A new species group defined in Lycocerus Gorham (Coleoptera, Cantharidae), with description of a new species from Xizang, China

H. C. XI 1, Y. N. WANG 2, X. K. YANG 2, H. Y. LIU 1, & Y. X. YANG 1

1The Key Laboratory of Zoological Systematics and Application, School of Life Science, Institute of Life Science and Green Development, Hebei University, Baoding, Hebei Province, China, and 2Key Laboratory of Zoological Systematics and Evolution, Institute of Zoology, Chinese Academy of Sciences, Beijing, Chaoyang, China

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Abstract
The Lycocerus varipubens species-group is defined to accommodate three previously described species and a new species from the Himalayan area, including L. varipubens, L. seminestens, L. purpurascens comb. nov. & stat. reinst. and L. zayuensis sp. nov. L. purpurascens, originally described in Cantharis and first combined in Lycocerus here, is reinstated as a valid specific name to replace L. rubrispinis syn. nov., which is a replacement name for Cantharis rubrispinis. Meanwhile, L. rubrispinis becomes a junior synonym of L. purpurascens. L. varipubens species-group could be distinguished from all other groups by the combination of following characters, the filiform antennae, pronotum wider than long, reddish-brown elytra with weakly or moderately developed longitudinal costae, all pro- and meso-outer claws each with a digitiform tooth in both sexes, and spermatheca with three spiral tubes. The species descriptions are provided with habitus photos, aedeagi, abdominal sternites VIII and reproductive systems of female. L. purpurascens and L. varipubens are recorded to China for the first time. In addition, a morphological phylogenetic analysis shows that the L. varipubens group is sister to L. purpurascens. A distribution map and a key to the species of this species-group are also provided.

http://www.zoobank.org/urn:lsid:zoobank.org:pub:7C82B6E4-9A71-4893-AD97-5692839D2236

Keywords: New combination, reinstated status, new species, new faunistic record, phylogenetic analysis

Introduction
Soldier beetles of the genus Lycocerus Gorham, 1889 sensu Okushima (2005) represent one of the most speciose cantharid genera, with over 300 species widely distributed in Oriental and southeastern Palearctic regions (Delkeskamp, 1977; Kazantsev & Brancucci 2007). No subgenus has been proposed to subdivide this large group since its redefinition by Okushima (2005), who suggested that no morphological character was valuable enough in the taxonomy of subgeneric level. Most recently, a morphology-based phylogeny of Lycocerus was constructed by Hsiao (2021), and the result supported the synonyms of Athemus Lewis, 1895, Athemellus Wittmer, 1972, Mikadocantharis Wittmer & Magis, 1978, Andrathemus Wittmer, 1978 and Isathemus Wittmer, 1995 with Lycocerus in various cladistic methods. However, it had to be acknowledged that some species definitely showed more or less similarity in their morphology (Okushima 2005). Therefore, the compromise to solve this systematic problem was to define some species-groups for Lycocerus (Okushima, 2005), and this concept was followed by the others. Until now, a total of 13 species-groups have been defined within it (Okushima 2005; Okushima & Brancucci 2008; Okushima & Yang 2013; Yang et al. 2014; Hsiao & Okushima 2015, 2016; Hsiao et al. 2016; Okushima & Hsiao 2017, 2021; Xi et al. 2021a, 2021b), but the majority of the species remains unassigned, so much more work is left to be done. The phylogenetic analyses of Lycocerus by Hsiao...
(2021) opposes the presumed relationships among the species-groups by Okushima (2005), and the completion of the species-group assignation will help further investigation on the relationship within this large genus.

During our recent study, an interesting species of Lycocerus from Xizang, China was discovered. It looks similar to L. varipubens (Wittmer, 1978), L. semiecastus (Wittmer, 1995) and L. rubrispinis Kazantsev, 2007 (which is going to be replaced by L. purpurascens (Pic, 1911) here) in the appearance, including body shape, coloration and pubescence, as well as characteristics of tarsal claws, but is different from them in the structure of aedeagus, so it is new to the science and described in the present study. Further examination of their female reproductive systems showed that the spermatheca is distinctive and provided with three tubes, which has never been found in any other group (Okushima 2005; Okushima & Brancucci 2008; Yang et al. 2014; Hsiao & Okushima 2016a; Okushima & Hsiao 2017), so a new species group is necessarily defined to accommodate these species. Meanwhile, the phylogenetic position of this new species group within Lycocerus will be explored based on the morphological data using cladistic methods. Additionally, some more distribution or morphological information will be added for the previously described species.

Material and methods

Specimens studied

The studied material is preserved in the following collections: Institute of Zoology, Chinese Academy of Sciences, Beijing, China (IZAS); Naturhistorisches Museum Basel, Switzerland (NHMB); Muséum national dʼHistoire naturelle, Paris, France (MNHN).

Terminology and techniques

Morphological terminology used in this study mainly follows that of Okushima (2005). The abbreviations in the figures are as follows, male genitalia (bp): basal piece; dp: dorsal plate of each paramere; is: inner sac of median lobe; lp: laterophyse; ml: median lobe; te: tegmen; vp: ventral process of each paramere) and female genitalia (ag: accessory gland; di: diverticulum; sd: spermathecal duct; sp: spermatheca; ov: median oviduct; va: vagina).

Genitalia of both sexes and abdominal sternites VIII of females were dissected and cleared in 10% NaOH solution, and female genitalia were dyed with hema-toxylin. Habitus photos were taken by a Leica M205A stereomicroscope, multiple layers were stacked using Combine ZM (Helicon Focus 5.3). Line drawings were made using a camera lucida attached to a Nikon SMZ1500 stereomicroscope, then edited in CorelDRAW 12 and Adobe Photoshop CS3.10.0.1.

Complete label data are listed for type specimens of the previously known species, using square brackets “[“]” for our marks and comments, [p] indicating that the following data are printed and [h] that they are handwritten. Quotation marks are used to separate data from different labels and a backslash “/” to separate data from different lines of the same label. For the additional specimens, quotation marks are used if their original labels are written in English. All the labels written in Chinese are transliterated into English. Body length is measured from the anterior margin of the clypeus to the elytral apex and body width across the humeral part of elytra.

The distribution map is produced by ArcGis 10.6 (Esri, Redlands, California, USA) and processed in the Adobe Photosop CS5. The geographical information is based on the literatures (Wittmer 1978, 1995; Kazantsev & Brancucci 2007) and the material of the present study.

Phylogenetic analysis

Following the work of Hsiao (2021), L. varipubens was sampled representing the L. varipubens group, and a state, “2. with three spiral tubes”, was added to the character 44 (Hsiao 2021: Table 3). In addition, as the replacement name for L. sichuanus Y. Yang et al. 2014 has been proposed in Xi et al. (2021a) due to the secondary homonym, the name of the species sampled for L. hickeri group should be corrected as Lycocerus hickeriminimus. The data matrix was edited manually and saved as “.tnt” format, and the analysis was carried out in TNT ver. 1.5 (Goloboff & Catalano 2016), using the implicit enumeration search with all characters unordered and unweighted. The assembled data matrix was also analyzed under the implied weighting (Goloboff et al. 2018) under K value 3. The character states were mapped on the most parsimonious tree using Winclada ver. 1.0 (Nixon 2002), with only unambiguous changes indicated.

Results and discussion

Taxonomy

Lycocerus varipubens species-group

Definition. Body 6.8–11.0 mm, antennae filiform or subfiliform, present with oval to round smooth impressions along outer margins of middle antennomes in male. Pronotum wider than long, with lateral
margins slightly or moderately diverging posteriorly. Elytra reddish brown, densely and coarsely punctate, matt, densely covered with short, decumbent reddish brown pubescence. Pro- and meso-outer claws each with a digitiform tooth at base in both sexes. Median lobe of aedeagus simple, without dorsal process. Vagina stout and extended apically into a thick duct; spermathecal duct relatively short; spermatheca provided with three spiral tubes, gradually narrowed apically, of which the basal one longest and the middle one shortest.

*Included species.* *L. varipubens* (Wittmer, 1978), *L. semiextensus* (Wittmer, 1995), *L. purpurascens* (Pic, 1911) *comb. nov.* & *stat. reinst.* and *L. zayuensis* sp. nov.

*Distribution.* All the species are restricted to the Himalayan area (Figure 1), located in 27.04–33.80°N, 75.36–97.46°E, from the western to eastern Himalayas.

*Remarks.* *L. varipubens* group could be distinguished from all other species groups (Okushima 2005; Okushima & Brancucci 2008; Yang et al. 2014; Hsiao & Okushima 2016; Okushima & Hsiao 2017) by the spermatheca with three spiral tubes. Also, it is recognized by the combinations of the characters listed by Hsiao (2021), including the body shape, coloration, and the shapes of eyes, antennae, pronotum and elytra, as well as the structures of tarsal claws in both sexes, aedeagus and female internal reproductive systems.

What’s noted here, in the statement of Principle of Priority (ICZN, 4th, article 23.1), the valid name of a taxon is the oldest available name applied to it, which also applies to the names to denote aggregates of species, and the precedence of such name is that which it has in the species group (ICZN (1999), 4th, article 23.3.3). Although *L. purpurascens* (Pic, 1911) *comb. nov.* & *stat. reinst.* is the oldest name in this group, the name of *L. purpurascens* species-group has been already preoccupied by Okushima (2005). The latter is originally proposed for *L. purpurascens* (Wittmer, 1978) which subsequently replaced with *L. purpureus* Kazantsev, 2007, and the species group name has been cited as *L. purpureus* species-group by Hsiao (2021). In order to avoid the confusion, the next oldest name is applied to this new species group as *L. varipubens* species-group.

Figure 1. Distribution map of *Lycocerus varipubens* species-group.
Key to the species of Lycocerus varipubens species-group

1. Aedeagus: ventral process of each paramere slightly bent dorsally in lateral view, laterophyses situated at dorsal side of median lobe, approaching each other and touching at apices.......................... 2
   – Aedeagus: ventral process of each paramere slightly bent ventrally in lateral view, laterophyses separated on lateral sides of median lobe, far from each other......................................................... 3

2. Aedeagus: ventral process of each paramere slightly shorter than dorsal plate; dorsal plate with inner apical angle acute, inner surface smooth at apical part, without any ridge (Figures 5D–F)........
   .......................................................... L. semiextensus
   – Aedeagus: ventral process of each paramere slightly longer than dorsal plate; dorsal plate with inner apical angle rounded, inner surface strongly ridged at apical part, the ridge obviously extruding over inner margin (Figures 5A–C)................................. L. purpurascens

3. Pronotum black, slightly wider than long, elytral venations moderately developed (Figures 4C–D); aedeagus: dorsal plate of each paramere subparallel-sided, laterophyse slightly shorter than dorsal plate (Figures 6D–F)............... L. zayuensis sp. nov.
   – Pronotum brown, obviously wider than long, elytral venations weakly developed (Figures 4A–B); aedeagus: dorsal plate of each paramere with inner margin protuberant in middle, laterophyse obviously shorter than dorsal plate (Figures 6A–C)........ L. varipubens

Lycocerus purpurascens (Pic, 1911) comb. nov. & stat. reinst.
(Figures 2A, 3A, 5A–C, 7A, 8A)

Cantharis purpurascens Pic, 1911: 143. [junior synonym of Athemus (s.str.) rubripennis (Pic, 1906) by Wittmer 1995: 264]. Here: first combination in Lycocerus, comb. nov.; reinstated as a valid specific name, stat. reinst.

Cantharis rubripennis Pic, 1906: 83 [original description].

Themis rubripennis: Jacobson 1911: 675 [checklist].

Athemus (Andrathemus) rubripennis: Wittmer 1978: 158, Figure 9 (parte) [illustration and description of aedeagus].

Athemus (s.str.) rubripennis: Wittmer 1995: 264, fig. 120 [photo of aedeagus].

Lycocerus rubripinis Kazantsev, 2007:54. [replacement name for Cantharis rubripennis Pic, 1906, preoccupied by Telephorus rubripennis Hope, 1831: 26.] syn. nov.

Type material examined. Holotype (Figure 2A) female at MNHN labeled: [h] “Kulu/Himachal Pradesh”, [h] “unreadable hand-written words”, “purpuraceus Pic”, [h] “Type”, [p] “TYPE”, [h] “Athemus s.str./rubripennis/Pic/det. W. Wittmer”.

Non-type material examined. China, Xizang: 1♂ (IZAS, IOZ(E)1390146), Nymlam, Dingrenbuqiao, 2600 m, 27.IV.1974, leg. X. Z. Zhang; 1♀ (IZAS, IOZ(E)1435454), Nymlam, Zham, 2600 m, 5. V.1966, leg. S. Y. Wang.

Descriptive notes. Male (Figure 3A). Aedeagus (Figures 5A–C): basal piece nearly as long as dorsal plate of each paramere; ventral process of each paramere straight in ventral view and slightly bent dorsally in lateral view, with apex narrowly rounded; dorsal plate slightly shorter than ventral process, about three times as long as wide, with inner margin slightly protuberant in middle, outer margin slightly sinuate near apical part, inner apical angle rounded in dorsal view, outer apical angle subrounded in lateral view, inner surface longitudinally and arcuately ridged near to inner and apical margins, the ridge obviously extruding over inner margin; laterophyse obviously shorter than ventral process, with apex sharply hooked and touching the other, slightly extruding over the ridge, the two laterophyses separated on dorsal side of the median lobe and approaching each other.

Female (Figure 2A). Abdominal sternite VIII (Figure 7A): triangularly emarginate in middle and on both sides of posterior margin, lateral emarginations slightly wider and much deeper than the middle one, the portion between lateral and middle emarginations slightly slender and narrowly rounded at apex, lateroapical angle subtruncate at apices, not reaching apices of the portion between lateral and middle emarginations.

Internal organ of reproductive system (Figure 8A): vagina stout and abruptly thinned at ventroapical portion into a stout tube, where diverticulum and spermathecal duct arising separately; diverticulum moderately long and spiral, gradually thinned apically; spermathecal duct very short; spermatheca provided with three spiral tubes, of which the basal one (spI) about twice longer than diverticulum, the middle one (spII) about one-fourth length of spI, the apical one (spIII) about three times longer than spII; accessory gland directly opening near base of spIII, thin and slightly shorter than spIII.

Remarks. Cantharis purpurascens Pic, 1911 was synonymized with Athemus (s.str.) rubripennis (Pic, 1906) by Wittmer (1995). However, this was neglected by
Kazantsev and Brancucci (2007) that the former was not listed as a synonym of the latter in the Palaearctic Catalogue. Meanwhile, *Athemus* (s.str.) *rubripennis* (Pic, 1906) originally described in *Cantharis* L. and found to be a primary homonym of *Telephorus rubripennis* Hope, 1831, so its name was replaced with *Lycocerus rubrispinis* by Kazantsev (2007).

According to the Principle of Priority, it requires that if a name in use for a taxon is found to be unavailable or invalid it must be replaced by the next oldest available name from among its synonyms (ICZN, 4th, article 23.3.5). Therefore, *L. purpurascens* (Pic, 1911) with first combination in *Lycocerus* should be reinstated as the valid name for this species, and *L. rubrispinis* Kazantsev, 2007 is a junior synonym at the moment.

**Distribution.** China (new record: Xizang); India, Nepal, Bhutan.

*Athemus (Andrathemus) semiextensus* (Wittmer, 1995) *(Figures 2B, 3B, 5D–F, 7B, 8B)*

*Athemus (Andrathemus) rubripennis* Pic — Wittmer 1978: 158, *Figure 9* (parte) [misidentification].

*Athemus (Andrathemus) semiextensus* Wittmer, 1995: 264, figs. 123, 124 [original description].

*Lycocerus semiextensus*: Kazantsev & Brancucci 2007: 253 [catalogue].

**Type material examined.** Holotype (Figure 2B) male at NHMB labeled: [p] “E-Nepal/Koshi/M. Brancucci”, [p] “Gufa-Gorza/2800-2100” m/4.
VI.1985”, [p] “HOLOTYPUS”, [h] “Athemus s. str./semiextensus/Wittm./det. W. Wittmer”, [p] “CANTHARIDAE/CANTH00001301”.

Non-type material examined. China, Xizang: 1♂ (IZAS, IOZ(E)1436784), Chomo, 2800 m, 8.VI.1961, leg. L. Y. Wang; 1♂ (IZAS, IOZ(E)1435842), Chomo, 2800 m, 5.VI.1961, leg. L. Y. Wang; 1♀ (IZAS, IOZ(E)1435849), Chomo, 2800 m, 7.VI.1961, leg. L. Y. Wang; 1♀ (IZAS, IOZ(E)1435846), Chomo, 2800 m, 6.VI.1961, leg. L. Y. Wang.

Descriptive notes. Male (Figures 2B, 3B). Aedeagus (Figures 5D–F): basal piece obviously shorter than dorsal plate of each paramere; ventral process of each paramere straight in ventral view and slightly bent dorsally in lateral view, with apex narrowly rounded; dorsal plate slightly longer than ventral process, moderately narrowed, about four times as long as wide, with inner margin slightly protuberant in middle, outer margin bisinuate, inner apical angle acute in dorsal view, outer apical angle rounded in lateral view, inner surface smooth; laterophyse obviously shorter than ventral process, with apex sharply hooked and touching the other, extruding over the middle emargination between dorsal plates, the two laterophyse separated on dorsal side of the median lobe and approaching each other; inner sac lengthened apically, nearly as long as tegmen.

Female. Abdominal sternite VIII (Figure 7B): triangularly emarginate in middle and roundly emarginate on both sides of posterior margin, lateral emarginations much wider and slightly deeper than the middle one, the portion between lateral and middle emarginations acute at apex, lateral emarginations slightly membranous at bottom, lateralapical angles widely rounded at apices, not reaching apices of the portion between lateral and middle emarginations.

Internal organ of reproductive system (Figure 8B): vagina stout and abruptly thinned at ventroapical portion into a stout tube, where diverticulum and spermathecal duct arising separately; diverticulum moderately long and spiral; spermathecal duct short; spermatheca provided with three spiral tubes, of which the basal one (spI) nearly as long as diverticulum, the middle one (spII) about 0.4 times as long as spI, the apical one (spIII) nearly as long as spI; accessory gland directly opening near base of spIII, slightly longer than spIII.

Distribution. China (Xizang); India, Nepal, Bhutan.

Lycocerus varipubens (Wittmer, 1978) (Figures 2C, 4A–B, 6A–C, 7C, 8C)

Athemus (Andrathemus) varipubens Wittmer, 1978: 157, Figure 8 [original description].
*Lycocerus varipubens*: Kazantsev & Brancucci 2007: 254 [catalogue].

**Type material examined.** Paratype (Figure 2C) male at NHMB labeled: [p] “28°00′N, 85°00′E/Mal.tr. 6.10, 500′/27 May 1967/ Canad. Nepal Expedit.”, [p] “PARATYPUS”, [h] “A. (Andrathemus)/varipubens/Wittm./det. W. Wittmer”, [p] “CANTHARIDAE/CANTH00001479”.

**Non-type material examined.** China, Xizang: 1♂ (IZAS, IOZ(E)1389491), Nymlam, Zham, 2650 m, 15.V.1966, leg. S. Y. Wang; 1♂ (IZAS, IOZ(E)1435455), same data as the proceeding one; 1♂ (IZAS, IOZ(E)1390098), Nymlam, Zham, 2250 m, 8.V.1974, leg. X. Z. Zhang; 1♂ (IZAS, IOZ(E)1436934), Nymlam, Zham, 2250 m, 10.V.1974, leg. X. Z. Zhang; 1♂ (IZAS, IOZ(E)1367315), same data as the proceeding one; 1♂ (IZAS, IOZ(E)1436935), Nymlam, Zham, 2250 m, 11.V.1974, leg. X. Z. Zhang; 1♂ (IZAS, IOZ(E)1390443), same data as the proceeding one; 1♂ (IZAS, IOZ(E)1390438), Nymlam, Zham, 2250 m, 12.V.1974, leg. X. Z. Zhang; 1♂ (IZAS, IOZ(E)1390442), Nymlam, Zham, 2250 m, 17.V.1974, leg. X. Z. Zhang; 1♂ (IZAS, IOZ(E)1390444), same data; 1♀ (IZAS, IOZ(E)1390436), Nymlam, Zham, 2650 m, 15.V.1966, leg. S. Y. Wang; 1♀ (IZAS, IOZ(E)1390437), Nymlam, Zham, 2400 m, 12.VI.1975, leg. F. S. Huang; 1♀ (IZAS, IOZ(E)1390809), Zham,

![Figure 4. Habitus, dorsal view (A, C. male; B, D. female): A–B. *Lycocerus varipubens* (Wittmer, 1978)(A. IZAS, IOZ(E)1389491; B. IZAS, IOZ(E)1435456); C–D. *L. zayuensis* sp. nov. (C. IZAS, IOZ(E)1389662; D. IZAS, IOZ(E)1436781). Scale bars: 2.0 mm.](image-url)
Descriptive notes. Male (Figures 2C, 4A). Aedeagus (Figures 6A–C): basal piece nearly as long as dorsal plate of each paramere; ventral process of each paramere slightly bent inwards in ventral view and bent ventrally in lateral view, with apex obtusely rounded; dorsal plate slightly longer than ventral process, strongly narrowed, about three times as long as wide, with inner margin far from the other and slightly protuberant in middle, outer margin slightly sinuate, inner apical and outer apical angles subrounded, inner surface longitudinally and arcually ridged near to outer and apical margins, the ridge slightly extruding over inner margin; laterophyse obviously shorter than ventral process, slightly bent dorsally and directing outwards, with apex hooked and opposite to the ridge on dorsal plate, the two laterophyses separated on lateral sides of the median lobe and far from each other; inner sac lengthened apically, nearly as long as tegmen.

Female (Figure 4B). Abdominal sternite VIII (Figure 7C): shallowly emarginate in middle and subroundly emarginate on both sides of posterior margin, lateral emarginations slightly narrower but much deeper than the middle one, the portion between lateral and middle emarginations obtuse-

Figure 5. Aedeagus (A, D. ventral view; B, E. dorsal view; C, F. lateral view): A–C. Lyocerus purpurascens (Pic, 1911) (IZAS, IOZ(E) 1390146); D–F. L. semiextensus (Wittmer, 1995) (IZAS, IOZ(E)1436784). Scale bars: 1.0 mm.
angled at apex, lateroapical angles subrounded at apices, not reaching apices of the portion between lateral and middle emarginations.

Internal organ of reproductive system (Figure 8C): vagina stout and abruptly thinned at ventroapical portion into a stout tube, where diverticulum and spermathecal duct arising separately; diverticulum moderately long and spiral, gradually thinned apically; spermathecal duct stout and very short; spermatheca provided with three spiral tubes, of which the basal one (spI) about twice longer than diverticulum, the middle one (spII) about one-third length of spI, the apical one (spIII) about half length of spI; accessory gland directly opening at the common base of spII and spIII, longer than spIII, abruptly expanded at basal one-fourth part.

Distribution. China (new record: Xizang); Nepal.

Lycocerus zayuensis Y. Yang et X. Yang sp. nov.
(Figures 4C–D, 6D–F, 7D, 8D)

Type material examined. Holotype: ♂ (IZAS, IOZ(E) 1389662), China, Xizang, Zayü, Gujing, 3100 m, 21.VI.1973, collector unknown. Paratypes: China, Xizang: 1♀ (IZAS, IOZ(E)1436933), same data as
holotype; 1♀ (IZAS, IOZ(E)1389663), same data as holotype; 1♂ (IZAS, IOZ(E)1389661), Zayù, Gujing, 3200 m, 19.VI.1973, leg. F. S. Huang; 1♀ (IZAS, IOZ(E)1436781), same data as the proceeding one; 1♂ (IZAS, IOZ(E)1436932), Zayù, 2300 m, 17.VI.1973, leg. F. S. Huang.

Description of the new species. Male (Figure 4C). Body length: 9.5–10.0 mm (9.5 mm in holotype); width: 2.5–2.9 mm (2.5 mm in holotype). Body dark brown, except for head black, prornotum black, with anterior and posterior margins brown, elytra reddish brown, apices of femora and bases of tibiae brown. Body densely covered with short, recumbent reddish-brown pubescence, of which sparser on disc of pronotum than other parts. Head subrounded, slightly narrowed behind eyes, vertex faintly hollowed, surface semilustrous, densely and finely punctate; eyes moderately large and protruding, head width across eyes slightly wider than anterior margin of pronotum and slightly narrower than posterior margin; terminal maxillary palpomers long triangular, apical half of inner margins arcuate; antennae filiform, extending to one-half length of the elytral when reclined, antennomere II shortest, slightly longer than wide at apices, III–VII slightly widened apically, III about 2.5 times as long as II, III–X each with an oblong to round smooth impression near apical part of outer margin, VII longest, VIII–XI nearly parallel-sided, XI slightly longer than X and pointed at apices. Pronotum subquadract, 1.1 times wider than long, widest at base, both anterior and posterior margin nearly straight, lateral margins moderately diverging posteriorly, anterior and posterior angles nearly rectangular, disc moderately convex at posterolateral parts, surface semilustrous, punctate like that on head. Elytra about 4 times longer than pronotum, 2.5 times longer than humeral width, which about 1.4 times wider than posterior margin of pronotum, lateral margins nearly parallel, elytral venations moderately developed, surface matt, largely punctate than that on pronotum. Legs slender, pro- and meso-outer tarsal claws each with a digitiform tooth at base.

Aedeagus (Figures 6D–F): basal piece nearly as long as dorsal plate of each paramere; ventral process of each paramere moderately bent inwards in ventral view and bent ventrally in lateral view, with apex obtusely rounded; dorsal plate slightly longer than ventral process, subparallel-sided, about twice as long as wide, with inner margin near to the other, outer margin slightly sinuate, apical margin...
rounded, inner apical angle rounded in dorsal view, outer apical angle obtusely rectangular in lateral view, inner surface longitudinally and arcuately ridged near to outer and apical margins, the ridge never extruding over inner margin; laterophyses slightly longer than ventral process, slightly bent dorsally and directing outwards, with apex hooked and opposite to the ridge on dorsal plate, the two laterophyses separated on lateral sides of the median lobe and far from each other; inner sac lengthened apically, shorter than tegmen.

Female (Figure 4D). Eyes less protruding than in male, antennae shorter, extending to basal one-third length of elytra when reclined, III–X without impressions, head width across eyes slightly narrower than anterior margin of pronotum, pronotum slightly convex on posterolateral parts of disc.

Abdominal sternite VIII (Figure 7D): roundly emarginate in middle and on both sides of posterior margin, lateral emarginations much wider and deeper than the middle one, the portion between lateral and middle emarginations narrowly rounded at apex, lateral emarginations largely membranous at bottom, lateralapical angles slightly truncate at apices and exceeding over apices of the portion between lateral and middle emarginations.

Internal organ of reproductive system (Figure 8D): vagina stout and abruptly thinned at

Figure 8. Internal organ of female reproductive system, lateral view. A. Lycocerus purpurascens (Pic, 1911) (IZAS, IOZ(E)1435454); B. L. semieextensus (Wittmer, 1995) (IZAS, IOZ(E)1435846); C. L.varipubens (Wittmer, 1978) (IZAS, IOZ(E)1390816); D. L. zayuensis sp. nov. (IZAS, IOZ(E)1436781). Scale bars: 1.0 mm.
ventroapical portion into a stout tube, where diverticulum and spermathecal duct arising separately; diverticulum moderately long and spiral, gradually thinned apically; spermathecal duct short; spermatheca provided with three spiral tubes, of which the basal one (spI) slightly longer than diverticulum, the middle one (spII) about one-fourth length of spI, the apical one (spIII) about half length of spI; accessory gland directly opening at the common base of spII and spIII, thin and about three times as long as spIII.

**Differential diagnosis.** This new species is similar to *L. varipubens* (Wittmer, 1978) (Figures 2C, 4A–B), but can be distinguished by the subquadrate pronotum, antennae extending to elytral mid-length, moderately developed elytral venations; the aedeagus with dorsal plate of each paramere subparallel-sided, about twice as long as wide, laterophyse slightly shorter than dorsal plate; female abdominal sternite VIII largely membranous around lateral emarginations of posterior margin, lateroapical angles slightly truncate at apices, spermathecal duct and accessory gland relatively long. In comparison, *L. varipubens* has rectangular pronotum, with lateral margins parallel-sided, antennae extending to apical one-third length of the elytra, weakly developed elytral venations, aedeagus with dorsal plate of each paramere strongly narrowed, about three times as long as wide, laterophyse obviously shorter than dorsal plate; female abdominal sternite VIII never membranous, lateroapical angles surrounded at apices, spermathecal duct and accessory gland relatively short.

**Etymology.** The specific name is derived from the name of the type locality, Zayü, Nyingchi, Xizang, China.

**Distribution.** China (Xizang).

**Phylogenetic analyses**

Maximum parsimony (MP) analysis under the implied weighting using K values 3 resulted in...
three most parsimonious trees. The produced topology of the majority consensus tree (Figure 9) (L = 97; CI = 55; RI = 70) is highly concordant with that of Hsiao (2021: Figure 2A), except for a different placement of L. aegrotus group. It shows that the L. varipubens group is sister to L. purpureus group, which is supported by the synapomorphy, modified accessory gland (abruptly expanded) (45:1). Although the close relationship is recovered for these two groups, regardless of the number of the spermathecal tubes, they could be easily distinguished from each other by the appearance. At present, only one species is included in the L. purpureus group, L. purpureus Kazantsev, 2007, which has orange body, blue and metallic shining elytra, also flat head, as well as absence of the antennal grooves in the male. Nevertheless, the phylogenetic relationships among the species groups within Lycocerus should be further investigated by molecular data in future to get a more well supported and objective phylogeny.

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No potential conflict of interest was reported by the author(s).

ORCID

H. C. Xi  http://orcid.org/0000-0002-3612-2523
Y. N. Wang  http://orcid.org/0000-0001-6070-4892
X. K. Yang  http://orcid.org/0000-0003-3676-6828

H. Y. Liu  http://orcid.org/0000-0003-1383-5560
Y. X. Yang  http://orcid.org/0000-0002-3118-6659

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