-sized species similar to the members of *L. hanatanii* (Okushima, 1996) species-group; it is regarded as being in sister position to this species-group (Hsiao et al. 2016). During our study on the Taiwanese fauna of Cantharidae, we discovered an unknown species of *Lycocerus*, which is related to *L. rhagonychiformis* by sharing some characters. After a careful

examination, it became clear that this interesting species is a new one here described as *L. wenchuani* sp. nov., and a new species-group including this new species and *L. rhagonychiformis* is herein proposed.

Materials and methods

The terminology used in the descriptions and the methods follow that of Okushima (2005) and Hsiao (2015), but Double Stain (product of BioQuip, USA) was used for staining the female genitalia. The distribution map was prepared using the SimpleMappr (Shorthouse 2010), based on label data of material examined in the present study. A double slash (//) is used to separate data from different labels and a single slash (/) to separate data from different lines on the same label.

The materials examined in this paper are deposited in the following institutions and private collection:

CMIC Natural History Museum and Institute, Chiba, Japan;
KURA Kurashiki Museum of Natural History, Kurashiki, Japan;
NHMB Naturhistorisches Museum Basel, Switzerland;
NMNS National Museum of Natural Science, Taichung, Taiwan;
YHC Yun Hsiao private collection, Taichung, Taiwan.

Taxonomy

Lycocerus rhagonychiformis group

Diagnosis. Small size (about 4–6 mm); small and not very prominent eyes; knife-shaped, subtriangular apical maxillary palpomere; filiform antennae, exceeding half of elytral length in male, extending to elytral midlength in female, without groove; subquadrate pronotum, narrower than head in male, nearly as wide as or slightly narrower than head in female; all claws simple in both sexes; abdominal ventrite VII of female with not well developed or indistinct median lobe; laterophyses of aedeagus long, visible in lateral view; long spermathecal duct; spermatheca provided with a spiral tube.

Differential diagnosis. This species-group resembles *L. hanatanii* species-group, which was defined and proposed by Okushima (2005). It can be distinguished from *L. hanatanii* species-group by subtriangular apical maxillary palpomere; longer antennae in male; narrower pronotum, especially in male; laterophyses of aedeagus long, visible in lateral view.

Remarks. Hsiao et al. (2016) revised *L. hanatanii* species-group by adding several members from Taiwan and mainland China. They used the morphological-based phylogenetic analysis including all the defined species-groups to support their classification. The clade *L. rhagonychiformis* + *L. hanatanii* species-group is supported in the resultant strict consensus tree. We herein propose a new species-group, *Lycocerus rhagonychiformis* group including *L. rhagonychiformis* (Wittmer, 1983) and *L. wenchuani* sp. nov. based on its diagnostic characters separated from *L. hanatanii* group and the phylogenetic relationship suggested in Hsiao et al. (2016).

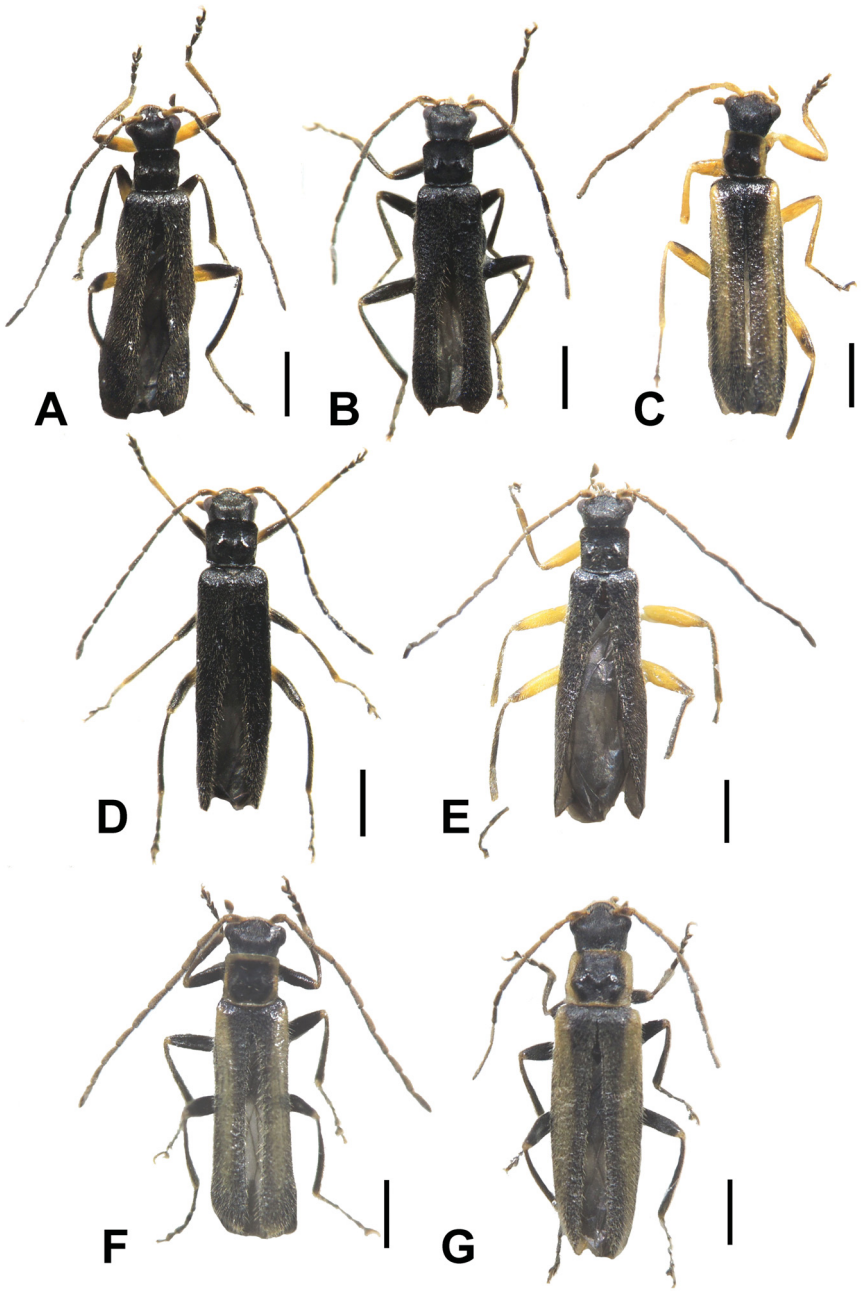

Fig 1. Habitus, dorsal view. A–E – *Lycocerus rhagonychiformis* (Wittmer, 1983); F–G – *L. wenchuani* sp. nov. A–C, F – males; D–E, G – females. Scale bars = 1.0 mm.

Lycocerus rhagonychiformis (Wittmer, 1983)

(Figs 1A–E, 2A–C, 3A–B, 4)

Athemellus rhagonychiformis Wittmer, 1983: 169 (original description).
Lycocerus rhagonychiformis: Kazantsev & Brancucci (2007): 253 (new combination).

Type locality. Taiwan, New Taipei City, NE slope of Lalashan.
Type material examined. Paratypes: 5 spec., 'TAIWAN / NE slope of Lalashan, 1900m / Taipei Hsien / 7. iv. 1981 / T. Shimomura leg.' (NHMB); 1 ♀, 'TAIWAN / Fenchihu / 1400m / 10. vi. 1977 / J & S. Klapperich leg.' (NHMB).
Additional material examined. TAIWAN: 1 ♂, 'FORMOSA [=TAIWAN] / Lake Yenyanfu / Ilan Hsien / 29. iv. 1982 / N. Ohbayashi leg.' (KURA); 1 ♂ 1 ♀, 'TAIWAN / Dakuanshan [=Lalashan] / Taoyuan Hsien / 4. iv. 1991 / Y. Okushima leg.' (KURA); 1 ♂ 2 ♀♀, 'TAIWAN / Mt. Lalashan / Taoyuan Hsien / 4. iv. 1991 / T. Kishimoto leg.' (KURA); 1 ♀, 'TAIWAN / T'ien-ch'ih / 2610m / Hsiao-hsueh Shan / Ho-p'ing Hsiang / T'aichung Hsien / 24. v. 1991 / A. Saito leg.' (CMIC); 2 ♂♂ 3 ♀♀, 'TAIWAN / Chung-hsueh Shan (Erh-san-ling Lin-tao [=230 Forest trail]) / 2450–2500m / Tai-an Hsiang / Miao-li Hsien / 24. v. 1991 / A. Saito leg.' (CMIC); 3 ♂♂ 2 ♀♀, 'TAIWAN / An-ma Shan / 2160–2300m / Ho-p'ing Hsiang / T'aichung Hsien / 25. v. 1991 / A. Saito leg.' (CMIC); 1 ♀, 'TAIWAN / Chia-li Shan / 2600–2650m / Tai-an Hsiang / Miao-li Hsien / 26. v. 1991 / A. Saito leg.' (CMIC); 2 ♂♂ 3 ♀♀, 'TAIWAN / Chia-li Shan / 2600–2850m / Tai-an Hsiang / Miao-li Hsien / 27. v. 1991 / A. Saito leg.' (CMIC); 1 ♂, 'TAIWAN / Lo Shan / 2100–2150m / Wu-feng Hsiang / Hsin-chu Hsien / 29. v. 1991 / A. Saito leg.' (CMIC); 1 ♀, 'TAIWAN / Kuan-wu / 2000m / Wu-feng Hsiang / Hsin-chu Hsien / 29. v. 1991 / A. Saito leg.' (CMIC); 1 ♂, 'TAIWAN / Lancanshan / Ilan / 26. iv. 2014 / L. Huang leg.' (YHC); 3 ♀♀, 'TAIWAN / Jengchin Historic Trail / Ilan / 26. iv. 2014 / Y. Hsiao leg.' (YHC); 1 ♂, 'TAIWAN / Dabaishan / Ilan / 14. iv. 2015 / L. Huang leg.' (YHC); 1 ♂ 1 ♀, 'TAIWAN / Chiarouhu / Ilan / 25. iv. 2015 / F.-C. Hsu leg.' (YHC); 1 ♀, 'TAIWAN / Taipingshan / Ilan / 9. v. 2015 / C.-F. Hsu leg.' (YHC).

Redescription. ***Coloration*.** Several color forms are presented: (1) nearly black, with basal parts of antennae and femora, and apical parts of tibiae yellowish (Figs 1A, 1D); (2) nearly black (Fig. 1B); (3) eyes and head black; antennae brown, with first two segments yellowish; pronotum completely black or dark yellow, with a black marking in middle; elytra fuscous, with large and thick pale yellow longitudinal stripe on each elytron; legs completely dark yellow or with apical parts of femora blackish; tibiae and tarsi with blackish tinge; prosternum dark yellow, meso-, metaventrites and abdomen black, with the margin of abdominal ventrites pale yellow (Fig. 1C); (4) nearly black, with basal parts of antennae and legs yellowish (Fig. 1E). Body closely covered with fine yellowish pubescence; anterior margin of clypeus fringed with pale bristles; antennae, elytra and legs with some yellowish bristles intermingled with primary pubescence.

Male (Figs 1A–C). Head nearly as long as wide; vertex faintly hollowed, depressed along apical margin of clypeus and in lateral areas before eyes; surface densely and finely punctate and semilustrous; anterior margin of clypeus arcuate and faintly indented in middle; eyes not so large, globular and slightly prominent, ratio of eye diameter to interocular space 1: 4.0–6.0 (mostly 4.5–5.0); terminal labial palpomeres rounded axe-shaped; terminal maxillary palpomeres rounded axe-shaped; antennae filiform, extending to apical third of elytra, antennomere I clavate, II short and a little expanded apicad, III to XI subcylindrical, all antennomeres without groove, ratio of lengths of antennomeres as follows: 200 : 100 : 170 : 200 : 225 : 225 : 225 : 215 : 200 : 170 : 180.

Pronotum subquadrate, about 0.80–0.90 (mostly 0.80) times as wide as head, nearly as long as wide; anterior and posterior margins moderately arcuate; lateral margins feebly sinuate,

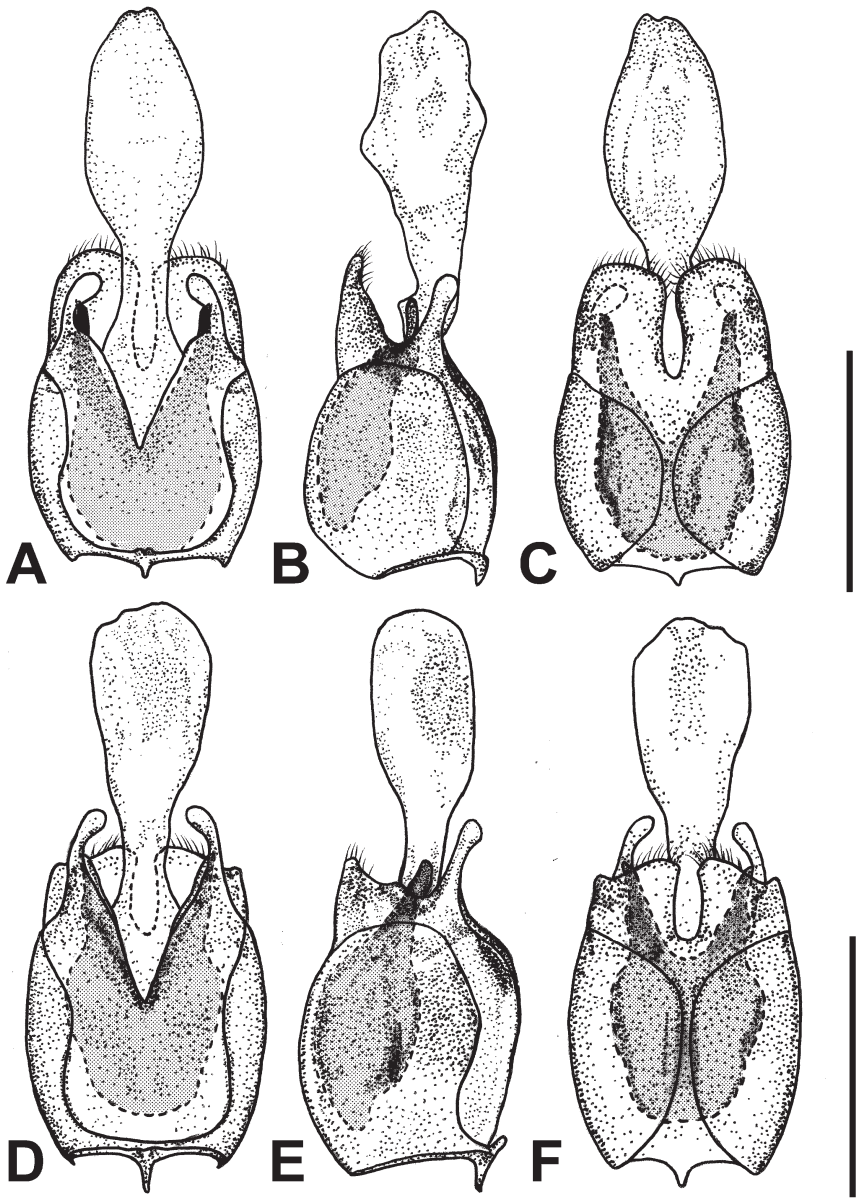

Fig 2. Aedeagus. A–C – *Lycocerus rhagonychiformis* (Wittmer, 1983); D–F – *L. wenchuani* sp. nov. A, D – ventral view; B, E – lateral view; C, F – dorsal view. Scale bars = 0.5 mm.

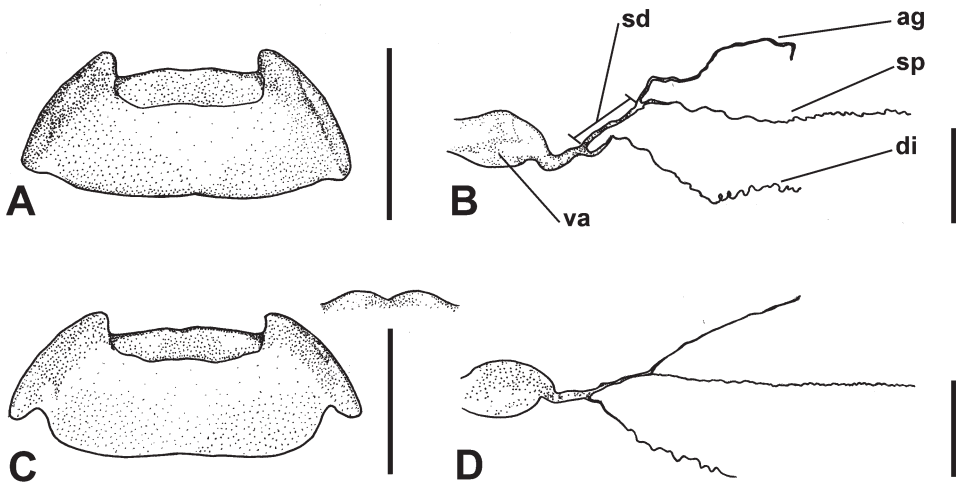

Fig 3. A, C – abdominal ventrite VII of female; B, D – female genitalia, lateral view. A–B – *Lycocerus rhagonychiformis* (Wittmer, 1983); C–D – *L. wenchuani* sp. nov. Scale bars = 0.5 mm. Abbreviations: ag – accessory gland; di – diverticulum; sd – spermathecal duct; sp – spermatheca; va – vagina.

slightly converging posteriorly or subparallel; anterior angles rounded; posterior angles obtuse; dorsum convex in postero-lateral and hollowed in antero-lateral areas; medio-longitudinal groove distinct in posterior half; surface smooth and semilustrous. Scutellum triangular with rounded apex.

Elytra conjointly about 1.6–1.7 (mostly 1.7) times as wide as pronotum, about 3.0 times as long as wide, sides subparallel; surface densely and finely punctate and semilustrous.

Legs moderately slender; femora mostly straight; tibiae mostly straight, with basal part feebly arcuate; claws simple.

Aedeagus (Figs 2A–C). Ventral process expanded apically, apex curved inwards, basal part broad and extending inwards onto ventral side; dorsal plate of each paramere longer than ventral process, subtruncated, apical margin with some hairs on it, concave on inner margin. Laterophyse slender with obtuse apex. Inner sac swollen apically, and somewhat shorter than tegmen.

Length: Body length: 4.50–5.50 mm; width: 0.75–1.00 mm.

Female (Figs 1D–E). Similar to male. Body wider than in male. Eyes somewhat smaller than in male, ratio of eye diameter to interocular space 1 : 5.2. Antennae distinctly shorter than in male, extending to elytral midlength, ratio of lengths of antennomeres as follows: 155 : 100 : 130 : 170 : 170 : 160 : 155 : 150 : 135 : 130 : 150. Pronotum about 0.90–0.95 (mostly 0.90) times as wide as head, about 0.93 times as long as wide. Elytra conjointly about 1.6–1.9 (mostly 1.7–1.8) times as wide as pronotum, about 2.8 times as long as wide. Claws

simple. Abdominal ventrite VII widely emarginate on each side of terminal margin, forming subtriangular lateral lobes, median lobe indistinct (Fig. 3A).

Female genitalia (Fig. 3B). Vagina stout, and abruptly extended apically as long and thick duct; diverticulum and spermathecal duct arising from apex of long duct of vagina; diverticulum moderately thin and spiral; spermathecal duct shorter than diverticulum; spermatheca provided with thin spiral tube, which is longer than diverticulum; accessory gland thin, shorter than spermathecal.

Body length: 4.25–5.25 mm; width: 1.00–1.25 mm.

Variation. The shape of pronotum is variable, from inverse trapezoid to square.

Differential diagnosis. The nearly black form resembles *L. nigripennis* (Pic, 1938) and the multi-color form resembles *L. wenchuani* sp. nov., *L. hanatanii* (Okushima, 1996), *L. ueharaensis* (Okushima, 1996) and *L. maculiceps* (Wittmer, 1983) in appearance. It can be distinguished from *L. nigripennis* by longer antennae, sparsely pubescent body, and aedeagus: subtruncated apical margin and concave inner margin of dorsal plate and longer laterophyse. From *L. wenchuani* sp. nov., *L. hanatanii*, *L. ueharaensis* and *L. maculiceps*, it differs in the combination of the following characters: completely black head, dark yellow legs, abdominal ventrite VII of females with median lobe not well developed, aedeagus: ventral process expanded apically, the apex curved inwards; dorsal plate longer than ventral process, with truncated apical margin; slender laterophyse, with an obtuse apex, visible in lateral view.

Distribution (Fig. 4). Taiwan (endemic).

Remarks. Judging by our examination and original description, all of the type series belong to the color form (4).

This species is distributed in the northern to central area of Taiwan at mid to high altitude (1400–2800 m). It appears mainly from late spring to early summer according to the label data.

Lycocerus wenchuani sp. nov.

(Figs 1F–G, 2D–F, 3C–D, 4)

Type locality. Taiwan, Pingtung County, Chunri Township, Jinshuiying Historic Trail.

Type material. Holotype: ♂, 'TAIWAN / Jinshuiying / Pingtung / 27. iv. 2014 / W.-C. Liao leg.' (NMNS). Paratypes: 3 ♀♀, same data as for the holotype (NMNS); 4 ♂♂, 2 ♀♀, 'TAIWAN / Dawu Working Circle 36 Land / 1030m / Ping Tung Co. / S. Taiwan / 6. v. 2002 / C.-L. Li leg.' (3 ♂♂ 1 ♀ in KURA; 1 ♂ 1 ♀ in YHC); 2 ♀♀, 'TAIWAN / Tu Ling / 1600m / I Lan Co. / N. E. Taiwan / 27–28. v. 2002 / C.-L. Li leg.' (KURA); 2 ♀♀, 'TAIWAN / Lijia forest-road / Taitung Co. / 30. v.–1. vi. 2010 / N. Ohbayashi leg.' (KURA).

Description. ***Coloration*.** Eyes black. Head black. Antennae blackish brown. Pronotum yellowish brown, with large black marking in middle. Elytra black, with large and thick yellowish brown longitudinal stripe on each elytron. Legs black, with basal parts and apices of tibiae yellowish brown or with basal parts of femora and tibiae yellowish brown. Prosternum yellowish brown, meso-, metaventrites and abdomen black. Body closely covered with fine pale pubescence; anterior margin of clypeus fringed with pale bristles; antennae, elytra and legs with some yellowish bristles intermingled with primary pubescence.

Male (Fig. 1F). Head nearly as long as wide; vertex faintly hollowed, depressed along apical margin of clypeus and in lateral areas before eyes; surface densely and finely punctate and semilustrous; anterior margin of clypeus arcuate and faintly indented in middle; eyes not

so large, globular and slightly prominent, ratio of eye diameter to interocular space 1: 4.0; terminal labial palpomeres rounded axe-shaped; terminal maxillary palpomeres rounded axe-shaped; antennae filiform, extending to apical third of elytra, antennomere I clavate, II short and a little expanded apicad, III to XI subcylindrical, all antennomeres without groove, ratio of lengths of antennomeres as follows: 160 : 100 : 165 : 200 : 200 : 200 : 190 : 185 : 185 : 165 : 200.

Pronotum subquadrate, about 0.85 times as wide as head, nearly as long as wide; anterior and posterior margins moderately arcuate; lateral margins subparallel, feebly sinuate; anterior angles rounded; posterior angles obtuse; dorsum convex in postero-lateral and hollowed in antero-lateral areas; medio-longitudinal groove distinct in posterior half; surface smooth and semilustrous. Scutellum triangular with rounded apex.

Elytra conjointly about 1.5 times as wide as pronotum, about 3.0 times as long as wide, sides subparallel; surface densely and finely punctate and semilustrous.

Legs moderately slender; femora mostly straight; tibiae mostly straight, with basal part feebly arcuate; claws simple.

Aedeagus (Figs 2D–F). Ventral process expanded apically, apex curved inwards, basal part broad and extending inwards onto ventral side; dorsal plate of each paramere shorter

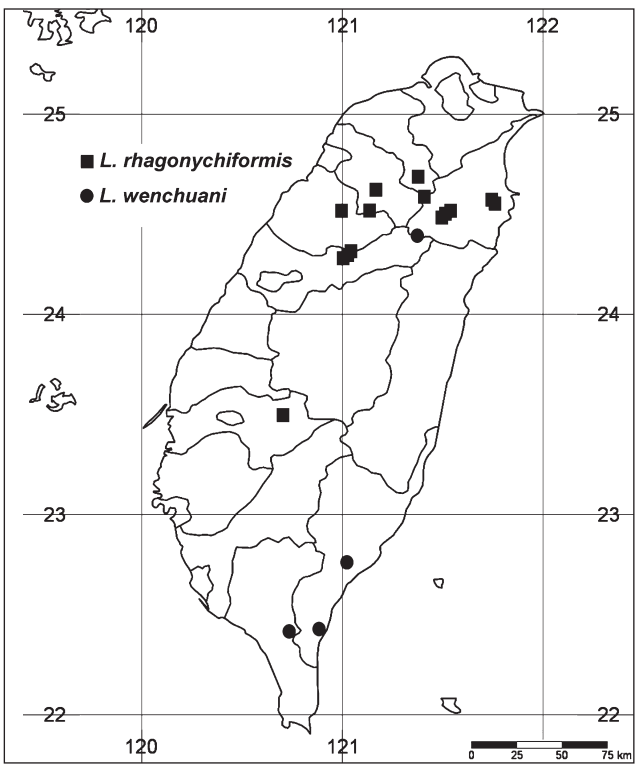

Fig 4. Distribution map of *Lycocerus* in Taiwan.

than ventral process, apical margin sinuate, with some hairs on it, concave on inner margin. Laterophyse thick with obtuse apex. Inner sac swollen apically, and somewhat shorter than tegmen.

Body length: 4.50–5.00 mm (holotype: 4.50 mm); width: 0.75–0.80 mm (0.75).

Female (Fig. 1G). Similar to male. Body wider than in male. Eyes somewhat smaller than in male, ratio of eye diameter to interocular space 1 : 5.0. Antennae distinctly shorter than in male, extending to elytral midlength, ratio of lengths of antennomeres as follows: 175 : 100 : 115 : 150 : 150 : 155 : 140 : 140 : 135 : 130 : 160. Pronotum nearly as wide as head, about 0.90 times as long as wide. Elytra conjointly about 1.7 times as wide as pronotum, about 2.8 times as long as wide. Claws simple. Abdominal ventrite VII widely emarginate on each side of terminal margin, forming subtriangular lateral lobes, median lobe not well developed or indistinct (Fig. 3C).

Female genitalia (Fig. 3D). Vagina stout and rounded, and abruptly extended apically as long and thick duct; diverticulum and spermathecal duct arising from apex of long duct of vagina; diverticulum moderately thin and spiral; spermathecal duct shorter than diverticulum; spermatheca provided with thin spiral tube, which is longer than diverticulum; accessory gland thin, shorter than spermathecal.

Length: 5.00–6.00 mm; width: 0.80–1.25 mm.

Differential diagnosis. This species resembles the multi-color form of *L. rhagonychiformis*, *L. hanatanii*, *L. ueharaensis* and *L. maculiceps* in appearance, but it can be distinguished by the combination of the following characters: completely black head, black legs, with basal parts and apices of tibiae yellowish brown or with basal parts of femora and tibiae yellowish brown, abdominal ventrite VII of females with median lobe not well developed or indistinct, aedeagus: ventral process expanded apically, the apex curved inwards; dorsal plate shorter than ventral process, with sinuate apical margin; thick laterophyse, with an obtuse apex, visible in lateral view.

Etymology. The specific name is dedicated to the collector of the holotype, Mr. Wen-Chuan Liao (Tainan, Taiwan), who is one of the citizen scientists assisting many Taiwanese insect taxonomists to collect materials.

Distribution (Fig. 4). Taiwan (endemic).

Remarks. This species is distributed in the southern to southeastern area of Taiwan about 1000–1600 m a.s.l. altitude. It appears mainly from late spring to early summer according to the label data.

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