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## TWO NEW SPECIES OF THE GENUS *LUCANUS* SCOPOLI, 1763 (COLEOPTERA: LUCANIDAE, LUCANINAE) FROM CHINA

C.-B. Wang

*Engineering Research Center for Forest and Grassland Disaster Prevention and Reduction, Mianyang Normal University, 166 Mianxing West Road, Mianyang 621000, Sichuan, P. R. China. E-mail: entomologist@qq.com*

**Summary.** Two names, *Lucanus zhanbishengi* Wang et Zhu, 2017 and *L. zhuxiangi* Wang et Zhan, 2018 are *nomen nudum*. To avoid future problems, both Chinese species are described and illustrated as new again. In order to keep stability as much as possible, the species names and the authors of corresponding species are remained unchanged.

**Key words:** stag beetles, Lucanini, taxonomy, unavailable names, new species, Oriental region.

**Ч.-Б. Ван. Два новых вида рода *Lucanus* Scopoli, 1763 (Coleoptera: Lucanidae, Lucaninae) из Китая // Дальневосточный энтомолог. 2024. N 512. С. 1-21.**

**Резюме.** Два названия, *Lucanus zhanbishengi* Wang et Zhu, 2017 и *L. zhuxiangi* Wang et Zhan, 2018, являются «голыми» или недействительными (*nomen nudum*). Чтобы избежать будущих проблем, оба китайских вида вновь описаны как новые и проиллюстрированы. Чтобы сохранить стабильность, насколько это возможно, названия видов и их авторы остаются неизменными.

## INTRODUCTION

*Lucanus* Scopoli, 1763 is the type genus of the family Lucanidae (Coleoptera) with members occurring in the Nearctic, Oriental and Palearctic Regions; however, it reaches its highest diversity in eastern Asia. Since the three milestone books of “*Stag beetles of China*” by Huang & Chen (2010, 2013, 2017), 14 species of *Lucanus* have been contributed to Chinese fauna (Wang & Zhu, 2017; Wang & Zhan, 2018; Wang & Ko, 2018; Huang & Chen, 2019, 2020; Adachi, 2020; Lin, 2021; Qi, 2021; Bian & Zhan, 2021; Zhan *et al.*, 2022; Wang *et al.*, 2023; Qi *et al.*, 2023) and a synonymy was proposed by Zhou *et al.* (2022). Therefore, the number of the *Lucanus* species from China comes to 67 (without subspecies) (Huang & Chen, 2010, 2013; Bartolozzi *et al.*, 2016; Wang *et al.*, 2023; Qi *et al.*, 2023).

More than five years ago, as the first author respectively, I described *L. zhanbishengi* Wang et Zhu, 2017 from Hunan of China (Wang & Zhu, 2017) and *L. zhuxiangi* Wang et Zhan, 2018 from Guangdong and Hunan of China (Wang & Zhan, 2018). In the past few years, several studies were published citing our two articles and/or names (Huang & Chen, 2019, 2020; Qi, 2021; Wang *et al.*, 2023; Qi *et al.*, 2023; Zhan & Young, 2023). Moreover, Zhan & Young (2023) redescribed the two species and assigned both of them to the *L. brivioi* species group.

However, due to blind pursuit of rapid publication, we chose the unconventional journal “*International Journal of Research Studies in Zoology*” which is issued and distributed electronically. According to Articles 8.5.2, 8.5.3, 8.6, and 78.2.4 of the Code of Zoological Nomenclature (ICZN, 1999) both *L. zhanbishengi* Wang et Zhu, 2017 and *L. zhuxiangi* Wang et Zhan, 2018 are unavailable names (*nomen nudum*). To avoid future problems, the best way is to publish full descriptions of the two species again (refer to the same case Santos-Silva *et al.*, 2021, 2022). In order to keep stability as much as possible, the species names and the authors of corresponding species are remained unchanged.

## MATERIAL AND METHODS

Specimens were relaxed and softened in hot water for 24 hours, and then transferred to distilled water to clean, dissect and observe. To examine the genitalia of both sexes, the last two abdominal segments were detached and treated with 10% solution of potassium hydroxide for 12 hours and then preserved in 75% ethanol. After examination, the body parts were mounted on a glass slide with Euparal Mounting Medium for future studies. Habitus photographs were taken using a Canon macro photo lens MP-E 65mm on a Canon 550D, or a Canon macro photo lens EF-S 60mm on a Canon 5DsR. Photographs of morphological details were taken using a Zeiss Axio Zoom.V16 motorized stereo zoom microscope with a Zeiss AxioCam MRc 5. Observations and measurements of morphological details were performed using an Olympus SZX9 stereomicroscope. The final deep focus images were created with Zerene Stacker 1.04 stacking software. Adobe Photoshop CS6 was used for post-processing. The morphological terminology follows Holloway (2007) and Huang & Chen (2010, 2013, 2017).

The material examined for this study is deposited in the following collections: **BITS** – Bin Insect Taxonomy Studio, Beijing, China; **CAU** – China Agricultural University, Beijing, China; **CBSZ** – Collection of Bi-Sheng Zhan, Zhenjiang, China; **CCZC** – Collection of Chao Zhou, Chengdu, China; **CXZB** – Collection of Xiang Zhu, Beijing, China. The specimens of *Lucanus brivioi* Zilioli, 2003 and *L. kraatzii* Nagel, 1926 were examined for comparison with new species.

Measurement criteria in millimetres (mm) are used as follows: body length: length between the apex of mandible to the elytral apex along the midline; elytral length: length between the basal border and the apex of elytra along suture; elytral width: widest part of both elytra combined; head length: length between the anterior apex of clypeus and the posterior margin of occiput along the midline; head width: widest part of head; mandible length: length from the apex of mandible to its base at anterior margin of the head; pronotal length: length of the pronotum along the midline; pronotal width: widest part of pronotum.

## TAXONOMY

### Genus *Lucanus* Scopoli, 1763

#### *Lucanus zhanbishengi* Wang et Zhu, sp. n.

<https://zoobank.org/NomenclaturalActs/8CE8539B-1361-4563-9B61-F8EE02ACF5A2>

Figs 1A–C, 2A–C, 3A,B, 4A–D, 5A–D, 6A–I, 8A,B, 9A–C, 10

*Lucanus zhanbishengi* Wang & Zhu, 2017: 55 (*nomen nudum*).

TYPE MATERIAL. Holotype: ♂, **China**: Hunan: Hongjiang City, Xuefengshan Nature Reserve, Subaoding, 1900 m, 6.VI 2016, Bi-Sheng Zhan leg. (BITS). Paratypes: 9♂, 4♀, same data as holotype except 3.VII 2017, Bi-Sheng Zhan & Xiang Zhu leg. (CBSZ).

DIAGNOSIS. Male. Labrum ligulate; head (Figs 1A–C) with anterior ridge evenly elevated and lateral ridges distinctly protruded; major inner tooth preceded by 6–7 smaller teeth and followed by 8–11 smaller teeth that not continued to mandibular base; protibia with 15–18 small teeth along outer margin; abdominal tergite VIII (Figs 4A, C) with poorly-defined lateral angles; sternite VIII (Figs 4B, D) with large membranous area in median; ventral plate of segment IX (Figs 5A, C) with thin longitudinal membranous stripe along midline of apical expansion; aedeagus with ventral plate (Figs 6A, F) at apical end of basal piece long, paramere apex (Figs 6C, H) weakly upcurved, penis (Figs 6A, F) short but wide (about 3/5 length of parameres), flagellum (Figs 6D, G, H) more than twice as long as parameres, flagellum apex (Figs 6E, I) weakly enlarged.

Female. Pronotum (Fig. 3A) widest behind middle; elytra (Fig. 3A) clothed with fine pubescence; protibial apex (Fig. 3A) with basal branch much more expanded; abdominal tergite VIII (Fig. 8A) with poorly-defined lateral angles; hemisternite (Figs 9A, B) moderately wide and inner lateral margin of sclerotized part long; spermatheca (Fig. 9C) with proximal part slender and turned dorsally, spermathecal

duct (Fig. 9A) about 2.5 times as long as spermatheca, spermathecal gland (Fig. 9A) cystiform.

DESCRIPTION. Male (holotype). Large size, body 51.9 mm long. Length (mm) of different body parts: head (6.9) : mandible (21.1) : pronotum (6.0) : elytra (18.5); width (mm): head (13.5) : pronotum (10.8) : elytra (12.8).

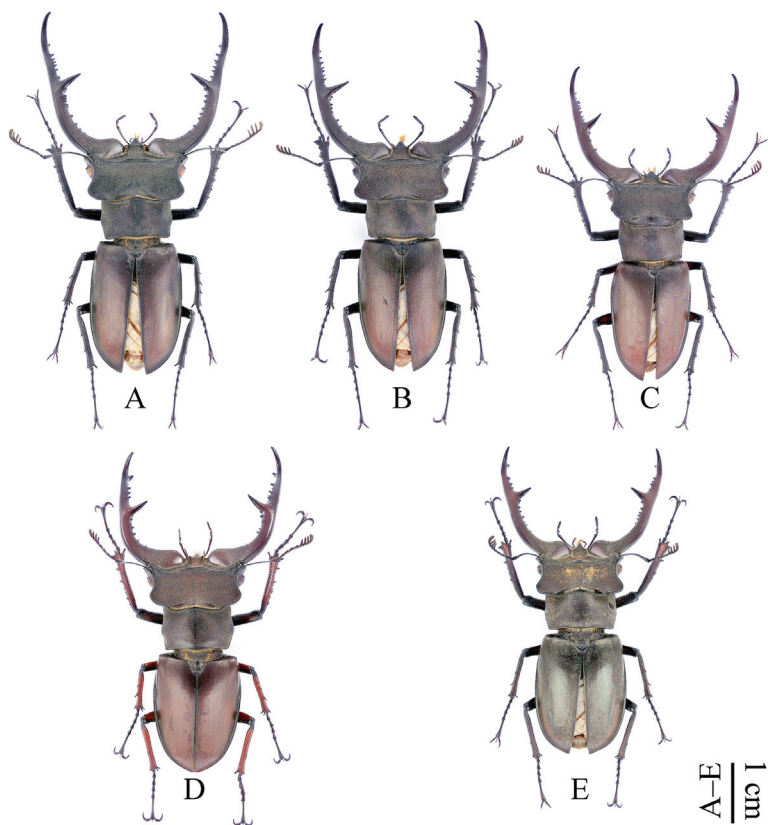


Fig. 1. Habitus of *Lucanus* spp., males, dorsal view. A–C – *L. zhanbishengi* sp. n.: A – paratype a, Hunan; B – paratype b, Hunan; C – holotype, Hunan; D – *L. brivioi* Zilioli, Fujian; E – *L. kraatzi* Nagel, Yunnan.

*Habitus* (Figs 1C; 2C). Color mainly blackish brown on both dorsal and ventral sides; elytra reddish brown; ventral sides of profemora, both dorsal and ventral sides of meso- and metafemora with transverse reddish stripes. Body clothed with fine, recumbent, yellowish pubescence, but markedly longer and denser on metasternum.

*Head* (Fig. 1C). Form transverse. Anterior ridge clearly defined and evenly elevated. Lateral ridges distinctly protruded, forming rounded lateral corners. Clypeolabrum fused with frons, not defined by transverse suture, about 1.4 times as long as wide;



labrum ligulate, lacking dorsal branch, simply rounded at apex. Mandible about 3.0 times as long as head, markedly incurved at basal 1/3, then straight to apex; apical fork with upper branch markedly longer than lower branch; major inner tooth slender and longer than mandibular width, preceded by 6–7 smaller teeth and followed by 8–11 smaller teeth that not continued to mandibular base. Antennal club with four antennomeres; antennomere 7 slender and sharply pointed apically; antennomeres 8–10 lamellate.

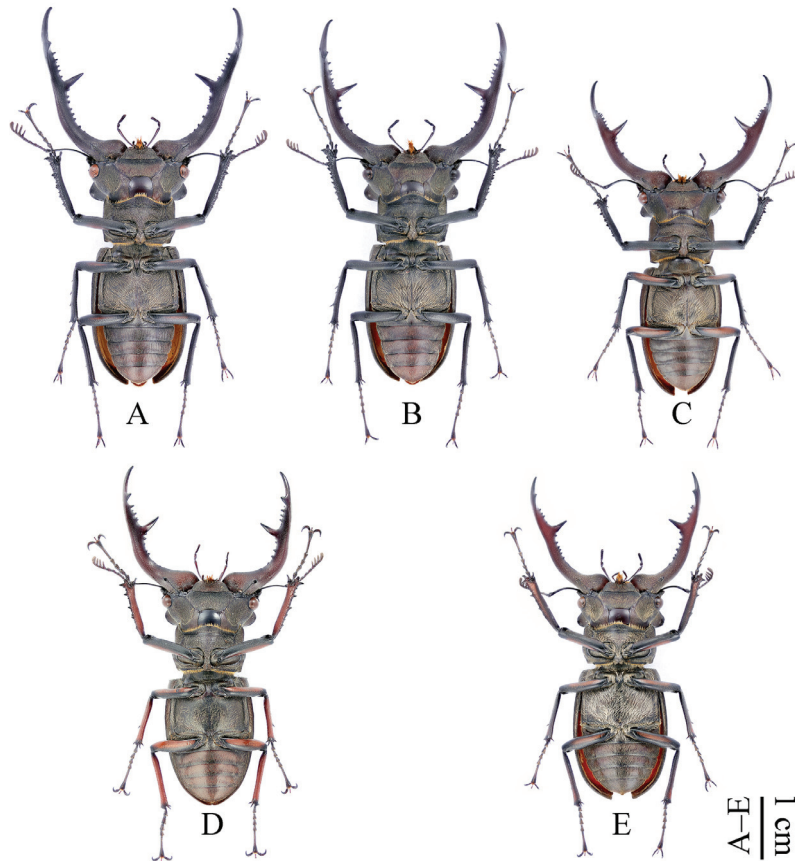


Fig. 2. Habitus of *Lucanus* spp., males, ventral view. A–C – *L. zhanbishengi*, sp. n.: A – paratype a, Hunan; B – paratype b, Hunan; C – holotype, Hunan; D – *L. brivioi* Zilioli, Fujian; E – *L. kraatzi* Nagel, Yunnan.

*Legs* (Fig. 1C). Protibia continuously serrated along outer margin, with 15–18 small teeth of different sizes; apex bifurcate with branches somewhat sharp at tips. Except apical spurs and spines, mesotibia with 3 small lateral spines and metatibia with 2 ones.

*Male terminalia and genitalia.* Abdominal tergite VIII (Fig. 4C) with poorly-defined lateral angles; sternite VIII (Fig. 4D) with large membranous area in median. Ventral plate of segment IX (Fig. 5C) with thin longitudinal membranous stripe along midline of apical expansion. Aedeagus (Fig. 6G) about 2.4 times as long as wide in dorsal view. Basal piece oblong in dorsal view, nearly 1.7 times as long as parameres, with paired sclerotized dorsal plates; ventral plate (Fig. 6F) at apical end of basal piece long, well sclerotized, widely emarginate at apical margin. Paramere with wide basal process; apex (Fig. 6H) weakly upcurved. Penis (Fig. 6F) short but wide, about  $\frac{3}{5}$  length of parameres. Flagellum (Figs 6G, H) long, more than twice as long as parameres, apex (Fig. 6I) weakly enlarged.

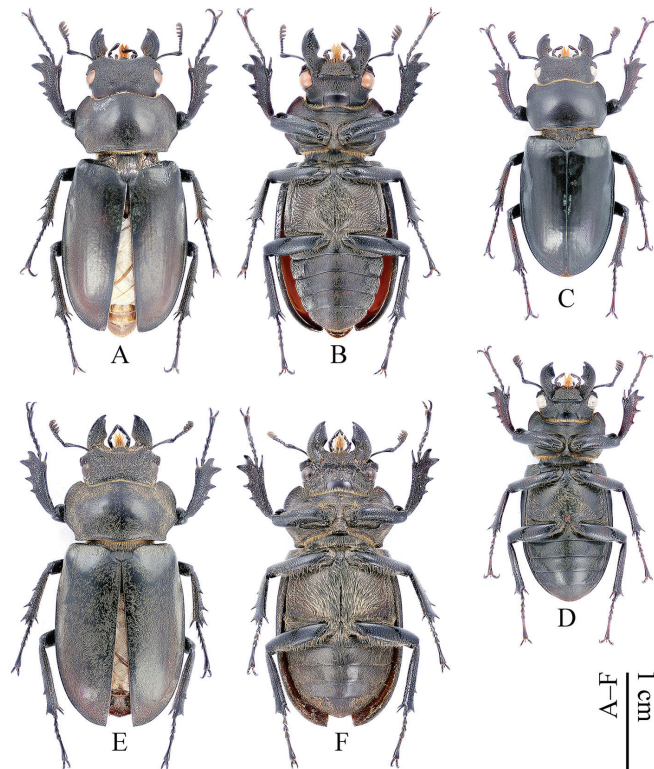


Fig. 3. Habitus of *Lucanus* spp., females. A, B – *L. zhanbishengi* sp. n., paratype c, Hunan; C, D – *L. brivioi* Zilioli, Fujian; E, F – *L. kraatzi* Nagel, Yunnan. (A, C, E – dorsal view; B, D, F – ventral view).

Male paratypes (Figs 1A, B; 2A, B). Body 49–57 mm long.

*Variation.* Color: Transverse reddish stripes on ventral sides of profemora, both dorsal and ventral sides of meso- and metafemora variable, absent (Fig. 2B), narrowed (Fig. 2A), or broadened (Fig. 2C). In large-sized males, apical fork of mandible more

opened, number of inner teeth more, clypeolabrum longer, anterior ridge of head well elevated, lateral ridges of head distinctly protruded; while in small-sized males, apical fork of mandible less opened, number of inner teeth fewer, clypeolabrum shorter, anterior ridge of head weakly elevated, lateral ridges of head weakly protruded.

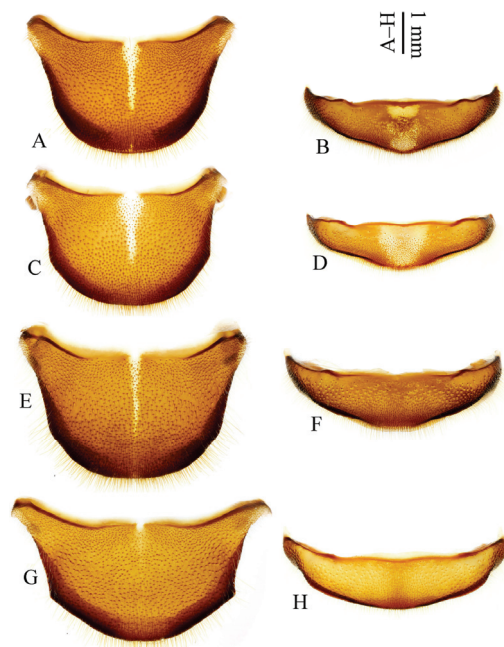


Fig. 4. Male abdominal tergites VIII (A, C, E, G – dorsal view) and sternites VIII (B, D, F, H – ventral view) of *Lucanus* spp. A, B – *L. zhanbishengi* sp. n., paratype b, Hunan; C, D – ditto, holotype, Hunan; E, F – *L. brivioi* Zilioli, Fujian; G, H – *L. kraatzi* Nagel, Yunnan.

Female paratype. Body 31.0 mm long. Length (mm) of different body parts: head (3.3) : mandible (3.0) : pronotum (6.0) : elytra (16.7); width (mm): head (7.9) : pronotum (10.5) : elytra (11.7).

*Habitus* (Figs 3A, B). Color almost entirely black on both dorsal and ventral sides. Body clothed with fine, recumbent, yellowish pubescence, but markedly longer and denser on metasternum.

*Head* (Fig. 3A). Canthus with both anterior and posterior angles clearly defined; anterior angle inside of eye; lateral margin weakly concave. Anterior and lateral ridges absent. Clypeolabrum transverse, flat at apex, not protruding medially. Both mandibles with distinct dorsal teeth; inner tooth of right mandible with broad and flat inner ridge; left mandible with 2 widely-separated inner teeth and small gap behind apex, inner margin between teeth long, weakly concave.

*Pronotum* (Fig. 3A) 1.7 times as wide as long, widest behind middle; anterior angle rounded; lateral angles weakly defined; posterior angle obtuse.

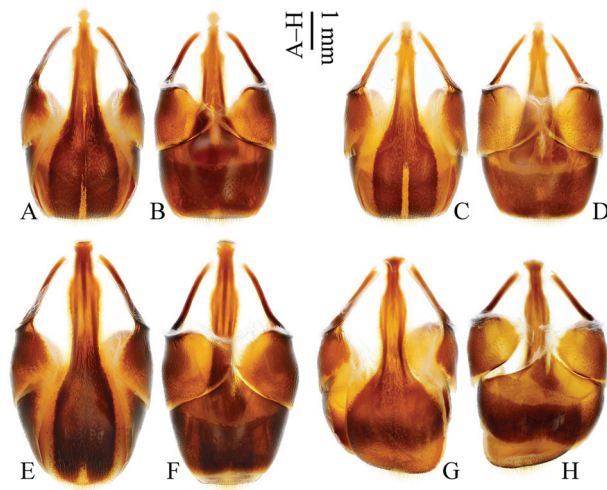


Fig. 5. Male abdominal segments IX of *Lucanus* spp. A, B – *L. zhanbishengi* sp. n., paratype b, Hunan; C, D – ditto, holotype, Hunan; E, F – *L. brevioi* Zilioli, Fujian; G, H – *L. kraatzi* Nagel, Yunnan. (A, C, E, G – ventral view; B, D, F, H – dorsal view).

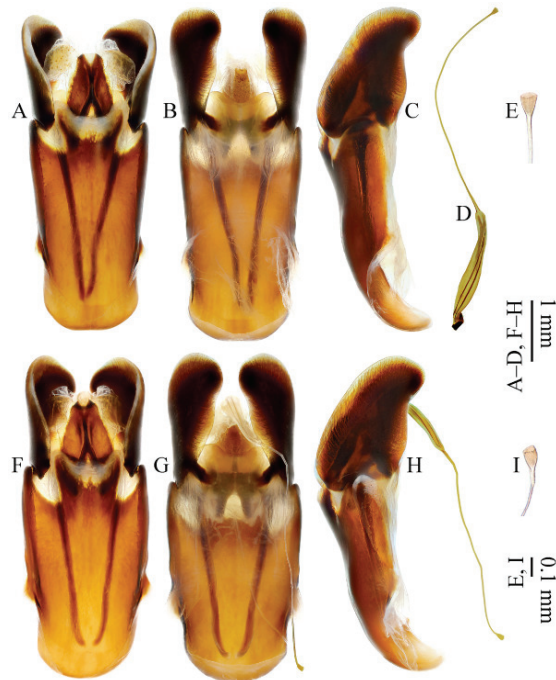


Fig. 6. Aedeagi of *L. zhanbishengi* sp. n. (D – flagellum; E, I – apices of flagellum). A–E – paratype b, Hunan; F–I – holotype, Hunan. (A, F – ventral view; B, D, E, G, I – dorsal view; C, H – lateral view).

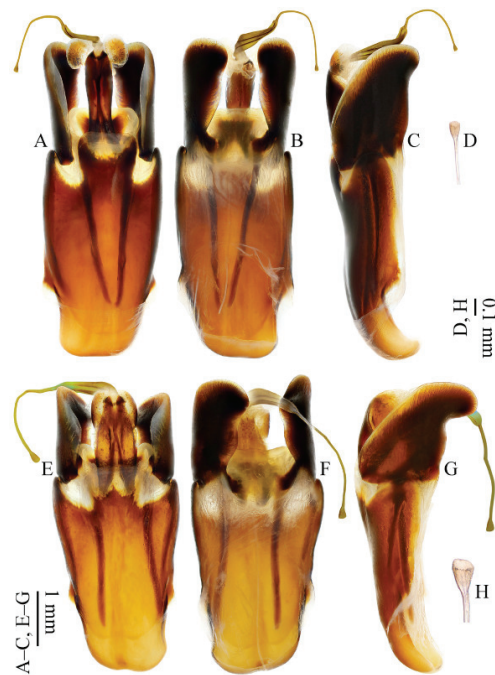


Fig. 7. Aedeagi of *Lucanus* spp. (D, H – apices of flagellum). A–D – *L. brivioi* Zilioli, Fujian; E–H – *L. kraatzi* Nagel, Yunnan. (A, E – ventral view; B, D, F, H – dorsal view; C, G – lateral view).

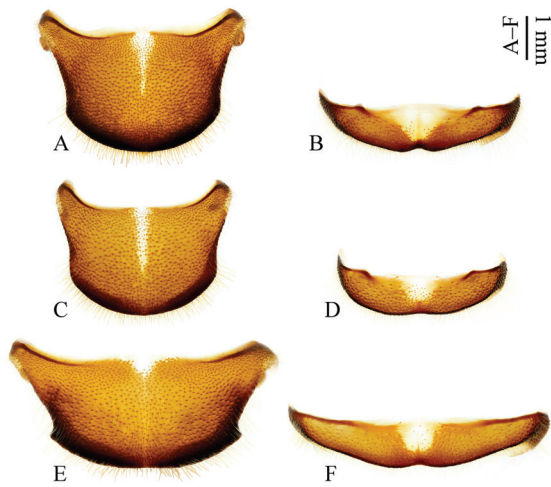


Fig. 8. Female abdominal tergites VIII (A, C, E – dorsal view) and sternites VIII (B, D, F – ventral view) of *Lucanus* spp. A, B – *L. zhanbishengi* sp. n., paratype c, Hunan; C, D – *L. brivioi* Zilioli, Fujian; E, F – *L. kraatzi* Nagel, Yunnan.



Legs (Fig. 3A). Protibial apex bifurcate, with basal branch much more expanded.

*Female terminalia and genitalia.* Abdominal tergite VIII (Fig. 8A) with poorly-defined lateral angles; sternite VIII (Fig. 8B) with large membranous area in median. Hemisternite (Figs 9A–B) moderately wide, broadly rounded apically, with outer apex not produced beyond inner apex; inner lateral margin of sclerotized part long. Spermatheca (Fig. 9A) sclerotized, J-shaped; proximal part slender and turned dorsally (Fig. 9C). Spermathecal duct (Fig. 9A) long, about 2.5 times as long as spermatheca. Spermathecal gland (Fig. 9A) cystiform, shorter than spermatheca. Central conjunction of tergite IX protruded medially and narrowed at tip.

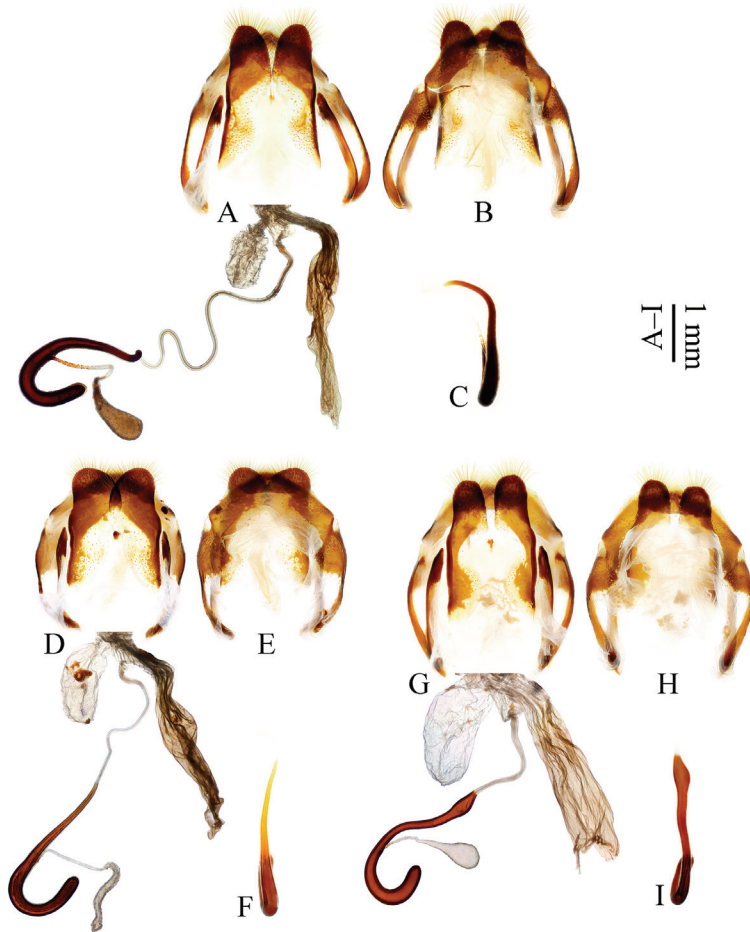


Fig. 9. Female genitalia of *Lucanus* spp. A–C *L. zhanbishengi* sp. n., paratype c, Hunan; D–F – *L. brivioi* Zilioli, Fujian; G–I – *L. kraatzi* Nagel, Yunnan. (A, D, G – ventral view; B, E, H – dorsal view of hemisternites; C, F, I – right lateral view of spermathecae).

FIELD OBSERVATIONS. Mating of *L. zhanbishengi* **sp. n.** in Xuefengshan Nature Reserve (Hunan) as shown in Fig. 10.

ETYMOLOGY. The specific epithet is dedicated to Mr. Bi-Sheng Zhan (Jiangsu University, Zhenjiang, China), one of the collectors of this new species and an enthusiastic amateur entomologist. The name is a noun in the genitive case.

DISTRIBUTION. China (Hunnan).



Fig. 10. Field observations (Hunan: Xuefengshan Nature Reserve) of the mating behavior of *Lucanus zhanbishengi* sp. n. (photo Bi-Sheng Zhan).

REMARKS. This new species was assigned to the *L. brivioi* species group (*sensu* Zhan & Young, 2023). It well resembles *L. brivioi* Zilioli, 2003 in general appearance, but can be distinguished from the latter by the combination of the following characters (*L. brivioi* in round brackets). Male: labrum ligulate (subtriangular), head with lateral ridges distinctly protruded (Figs 1A–C) (moderately protruded (Fig. 1D)), major inner tooth preceded by 6–7 smaller teeth and followed by 8–11 (preceded by about 4–5 smaller teeth and followed by about 6–8), protibia with 15–18 small teeth along outer margin (9–11 small teeth along outer margin), abdominal sternite VIII with large membranous area in median (Figs 4B, D) (without membranous area (Fig. 4F)), ventral plate of segment IX with thin longitudinal membranous stripe along midline of apical expansion (Figs 5A, C) (only with small membranous area in median of apical part (Fig. 5E)), penis short but wide, about 3/5 length of parameres (Figs 6A, F) (long and slender, nearly as long as parameres (Fig. 7A)), flagellum more than twice as long as parameres (Figs 6D, G, H) (about 1.4 times as long as parameres (Figs 7A–C)). Female: elytra clothed with fine pubescence (Fig. 3A) (glabrous (Fig. 3C)), protibial apex with basal branch much more expanded (Fig.

3A) (weakly expanded (Fig. 3C)), hemisternite moderately wide and inner lateral margin of sclerotized part long (Figs 9A–B) (hemisternite rather wide and inner lateral margin of sclerotized part short (Figs 9D–E)), spermatheca with proximal part slender and turned dorsally (Fig. 9C) (almost straight (Fig. 9F)), spermathecal duct about 2.5 times as long as spermatheca (Fig. 9A) (almost as long as spermatheca (Fig. 9D)), spermathecal gland cystiform (Fig. 9A) (vermiform (Fig. 9D)).

This new species is similar to *L. kraatzi* Nagel, 1926, but it is easily to distinguish them by the combination of the following characteristics (*L. kraatzi* in round brackets). Male: labrum ligulate (subtriangular), head with anterior ridge evenly elevated and lateral ridges distinctly protruded (Figs 1A–C) (anterior ridge much more elevated in median and lateral ridges strongly protruded (Fig. 1E)), major inner tooth preceded by 6–7 smaller teeth and followed by 8–11 smaller teeth (preceded by about 4 smaller teeth and followed by about 8 smaller teeth), protibia with 15–18 small teeth along outer margin (2–4 small teeth along outer margin), abdominal tergite VIII with poorly-defined lateral angles (Figs 4A, C) (with well-defined lateral angles (Fig. 4G)), sternite VIII with large membranous area in median (Figs 4B, D) (without membranous area (Fig. 4H)), ventral plate of segment IX with thin longitudinal membranous stripe along midline of apical expansion (Figs 5A, C) (without membranous area (Fig. 5G)), aedeagus with ventral plate at apical end of basal piece long (Figs 6A, F) (short (Fig. 7E)), paramere apex weakly upcurved (Figs 6C, H) (strongly upcurved (Fig. 7G)), penis short but wide, about 3/5 length of parameres (Figs 6A, F) (long and slender, nearly as long as parameres (Fig. 7E)), flagellum more than twice as long as parameres (Figs 6D, G, H) (less than twice as long as parameres (Figs 7E–G)), flagellum apex weakly enlarged (Figs 6E, I) (strongly enlarged (Fig. 7H)). Female: elytra clothed with fine pubescence (Fig. 3A) (clothed with strong pubescence (Fig. 3E)), protibial apex with basal branch much more expanded (Fig. 3A) (moderately expanded (Fig. 3C)), abdominal tergite VIII with poorly-defined lateral angles (Fig. 8A) (with well-defined lateral angles (Fig. 8E)), spermatheca with proximal part slender and turned dorsally (Fig. 9C) (inflated and straight (Fig. 9I)), spermathecal duct about 2.5 times as long as spermatheca (Fig. 9A) (about 0.7 times as long as spermatheca (Fig. 9G)).

*L. zhanbishengi* sp. n. is also somewhat similar to *L. deuveianus* Boucher, 1998 and *L. hewenjae* Huang & Chen, 2013 from Guangxi Province, but it is not difficult to distinguish it from them by the combination of characters in the above section of diagnosis.

### ***Lucanus brivioi* Zilioli, 2003**

Figs 1D, 2D, 3C,D, 4E,F, 5E,F, 7A–D, 8C,D, 9D–F, 11C,F, 13B, 15D–F,H, 16D,E

**MATERIAL EXAMINED.** **China:** Fujian: Quanzhou City, Dehua County, Daiyunshan Nature Reserve, 1500 m, VI 2016, 3♂, 1♀, Bi-Sheng Zhan leg. (CBSZ).

**DISTRIBUTION.** China (Fujian).



***Lucanus kraatzi* Nagel, 1926**

Figs 1E, 2E, 3E,F, 4G,H, 5G,H, 7E–H, 8E,F, 9G–I

MATERIAL EXAMINED. **China:** Yunnan, Qujing City, Tianshengqiao power station, 1700 m, VIII 2016, 3♂, 1♀, Yun-Chuan Xu leg. (CBSZ).

DISTRIBUTION. China (Fujian, Guizhou, Sichuan, Yunnan).

***Lucanus zhuxiangi* Wang et Zhan, sp. n.**

<https://zoobank.org/NomenclaturalActs/A0912EEB-5EC5-46FF-9A2D-47456120211D>

Figs 11A,B,D,E, 12A–D, 13A, 14A–F, 15A–C,G, 16A–C, 17A–D

*Lucanus zhuxiangi* Wang & Zhan, 2018: 2 (*nomen nudum*).

TYPE MATERIAL. Holotype: ♂, **China:** Hunan: Chenzhou City, Yizhang County, Mangshan Nature Reserve, VI 2017, Xiang Zhu leg. (CAU). Paratypes: 7♂, 7♀, same data as holotype except Xiang Zhu & Bi-Sheng Zhan leg. (CXZB); 6♂, 8♀, same data as holotype except VI 2016 (CXZB); 21♂, 22♀, Guangdong: Nanling Nature Reserve, VI 2014, Xiang Zhu leg. (CXZB); 40♂, 28♀, same data as previous except VI 2015 (CXZB); 46♂, 15♀, same data as previous except VI 2016 (CXZB); 8♂, 8♀, same data as previous except VI 2017, Xiang Zhu & Bi-Sheng Zhan leg. (CXZB); 1♂, same data as previous except 2.VII 2018, Huan Liu leg. (CCZC); 1♀, same data as previous except 11.VII 2018 (CCZC).

DIAGNOSIS. Male. All tibiae and femora (Figs 11A, B) with yellowish stripes on dorsal and ventral sides; labrum slenderly subtriangular; head (Fig. 13A) with anterior ridge subroundly elevated and lateral ridges broad, forming widely-rounded lateral corners; major inner tooth (Fig. 13A) preceded by 3–5 smaller teeth and followed by 8–10 smaller teeth that not continued to mandibular base; protibia (Figs 11A; 12A–D) with 4–5 large teeth along outer margin, some smaller or indistinct teeth of different sizes among large ones; abdominal tergite VIII (Fig. 14A) with poorly-defined lateral angles; sternite VIII (Fig. 14B) without membranous area; ventral plate of segment IX (Fig. 14C) with linear longitudinal membranous stripe along midline of apical expansion; aedeagus with ventral plate (Fig. 15A) at apical end of basal piece long, well sclerotized, widely emarginate at apical margin; paramere (Fig. 15C) weakly upcurved at apex; penis (Fig. 15A) long and slender, nearly as long as parameres; flagellum (Figs 15A–C) about 1.4 times as long as parameres, apex (Fig. 15G) weakly enlarged.

Female. All femora (Figs 11D, E) with yellowish stripes on ventral sides; pronotum (Fig. 11D) widest at basal 2/5; elytra (Fig. 11D) clothed with fine pubescence; protibia (Fig. 11D) with apical branches relatively broader and blunter; abdominal tergite VIII (Fig. 14E) with poorly-defined lateral angles; sternite VIII (Fig. 14F) distinctly emarginate at median of posterior margin; hemisternite (Fig. 16A) moderately wide and inner lateral margin of sclerotized part long; spermatheca (Figs 16A, C) with proximal part moderately to strongly curved inwards, and weakly turned ventrad (Fig. 16B); spermathecal duct (Fig. 16A) about 2.1 times as long as spermatheca; spermathecal gland (Fig. 16A) vermiform, shorter than spermatheca.

DESCRIPTION. Male (holotype). Large size, body 56.2 mm long. Length (mm) of different body parts: head (7.7), mandible (22.7), pronotum (6.8), elytra (20.9); width (mm): head (16.4), pronotum (11.9), elytra (14.1).

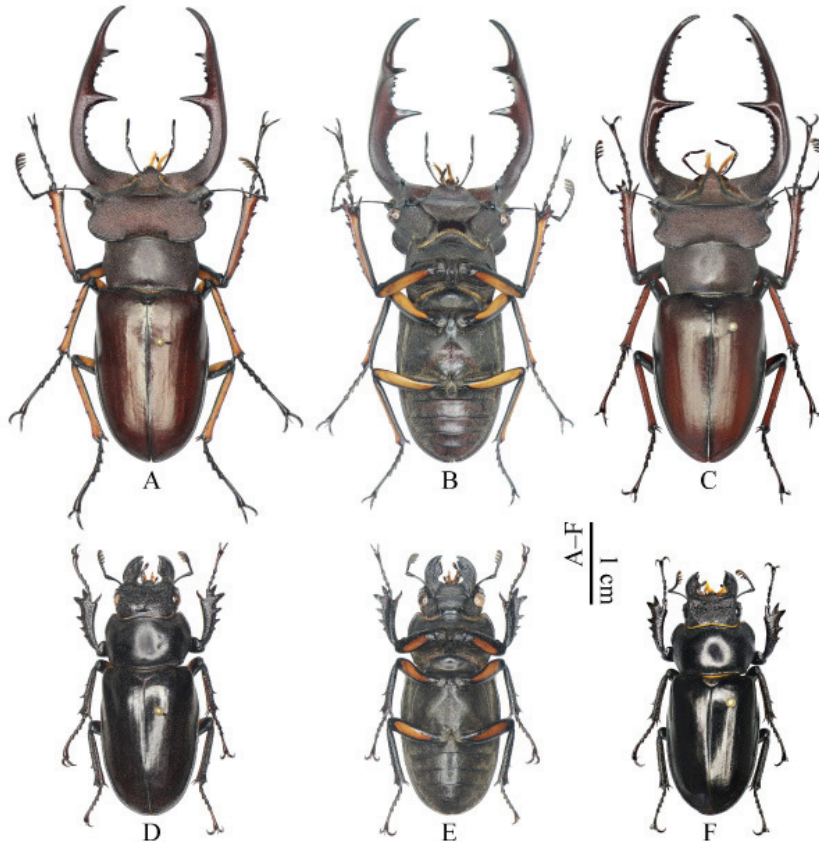


Fig. 11. Habitus of *Lucanus* spp. A, B – *L. zhuxiangi* sp. n., ♂, holotype, Hunan; D, E – ditto, ♀, paratype, Hunan; C – *L. brivioi* Ziliol, ♂, Fujian; F – ditto, ♀, Fujian. (A, C, D, F – dorsal view; B, E – ventral view).

*Habitus* (Figs 11A, B; 12B). Color mainly reddish brown to blackish brown on both dorsal and ventral sides; elytra sheen, reddish brown; all tibiae and femora with large, transverse, yellowish stripes on dorsal and ventral sides. Body clothed with fine, recumbent, yellowish pubescence, not longer and denser on metasternum.

*Head* (Fig. 13A). Form transverse. Anterior ridge clearly defined and subroundly elevated. Lateral ridges broad, moderately protruded, forming widely-rounded lateral corners. Clypeolabrum fused with frons, not defined by transverse suture, about 1.5 times as long as wide; labrum slenderly subtriangular, with dorsal branch, subrounded at apex. Mandible about 3.0 times as long as head, distinctly incurved

at basal 1/3, then straight to apex; apical fork with upper branch markedly longer than lower branch; major inner tooth slender and longer than mandibular width, preceded by 3–5 smaller teeth and followed by 8–10 smaller teeth that not continued to mandibular base. Antennal club with four antennomeres; antennomere 7 slender and sharply pointed apically; antennomeres 8–10 lamellate.

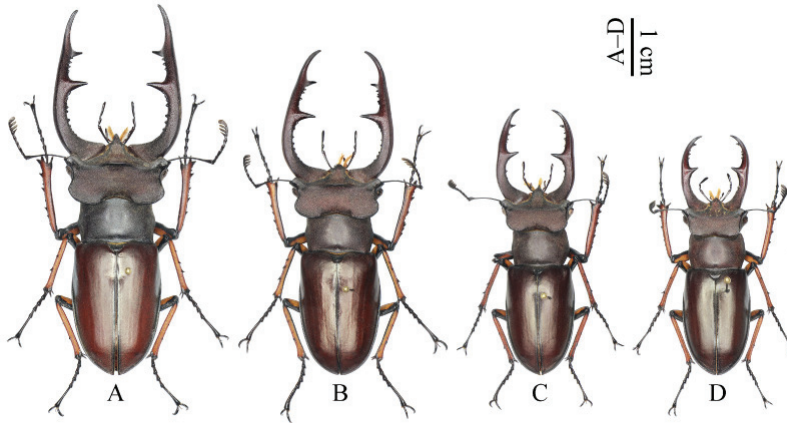


Fig. 12. Habitus of *Lucanus zhuxiangi* sp. n., male, Hunan, dorsal view. A – paratype, large-sized; B – holotype, common-sized; C – paratype, moderate-sized; D – paratype, small-sized.

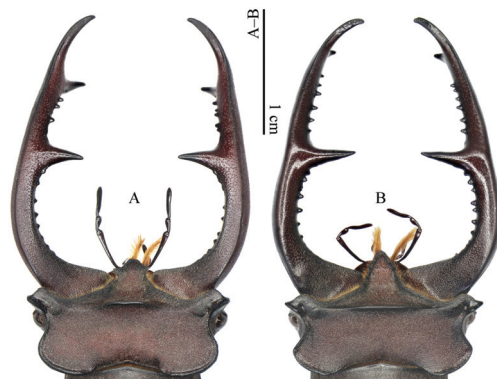


Fig. 13. Head of *Lucanus* spp., male, dorsal view. A – *L. zhuxiangi* sp. n., holotype, Hunan; B – *L. brivioi* Zilioli, Fujian.

*Legs* (Figs 11A; 12B). Protibia with 4–5 large teeth along outer margin, some smaller or indistinct teeth of different sizes among large ones; apex bifurcate with branches bluntly rounded at tips. Except apical spurs and spines, mesotibia with 4 or 5 small lateral spines (basal one or two tiny) and metatibia with 3 spines (basal one tiny).

*Male terminalia and genitalia.* Abdominal tergite VIII (Fig. 14A) with poorly-defined lateral angles; sternite VIII (Fig. 14B) without membranous area and weakly protruded in median of posterior margin. Ventral plate of segment IX (Fig. 14C) with linear longitudinal membranous stripe along midline of apical expansion. Aedeagus (Fig. 15A) about 2.6 times as long as wide in dorsal view. Basal piece (Fig. 15A) oblong in dorsal view, nearly 1.6 times as long as parameres, with paired sclerotized dorsal plates (Fig. 15B); ventral plate (Fig. 15A) at apical end of basal piece long, well sclerotized, widely emarginate at apical margin. Paramere with wide basal process; apex (Fig. 15C) weakly upcurved. Penis (Fig. 15A) long and slender, nearly as long as parameres. Flagellum (Figs 15A–C) relatively short, about 1.4 times as long as parameres, apex (Fig. 15G) weakly enlarged.

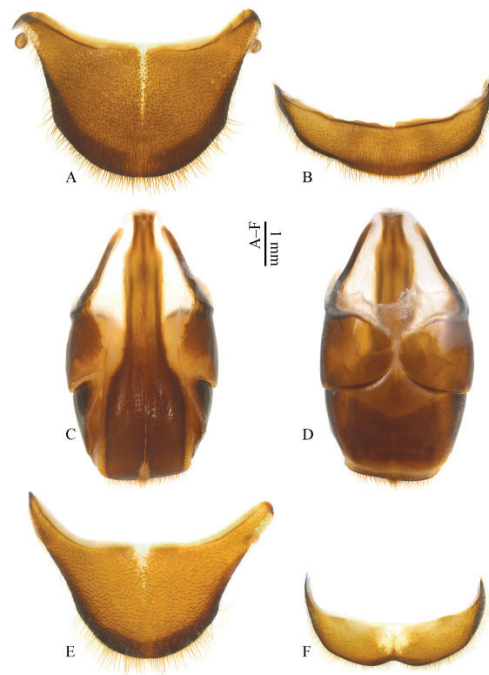


Fig. 14. Abdominal segments of *Lucanus zhuxiangi* sp. n., Hunan. A–D – holotype, ♂: A – tergite VIII; B – sternite VIII; C, D – segment IX; E, F – paratype, ♀: E – tergite VIII; F – sternite VIII (A, D, E – dorsalview; B, C, F – ventral view).

*Male Paratypes.* Body 41.0–63.9 mm long (Figs 12A, C, D).

*Variation.* In large-sized males, apical fork of mandible more opened, number of inner teeth more, clypeolabrum longer, anterior ridge of head well elevated; while in small-sized males, apical fork of mandible less opened, number of inner teeth fewer, clypeolabrum shorter, anterior ridge of head weakly elevated.

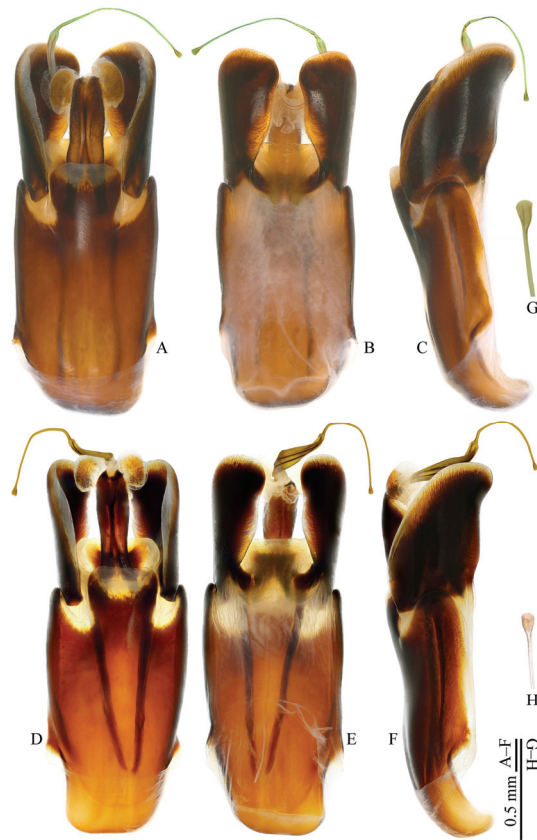


Fig. 15. Aedeagi of *Lucanus* spp. (G, H – apices of flagellum). A–C, G – *L. zhuxiangi* sp. n., holotype, Hunan; D–F, H – *L. brivioi* Zilioli, Fujian. (A, D – ventral view; B, E, G, H – dorsal view; C, F – lateral view).

Female Paratype. Body 32.0 mm long. Length (mm) of different body parts: head (4.2), mandible (3.5), pronotum (6.7), elytra (17.7); width (mm): head (8.3), pronotum (10.7), elytra (12.0).

*Habitus* (Figs. 11D, E). Color mostly black on both dorsal and ventral sides; ventral sides of profemora, dorsal and ventral sides of meso- and metafemora with transverse yellowish stripes. Body clothed with fine, recumbent, yellowish pubescence, not longer and denser on metasternum.

*Head* (Fig. 11D). Canthus with both anterior and posterior angles clearly defined; anterior angle inside of eye; lateral margin weakly concave. Anterior and lateral ridges absent. Clypeolabrum transverse, weakly emarginate at apex. Right mandible with low dorsal tooth, inner tooth with broad and flat inner ridge; left mandible without dorsal tooth, with 2 widely-separated inner teeth and small gap behind apex, inner margin between teeth long, weakly concave.

*Pronotum* (Fig. 11D) 1.6 times as wide as long, widest at basal 2/5; anterior angle rounded; lateral angles weakly defined; posterior angle widely subrounded.

*Legs* (Fig. 11D). Protibia with 3 distinct teeth along outer margin; apex bifurcate, with branches relatively broader, blunter, and basal branch much more expanded.

*Female terminalia and genitalia.* Abdominal tergite VIII (Fig. 14E) with poorly-defined lateral angles; sternite VIII (Fig. 14F) with membranous area in median and distinctly emarginate in median of posterior margin. Hemisternite (Fig. 16A) moderately wide, broadly rounded apically, with outer apex not produced beyond inner apex; inner lateral margin of sclerotized part long. Spermatheca (Figs 16A, C) sclerotized, J-shaped; proximal part moderately to strongly curved inwards, and weakly turned ventrad (Fig. 16B). Spermathecal duct (Fig. 16A) long, about 2.1 times as long as spermatheca. Spermathecal gland (Fig. 16A) vermiform, shorter than spermatheca. Central conjunction of 9th tergite protruding medially and roundly narrowed at tip.

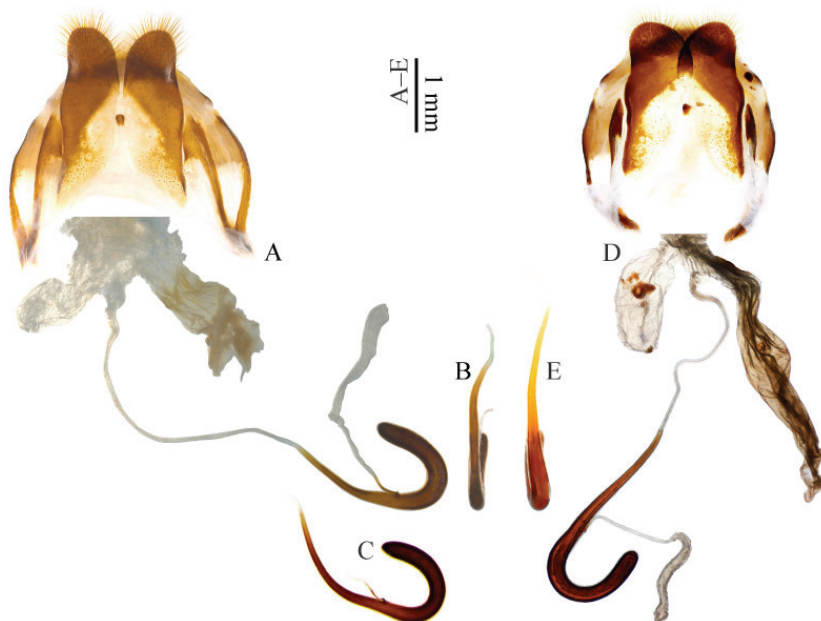


Fig. 16. Female genitalia of *Lucanus* spp. A–C – *L. zhuxiangi* sp. n., paratype, Hunan; D, E – *L. brivioi* Zilioli, Fujian. (A, C, D – ventral view; B, E – right lateral view of spermathecae).

**FIELD OBSERVATIONS.** Mating behavior of *L. zhuxiangi* **sp. n.** in Mangshan Nature Reserve (Hunan) as shown in Figs 17A–C.

**ETYMOLOGY.** The specific epithet is dedicated to Mr. Xiang Zhu (Beijing, China), one of the collectors of this new species and an enthusiastic amateur entomologist. The name is a noun in the genitive case.

**DISTRIBUTION.** China (Guangdong, Hunan).



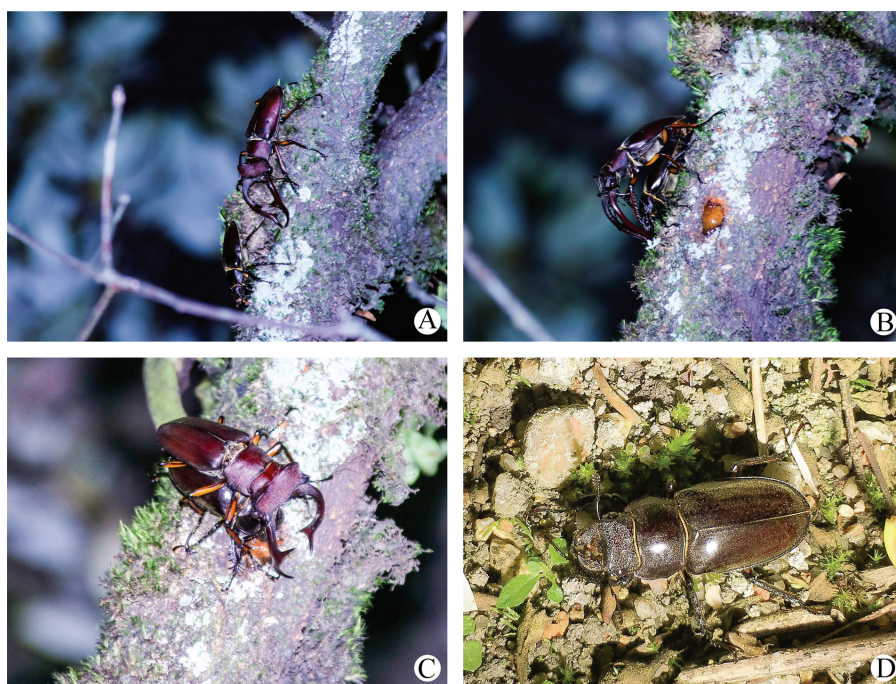


Fig. 17. Field observations (Hunan: Mangshan Nature Reserve) of *Lucanus zhuxiangi* sp. n. A – approaching; B, C – mating; D – female on the ground. (A–C – photo Jun Chen; D – photo Xiang Zhu).

REMARKS. This new species was assigned to the *L. brivioi* species group (*sensu* Zhan & Young, 2023). It well resembles *L. brivioi* Zilioli, 2003 in general appearance (their aedeagi are also similar to each other, however, there are still differences on the curvatures of the outer margins of penis and the sizes of the flagellum apices), but it can be distinguished by the combination of the following characters (*L. brivioi* in round brackets). Male: all tibiae and femora with yellowish stripes on dorsal and ventral sides (Figs 11A, B) (with reddish stripes on dorsal and ventral sides (Fig. 11C)), labrum more slender (shorter), major inner teeth of mandibles stouter (Fig. 13A) (more slender (Fig. 13B)), head with lateral ridges rounded at lateral corners (Fig. 13A) (obtuse at lateral corners (Fig. 13B)), ventral plate of segment IX with linear longitudinal membranous stripe along midline of apical expansion (Fig. 14C) (only with small membranous area in median of apical part). Female: all femora with yellowish stripes on ventral sides (Fig. 11E) (almost uniformly black (Fig. 11F)), protibiae with apical branches relatively broader and blunter (Fig. 11D) (relatively smaller and sharper (Fig. 11F)), abdominal sternite VIII distinctly emarginate in median of posterior margin (Fig. 14F) (weakly emarginate in median of posterior margin), hemisternite moderately wide and inner

lateral margin of sclerotized part long (Fig. 16A) (rather wide and inner lateral margin of sclerotized part short (Fig. 16D)), spermatheca with proximal part moderately to strongly curved inwards (Figs 16A, C) (straight or weakly curved inwards (Fig. 16D)).

*L. zhuxiangi* sp. n. is also somewhat similar to *L. deuveianus* Boucher, 1998 and *L. hewenjieae* Huang et Chen, 2013 from Guangxi Province, but it is not difficult to distinguish it from them by the combination of characters in the above section of diagnosis.

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