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## ● A new species of the stage beetle genus *Lucanus* Scopoli, 1763 (Coleoptera: Lucanidae: Lucaninae) from China and new data of *Lucanus hewenjiae* Huang & Chen, 2013

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**Abstract:** The type genus of Lucanidae, *Lucanus* Scopoli, 1763, exhibits a high diversity in China, currently comprising 60 Chinese species. Here we describe a new species of *Lucanus* from Sichuan, China: *Lucanus wangyifani* sp. nov. We also first record *Lucanus hewenjiae* Huang & Chen, 2013 from Hunan Province, and discuss the difference between the specimens from Hunan and Guangxi. The variation of *L. wangyifani* sp. nov. and *L. hewenjiae* are illustrated.

**Keywords:** new provincial record, new taxon, Sichuan Province, taxonomy

## ● 中国深山锹属一新种记述及何氏深山锹之新数据（鞘翅目：锹甲科：锹甲亚科）

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**摘要:** 深山锹属 *Lucanus* Scopoli, 1763 在中国具有高度多样性, 目前共纪录 60 种。本文描述了采自中国四川的深山锹属一新种: 王氏深山锹 *Lucanus wangyifani* sp. nov.。同时本文首次纪录何氏深山锹 *Lucanus hewenjiae* Huang & Chen, 2013 在湖南省的分布及讨论该种湖南与广西标本的差异, 并提供王氏深山锹与何氏深山锹的形态特征图示。

**关键词:** 省级新纪录, 新分类单元, 四川省, 分类学

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## ● Introduction

*Lucanus* Scopoli, 1763, the type genus of Lucanidae, is a widely distributed genus from Eurasia and North America. China harbors the highest diversity of this genus, with 60 species (Huang & Chen 2010, 2013, 2017; Zhan & Young 2023). These species are divided into seven species groups based on morphological characters (Zhan & Young 2023), i.e., *L. fortunei* species group, *L. brivioi* species group, *L. kraatzi* species group, *L. parryi* species group, *L. laminifer* species group, *L. maculifemoratus* species group and *L. lunifer* species group.

*Lucanus hewenjiae* Huang & Chen, 2013 is a special species with multiform mandible shape. This species is characterized by the evenly curved mandible, the longer lower apical fork branches, the shorter major tooth of mandible and the slender aedeagus. Huang & Chen (2013) first described this species based on eight specimens from Mt. Maoer, Guangxi. Zhan & Young (2023) provides a detailed description of this species. To date, *L. hewenjiae* is known only from its type locality, Mt. Maoer.

Here we describe a new species of *Lucanus* from Sichuan, China, i.e. *Lucanus wangyifani* **sp. nov.** In addition, we first record *Lucanus hewenjiae* from Mt. Tianmen, Zhangjiajie, Hunan. Some differences between the population from Mt. Tianmen and Mt. Maoer are discussed.

## ● Material and methods

Habitus photos were taken using a Canon® 5D Mark III with EF 100 mm f/2.8 macro lens. Two Godox V850II flashes as light source. Genitalia were prepared by clearing the apex of the abdomen with 15% KOH at 135°C for 5 min. After rinsing the KOH with distilled water, the apex of the abdomen was transferred to glycerin for further examination. The photographs of male genitalia were taken using a Canon® 5D Mark III with MP-E 65mm f/2.8 1-5X Macro Lens. Two Godox V850II flashes as light source. Zerene Stacker was used for image stacking. All images were modified and grouped into plates in Adobe Photoshop 2023.

Specimens examined in this study are deposited in the following collections: **CSTJ**—Private Collection of Sheng-Tong Jin, Nanjing; **CZCL**—Private Collection of Ze-Chuan Li, Beijing; **CYTL**—Private Collection of Yi-Teng Li, Wuhan; **CQLN**—Private Collection of Qian Li, Nanjing; **CYZH**—Private Collection of Yu-Zhou Huang, Changsha; **CYFW**—Private Collection of Yi-Fan Wang, Suzhou; **CZHZ**—Private Collection of Zhi-Hong Zhan, Nanjing; **CKXJ**—Private collection of Kai-Xiang Jing, Chengdu; **CMLL**—Private collection of Mo-Lin Lu, Taizhou; **NJAU**—Entomological Museum, Nanjing Agricultural University (Meng Wang).

## ● Taxonomy

### Family Lucanidae Latreille, 1804

### Subfamily Lucaninae Latreille, 1804

### Genus *Lucanus* Scopoli, 1763

#### *Lucanus wangyifani* sp. nov. 王氏深山锹

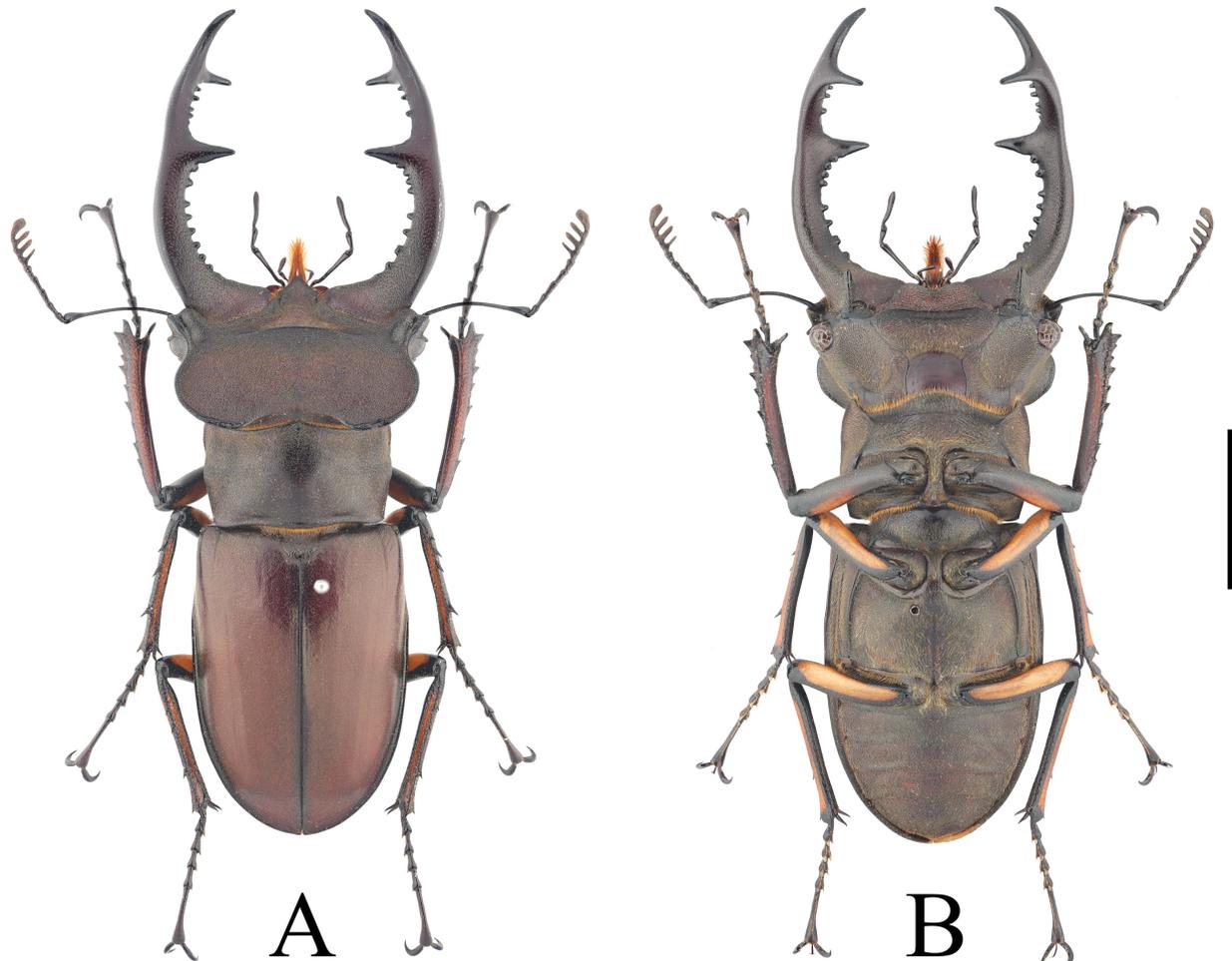
<https://zoobank.org/136CC82A-DCB5-4C18-996C-0E4A24B3F3AB>

Figs 1–6

**Type material. Holotype:** ♂, **CHINA: Sichuan**, Guang'an, Mt. Huaying [华莹山], 1300–1600 m, 1–4.VII.2025, leg. Yifan Wang, Molin Lu, Yiteng Li & Kaixiang Jing (NJAU). **Paratypes:** 27♂4♀, same as holotype (CYFW); 25♂5♀, same as holotype (CYTL); 26♂4♀, same as holotype (CMLL); 11♂4♀, same as holotype (CKXJ); 4♂2♀, same as holotype (CZCL); 5♂4♀, same as holotype (CZHZ); 4♂1♀, same as holotype (CYZH).

**Diagnosis. Male.** Head and pronotum reddish to dark brown, covered with dense pubescence; elytra reddish brown. Mandible basal 1/3 incurved, distal part relatively straight; upper branches of apical fork nearly two times length of lower apical fork branches, major teeth long, triangular and pointing inside. Protibiae with serrated teeth

at outer margin, apex of protibiae forming two sharp and strong teeth, the apical one towards anteriorly. Penis slender. Flagellum short. **Female.** Body dark, covered with dense pubescence. Canthus extended laterad, posterior angle protruded. Pronotum widest at anterior angle, anterior angle round. Hemisternite rounded distally expanded into round plate shape. Spermatheca J-shaped, well sclerotized. Spermathecal duct short, about three times length of spermathecal.

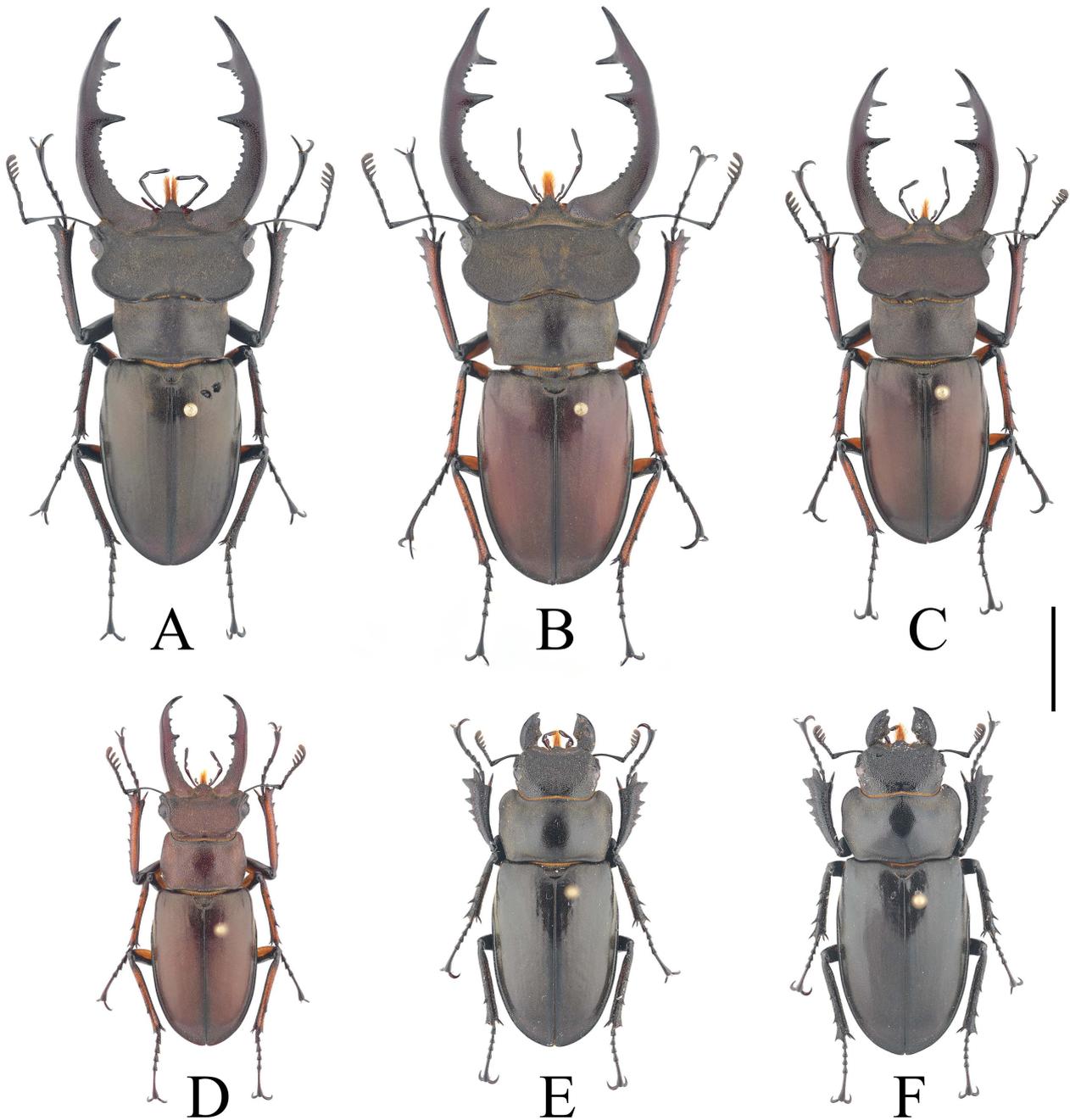


**FIGURE 1.** Habitus of holotype of *Lucanus wangyifani* sp. nov.: **A** dorsal view **B** ventral view. Scale bar = 10 mm.

**Description. Male (Figs 1, 2A–C, 6A).** Body length 35–58 mm. Head and pronotum reddish to dark brown, covered with dense pubescence; elytra reddish brown.

Head (Figs 3M, N, R) transverse, anterior ridge raised, lateral ridge narrowed at the front 1/3 and posterior part strongly extended. Canthus distinct, dividing more than 1/3 of eye, posterior angle protruded. Clypeolabrum triangular, distally rounded, covered with dense yellow pubescence. Mandible of large size male strong, basal 1/3 incurved, distal part relatively straight; apical fork strongly developed, widely open, upper branches of apical fork nearly two times length of lower apical fork branches; major teeth long, triangular and pointing inside; numerous small teeth present on inner margin of mandible. Mandible of small size male slender and straight, basal 1/3 incurved; apical fork weakly developed, upper branches of apical fork more than two times length of lower apical fork branches; major teeth short, triangular and pointing inside; few small teeth present on inner margin of mandible. Antennae geniculate, distally with four antennal club.

Pronotum transverse, narrower than head, about 1.8 times as wide as long, widest at the middle. Lateral angles triangular, strongly extend ventrad.



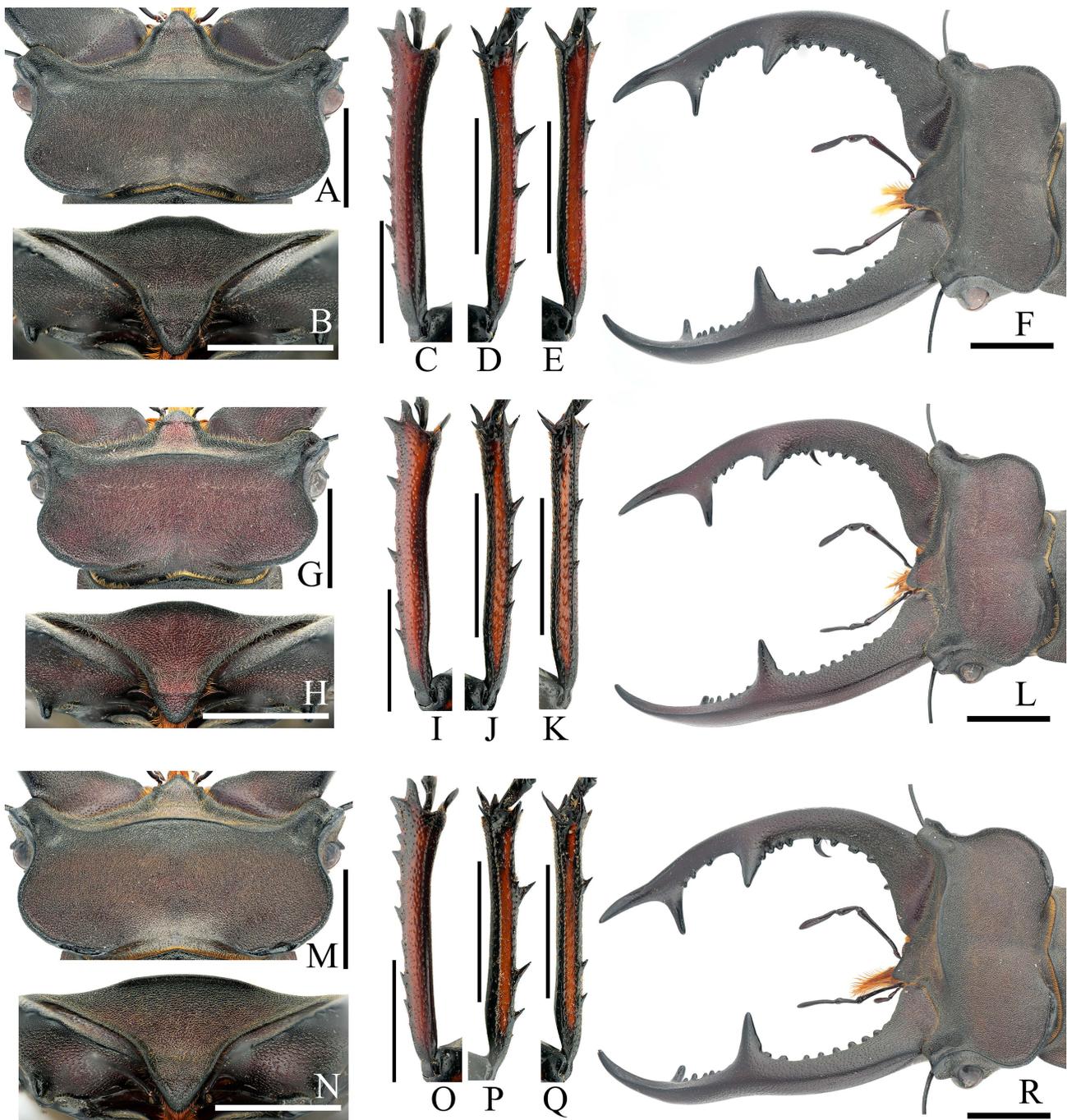
**FIGURE 2.** Dorsal view of habitus of *Lucanus wangyifani* sp. nov.: **A** black male individual **B** large size male **C** medium size male **D** small size male **E**, **F** females. Scale bar = 10 mm.

Legs (Figs 3O–Q) black with yellow to orange stripes. Protibiae with numerous serrated teeth at outer margin, apex bifurcate, forming two sharp and strong teeth, the apical one towards anteriorly. Apical spur strong, slender and sharp.

Elytra elongate, 1.4 times as long as wide; covered with short dense pubescence.

Abdominal tergite VIII (Fig. 4F) with weakly developed lateral angles, a colorless and hyaline stripe present at the middle, more than half of tergite VIII length. Posterior margin of sternite VIII (Fig. 4G) relatively protrude. Ventral plate of the abdominal segment IX elongated, distally extended and constricted towards the base; a short crack present on apex (Figs 4D, E). Aedeagus almost three times as long as wide. Basal piece basally constricted. Paramere rounded and incurved. Penis slender, shorter and thinner than paramere. Flagellum short, distally

expanded into round plate shape. Struct as two well sclerotized band.



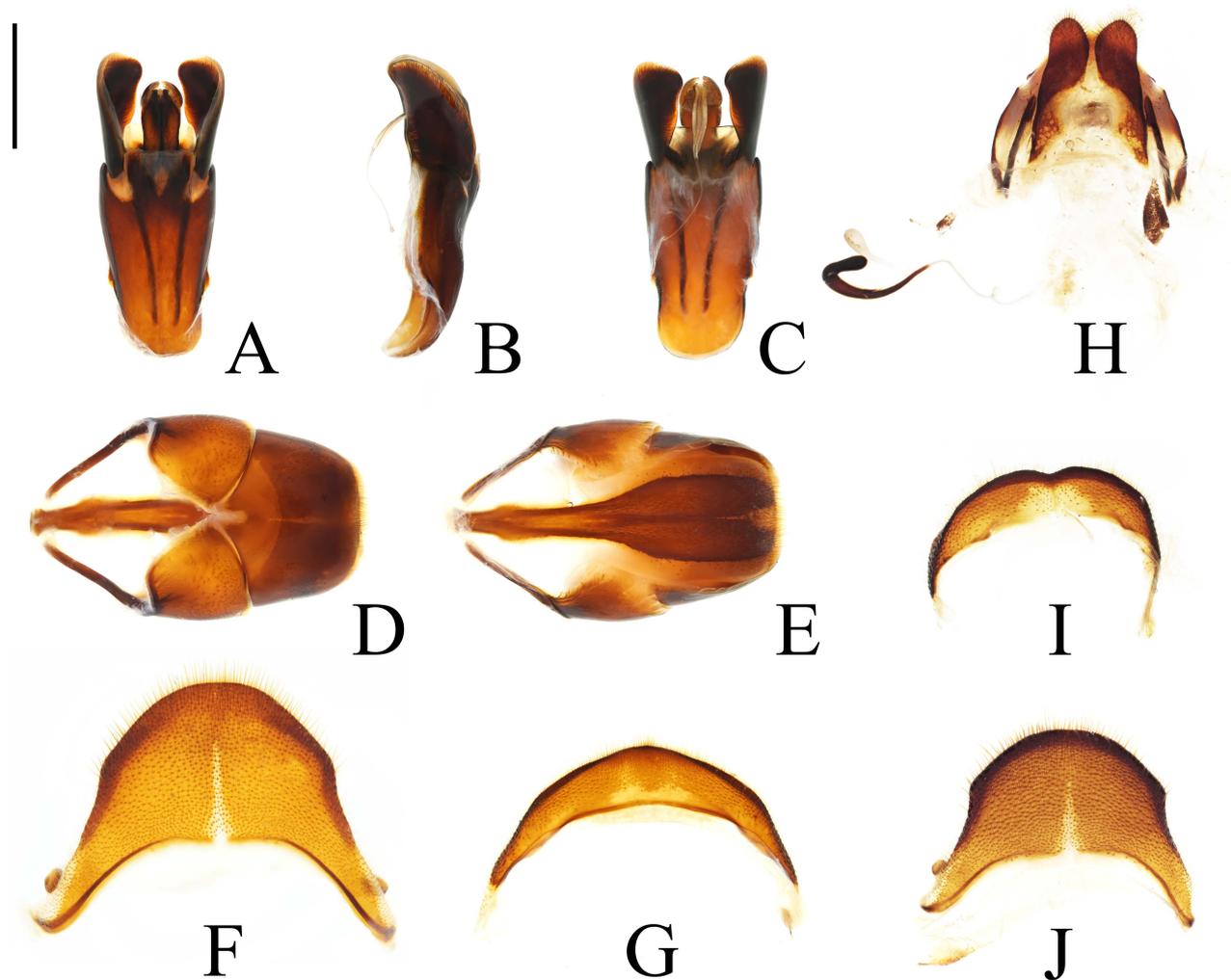
**FIGURE 3.** Diagnostic character of male *Lucanus wangyifani* sp. nov. and *Lucanus hewenjiae* Huang & Chen, 2013: A–F *L. hewenjiae* from Mt. Maoer G–L *L. hewenjiae* from Mt. Tianmen M–R *L. wangyifani* sp. nov. Scale bars = 5 mm.

**Female (Figs 2E, F; 5).** Body length 31–34 mm. Body dark brown, covered with dense pubescence, head covered with numerous large and deep punctures; pronotum and elytra covered with dense punctures.

Head transverse, narrower than pronotum. Canthus well developed, extended laterally, posterior angle protruded. Mandible small, right mandible with broad and flat inner margin, left mandible with two teeth.

Pronotum wide, widest at anterior angle (Fig. 5L). Anterior angle round, constricted toward posterior angle.

Legs black (Figs 5G–I). Protibiae with few triangular teeth at outer margin, apex of protibiae extremely extended and bifurcate, forming tow strong teeth.



**FIGURE 4.** Genitalia structures of *Lucanus wangyifani* sp. nov.: A–C aedeagus D, E male abdominal segment IX F male tergite VIII G male sternite VIII H hemisternite I female sternite VIII J female tergite VIII. A, E ventral view B lateral view C, D, F–J dorsal view. Scale bar = 2 mm.

Elytra elongate, 1.4 times as long as wide.

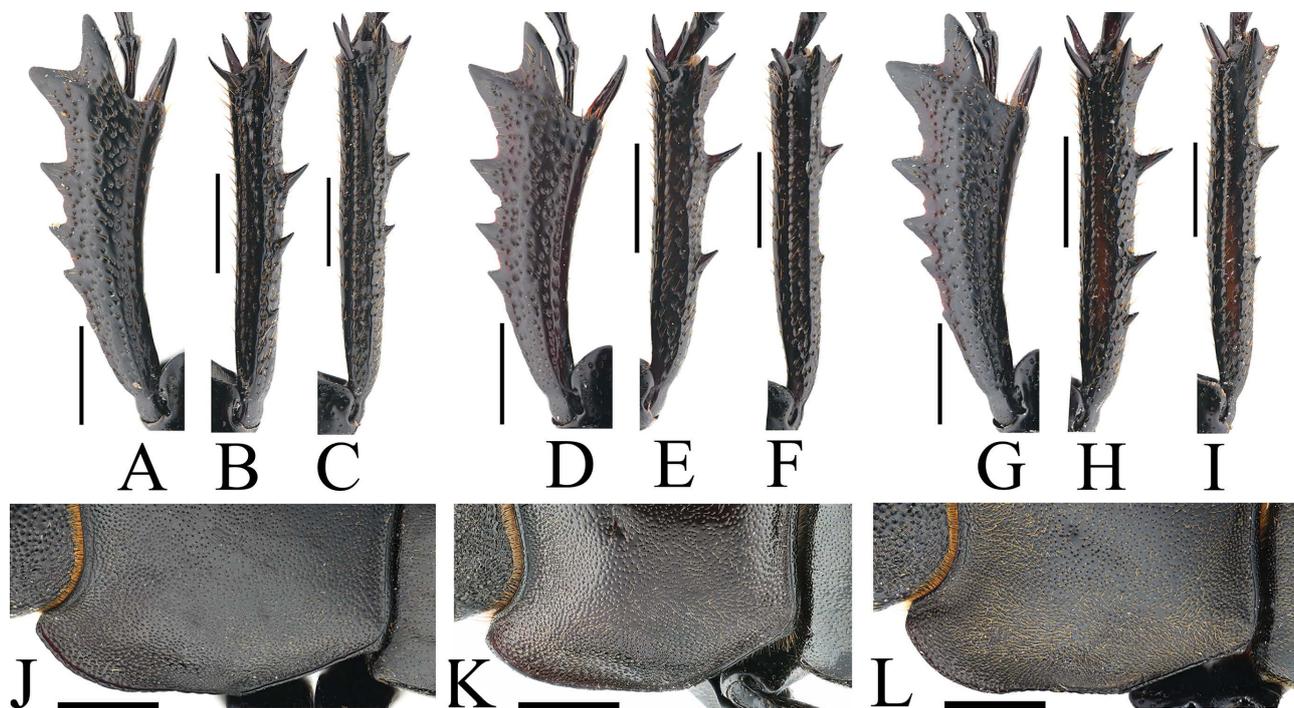
Abdominal tergite VIII with distinct lateral angles, a subtriangular hyaline marking present at middle of posterior margin (Fig. 5J). Posterior margin of sternite VIII concaved medially (Fig. 5I). Apical hemisternite well sclerotized and rounded. Spermatheca J-shaped, well sclerotized. Spermathecal duct short, about three times length of spermathecal (Fig. 5H).

**Distribution.** China (Sichuan).

**Etymology.** This new species is in honor of Mr. Yi-Fan Wang (王一凡), who contributed a lot to the field work in Sichuan.

**Remarks.** This species is very closely related to *Lucanus hewenjiae* in having similar male mandible. However, these two species can be distinguished by the following characters. Male: Major teeth of *L. wangyifani* sp. nov. are longer than those of *L. hewenjiae* (in large size male, the ratio of the width of the head anterior margin to the length of major teeth in average is 4.95 in *L. wangyifani* sp. nov. whares 6.17 in *L. hewenjiae*) (Figs 3F, L, R). The anterior ridge of head in *L. wangyifani* sp. nov. (Fig. 3N) is more broadly raised than in *L. hewenjiae* (Figs 3B, H). Distal part of the flagellum in *L. wangyifani* sp. nov. forms round plate, whares in *L. hewenjiae* it is simply robust. Female: The pubescence covering the body is longer and denser in *L. wangyifani* sp. nov. compared to *L. hewenjiae*. In *L.*

*wangyifani* sp. nov. the pronotum is widest at anterior angle (Fig. 5), while in *L. hewenjiae* is present at lateral angle (Figs 5J, K).



**FIGURE 5.** Diagnostic character of female *Lucanus wangyifani* sp. nov. and *Lucanus hewenjiae* Huang & Chen, 2013: A–C, J *L. hewenjiae* from Mt. Maoer D–F, K *L. hewenjiae* from Mt. Tianmen G–I, L *L. wangyifani* sp. nov. Scale bars = 2 mm.

### *Lucanus hewenjiae* Huang & Chen, 2013 何氏深山锹

*Lucanus hewenjiae* Huang & Chen, 2013: 33; Zhan & Young 2023: 322. **Type locality:** “China, Guangxi Province, Guilin City, Xing’an County, Maoershan Nature Reserve”.

Figs 3, 5, 7–11

**Material examined.** 9♂6♀, CHINA: Hunan, Zhangjiajie, Tianmenshan Town [天门山镇], Mt. Tianmen [天门山], 1400 m, 10–15.VI.2025, leg. Changyu Lü (CSTJ); 3♂2♀, same as previous (CYZH); 1♂, same as previous (CQLN); 1♂, same as previous (CZCL); 2♂2♀, CHINA: Hunan, Zhangjiajie, Tianmenshan Town [天门山镇], Mt. Tianmen [天门山], 1400 m, 05–06.VI.2025, leg. Shengtong Jin (CSTJ); 1♀, CHINA: Hunan, Zhangjiajie, Tianmenshan Town [天门山镇], Mt. Tianmen [天门山], 1400 m, 05–06.VI.2025, leg. Qian Li (CQLN); 1♀, CHINA: Hunan, Zhangjiajie, Tianmenshan Town [天门山镇], Mt. Tianmen [天门山], 1400m, 22.VII.2024, leg. Yiteng Li (CYTL); 1♂1♀, CHINA: Guangxi, Guilin, Xing’an County, Mt. Maoer [猫儿山], 1950 m, 28.VI.2020, leg. Yingbing Li (CYZH); 1♂1♀, CHINA: Guangxi, Guilin, Xing’an County, Mt. Maoer [猫儿山], 1950 m, 21.VI.2023, leg. Yingbing Li (CSTJ).

**Distribution.** China: Guangxi, Hunan (new provincial record).

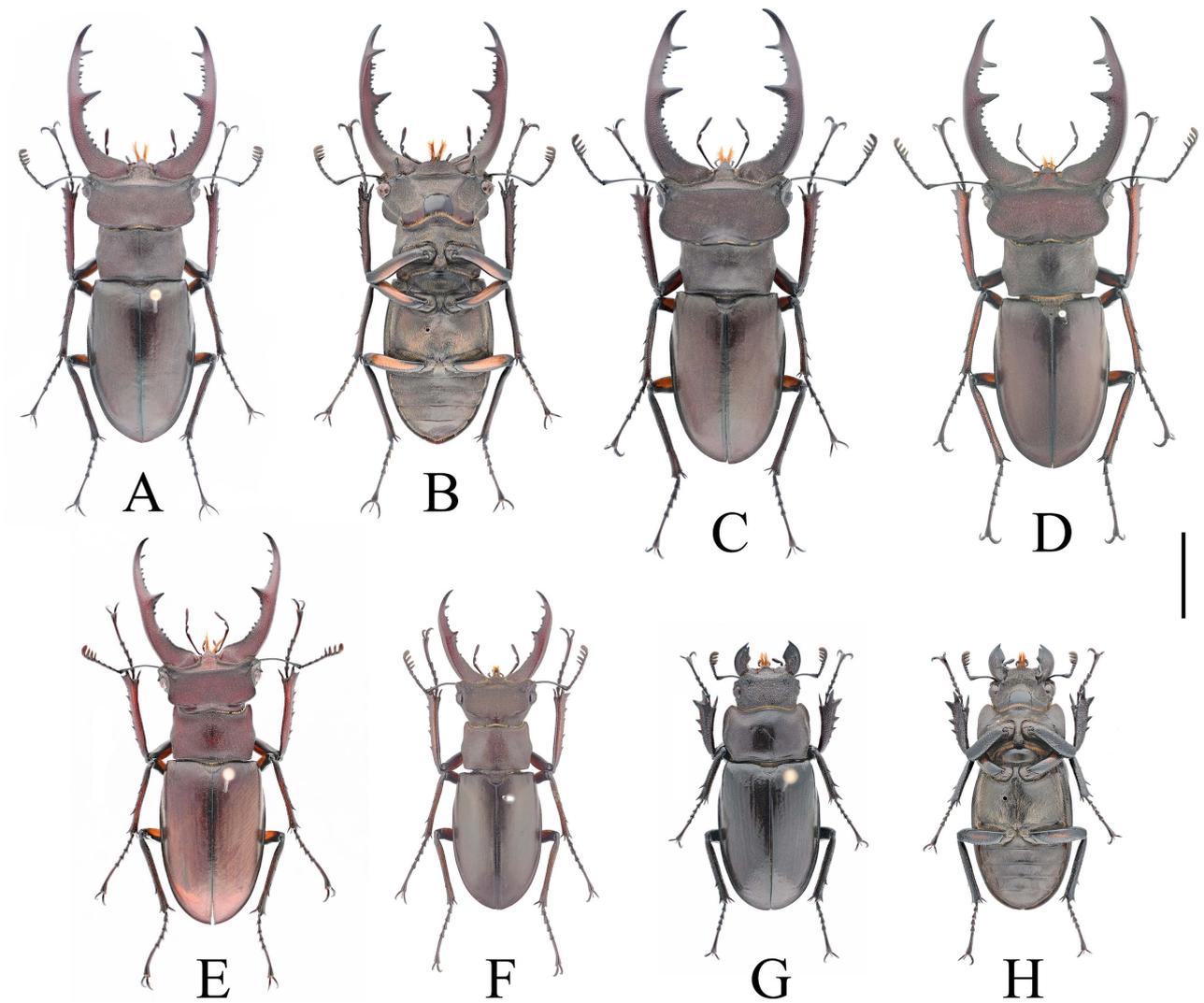
**Biology and ecology.** Adults living on broadleaf trees at the top of the Mt. Tianmen (Fig. 9).

**Remarks.** The specimens of *L. hewenjiae* we examined from Mt. Tianmen, Hunan exhibit great similarity compared to those from Mt. Maoer, Guangxi. The most notable distinction between the population from the two localities is that the population from Mt. Tianmen has a relatively smaller body size, in corresponding forms the population from Mt. Tianmen is about 20% smaller (Figs 7A–F; 10A). These two localities are separated by 500 km, yet such wide distributions are not uncommon in the *Lucanus brivioi* group, i.e., *L. brivioi*, *L. fonti* and *L.*

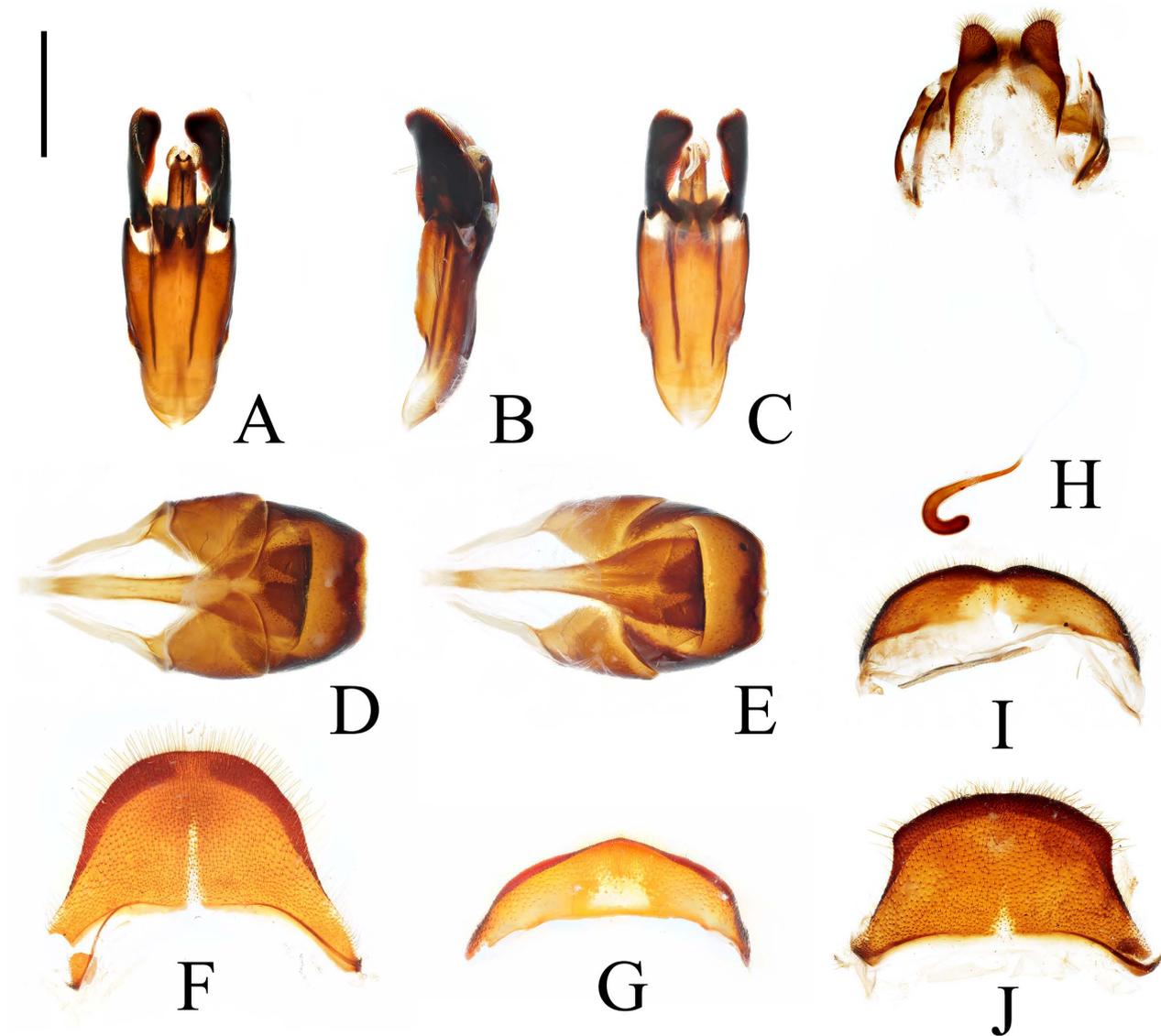
*fairmairei*. Therefore, we consider the specimens from Mt. Tianmen to represent as *L. hewenjiae*.



**FIGURE 6.** Living adult of *Lucanus wangyifani* sp. nov. and habitat: **A** living adult **B** natural habitats.



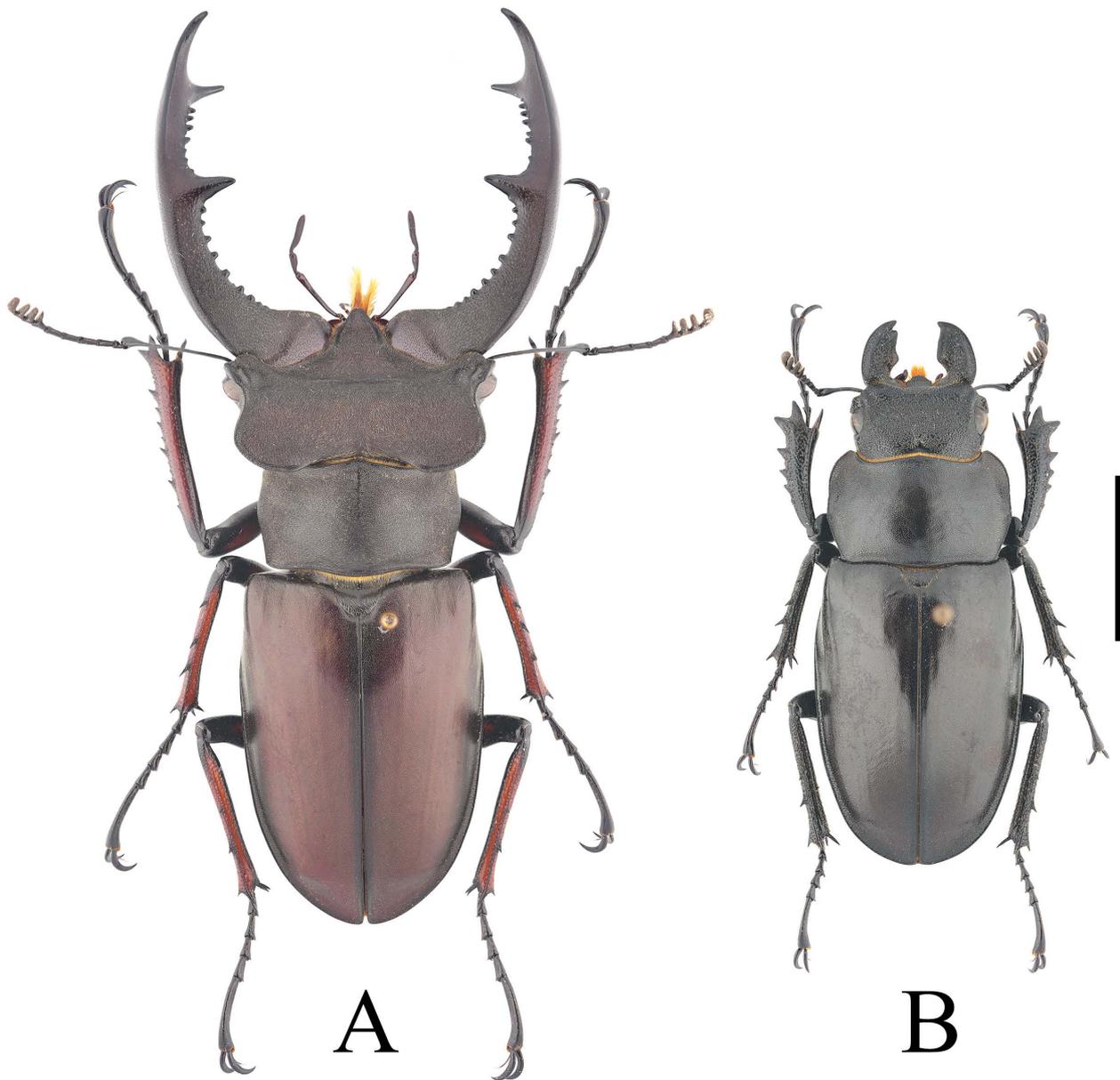
**FIGURE 7.** Habitus of *Lucanus hewenjiaae* Huang & Chen, 2013 from Mt. Tianmen: **A, B** medium size male **C, D** large size male **E, F** small size male **G, H** female. **A, C–G** dorsal view **B, H** ventral view. Scale bar = 10 mm.



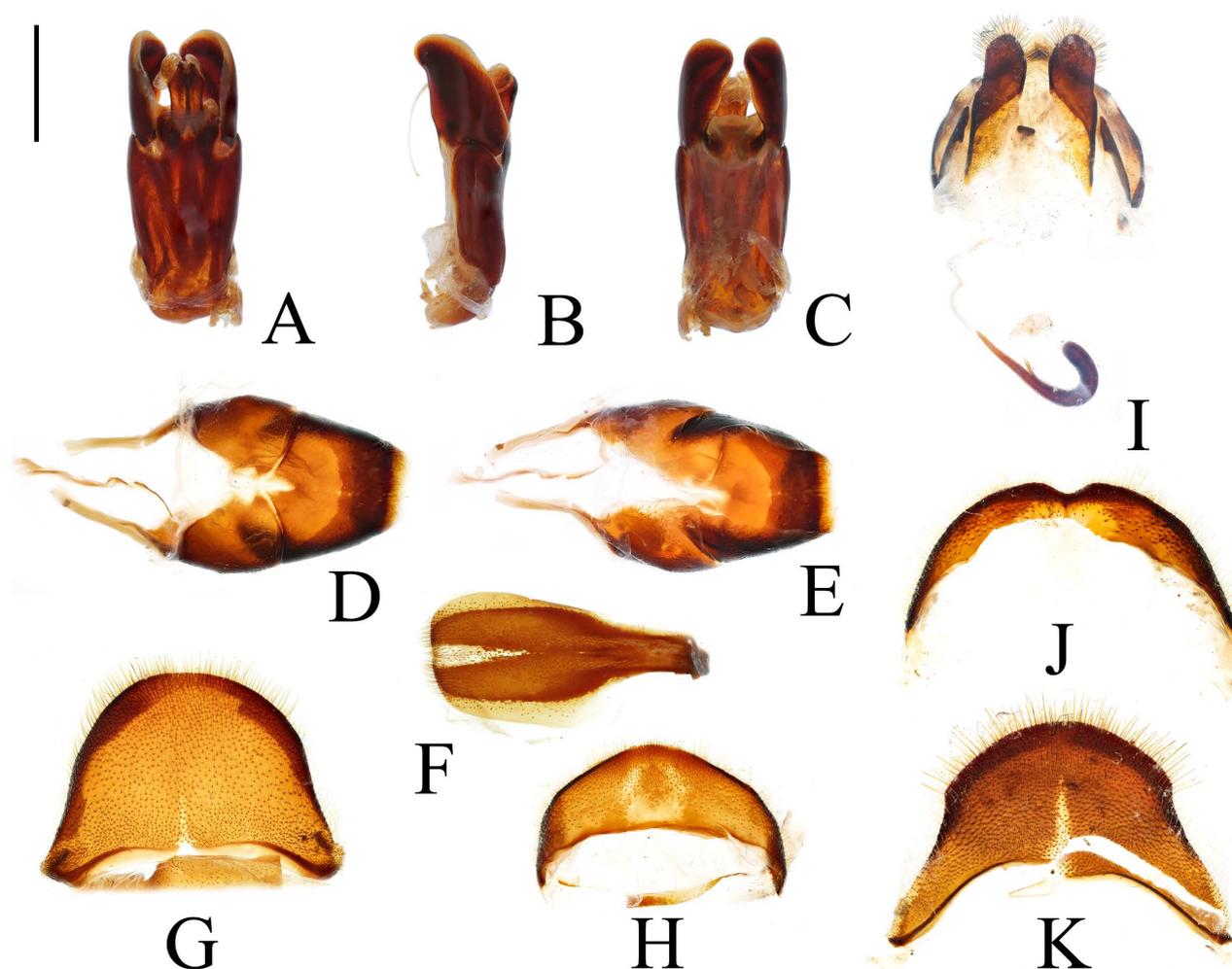
**FIGURE 8.** Genitalia structures of *Lucanus hewenjiaei* Huang & Chen, 2013 from Mt. Tianmen: A–C aedeagus D, E male abdominal segment IX F male tergite VIII G male sternite VIII H hemisternite I female sternite VIII J female tergite VIII. A, E ventral view B lateral view C, D, F–J dorsal view. Scale bar = 2 mm.



**FIGURE 9.** Living adult of *Lucanus hewenjae* Huang & Chen, 2013 from Mt. Tinamen and habitat: **A, B** living adults **C, D** natural habitats.



**FIGURE 10.** Habitus of *Lucanus hewenjiaei* Huang & Chen, 2013 from Mt. Maoer: **A** male, dorsal view **B** female, dorsal view. Scale bar = 10 mm.



**FIGURE 11.** Genitalia structures of *Lucanus hewenjiae* Huang & Chen, 2013 from Mt. Maoer: **A–C** aedeagus **D, E** dorsal plate of male abdominal segment IX **F** ventral plate of male abdominal segment IX **G** male tergite VIII **H** male sternite VIII **I** hemisternite **J** female sternite VIII **K** female tergite VIII. **A, E** ventral view **B** lateral view **C, D, F–K** dorsal view. Scale bar = 2 mm.

## ● Discussion

Identifying *L. hewenjiae* from its congeners is a substantial challenge. Huang & Chen (2013) provided a brief diagnosis for *L. hewenjiae* but did not offer a specific taxonomic description of its holotype, until Zhan & Young (2023) first provided comprehensive description of this species. Furthermore, Huang & Chen (2013) designated an incomplete specimen as holotype, which lacks the distal half of left mandible and lower apical fork branch of right mandible. Consequently, the holotype cannot fully represent characters of *L. hewenjiae*, due to the absence of the lower apical fork. For the high degree of individual variation, it's difficult to find diagnostic characters fit all specimens. In this study, we compared multiple specimens of *L. hewenjiae* and *L. wangyifani* **sp. nov.**, and determined following reliable diagnostic characters: the length of male major teeth and the density of pubescence. In contrast, the shape of male mandible and the small teeth on inner margin of mandible is varied.

This new species is highly attracted to light and exhibits a great flying ability. Notably, multiple individuals were consistently observed flying toward the light traps in windy weather conditions. Our previous fieldwork also revealed that *L. hewenjiae* also remains highly active in windy and foggy weather, whereas most other *Lucanus* species are unable to fly toward light traps under such conditions. Huang & Chen (2020) described *L. cenwangaoshanus*, which is closely related to *L. hewenjiae* and *L. wangyifani* **sp. nov.** Nevertheless, they didn't

provide the altitude data of type specimens. During our fieldwork in Mt. Cenwanglao, we noticed that *L. cenwanglaoshanus* appeared at altitude above 1800 m, and shown a weak flying ability. Most individuals of *L. cenwanglaoshanus* can only arrive the light traps that placed in forest, while only few individuals arrived those away from forest. Although *L. parryi* and *L. wangiifani* **sp. nov.** are sympatric in Mt. Huaying, the former was observed in significantly lower numbers compared to this new species during the recent fieldwork. This disparity suggests that *L. wangiifani* **sp. nov.** may hold a dominant ecological position within this localized habitat.

## ● Acknowledgements

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## ● Additional information

**Author contributions:** Conceptualization: Y-T Li & Y-Z Huang. Project administration: Y-Z Huang. Resources: Y-T Li & S-T Jin. Supervision: Y-Z Huang. Visualization: Y-Z Huang. Writing—original draft: Y-T Li & Y-Z Huang. Writing—review and editing: Y-Z Huang & Y-T Li.

**Conflict of interest:** The authors have declared that no competing interests exist.

**Data availability:** All of the data that support the findings of this study are available in the main text.

**Ethical statement:** No ethical statement was reported.

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