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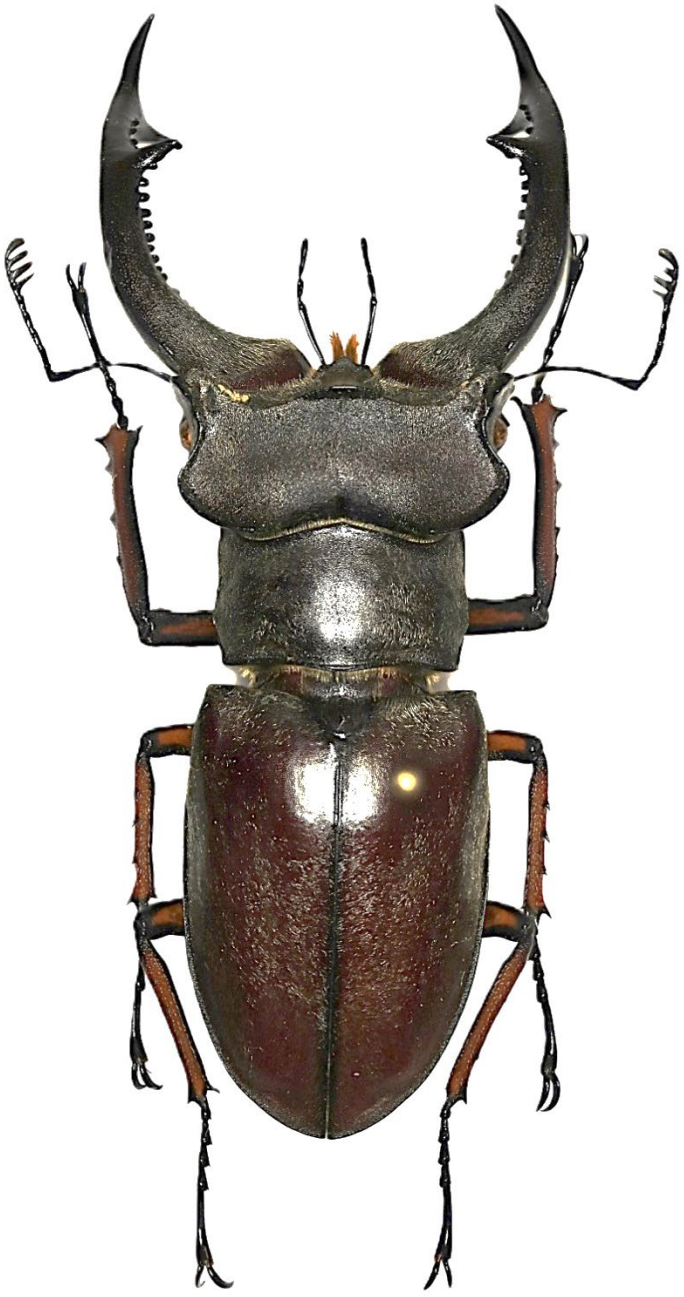

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Is an occasional published journal devoted to taxonomy and to biodiversity of *Coleoptera*. We offer cooperation on the new description for every taxonomist from all parts of the world. Any descriptions and taxonomical act should be in accordance with the criteria defined by ICZN. Articles must be in English or in another mainly spoken language in science with English abstract.

Contents

Cover
♂ of ***Lucanus puchneri*** from Laos

Contribution to the knowledge of the *Lucanus* from Laos with description of *Lucanus puchneri* (*Coleoptera, Lucanidae*)

Klaus-Dirk Schenk

Abstract

The new species *Lucanus puchneri* is described and figured. The relationship to known taxa is discussed. A specimen of the recently described *L. collardi* is figured.

Key words

Coleoptera, Lucanidae, *Lucanus puchneri, Lucanus collardi,* Laos, Vietnam

Introduction

The Genus *Lucanus* Scopoli, 1763 is well represented in Laos. Most of the *Lucanus* living in Laos are also found in Vietnam. So far, the following taxa have been recorded for Laos: *L. angusticornis angusticornis* Didier, 1925; *L. formosus formosus* Didier, 1925; *L. fujitai* Katsura et Giang, 2002; *L. marazziorum* Zilioli, 2012; *L. satoi* Nagai et Tsukamoto, 2003; *L. sericeus ohbayashii* Nagai, 2003; *L. tsukamotoi* Nagai, 2002; *L. vitalisi* Pouillaude, 1913 and recently *L. collardi* Sato et all., 2024. Now some interesting *Lucanus*-specimens have been collected during a scientific project undertaken in Laos and supported by Mr. Alfred Puchner from Austria. Mr. Puchner handed over to the author many of the Lucanidae for determination. The author could determine several specimens of *L. angusticornis angusticornis*, *L. sericeus ohbayashii*, *L. tsukamotoi*, a single male of the recently described *L. collardi* and a new species described herein as *Lucanus puchneri*.

Lucanus collardi Sato et all., 2024

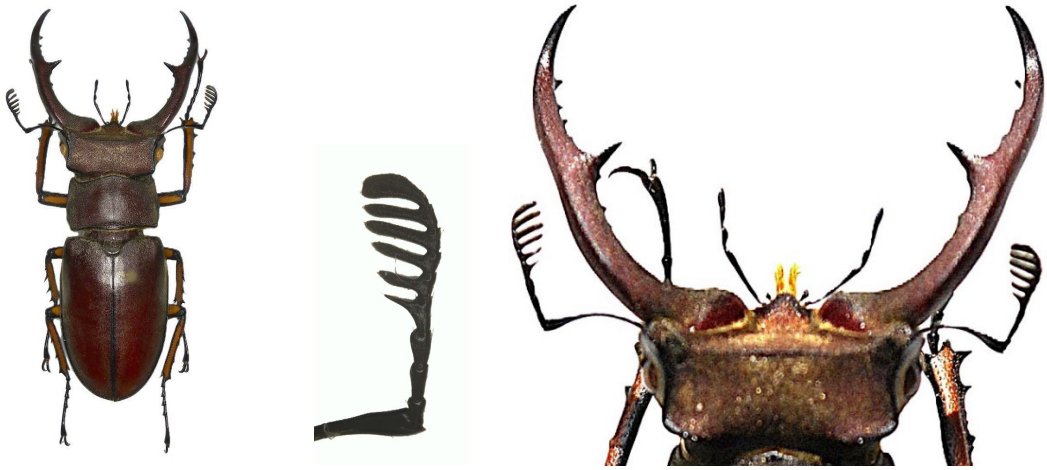

Fig. 1: ***Lucanus collardi*** ♂ 40,1 mm, Laos, Xiang Khouang, Phou Sam Soum, 2150m, 28.VII.2018, Petrànyi leg., dorsal view, right antenna enlarged, head enlarged

L. collardi was recently descibed by Sato et all. (2024) from Vietnam, Nhe An Province, Ki Son (3 ♂♂, 1 ♀) and Laos, Xieng Khouang Province, Phu Sam Soum (1 ♂). Fig. 1 shows a ♂ specimen identified by the author as *L. collardi* collected in 2018 at the type location in Laos (Laos, Xiang Khouang, Phou Sam Soum, 2150m, 28.VII.2018, Petrànyi leg.). The figured specimen is 40,1 mm long and represents a smaller ♂ of *L. collardi*.

Lucanus puchneri spec. nov.

Holotype. ♂, Laos, Xiangkhouang Province, 10 km N.E. of Phonsavan, Kong Keo, 1122 m, N 19°30`0´´, E 103°17`24´´, 7.IV.2019, G. Petranyi leg., in coll. K.-D. Schenk, Wehretal, Germany.

Paratypes. 1 ♂ and 1 ♀ same collecting data, in coll. K.-D. Schenk, Wehretal, Germany. 2 ♂ and 7 ♀ same collecting data in coll. A. Puchner, Oberdanegg, Austria, 3 ♂, Laos, Xiangkhouang Province, Phou Samsoum, 2150 m, N 19°8`50``, E 103°47`56``, 28.VII.2018, G. Petranyi leg., in coll. A. Puchner, Oberdanegg, Austria.

Etymology. The name is dedicated to the ambitious entomologist Alfred Puchner, who kindly provided the specimens for description.

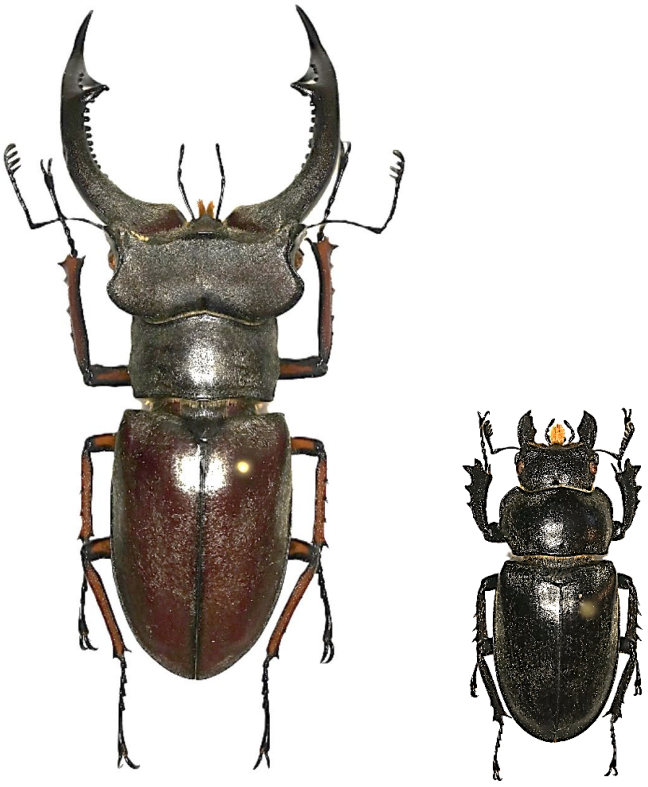

Fig. 2: ***Lucanus puchneri*** ♂ 65,6 mm, Laos, Xiang Khouang Province, 10 km N.E. of Phonsavan, 1122m, IV. 2019, Petrányi leg., ♀ 35,7 mm, same collecting data

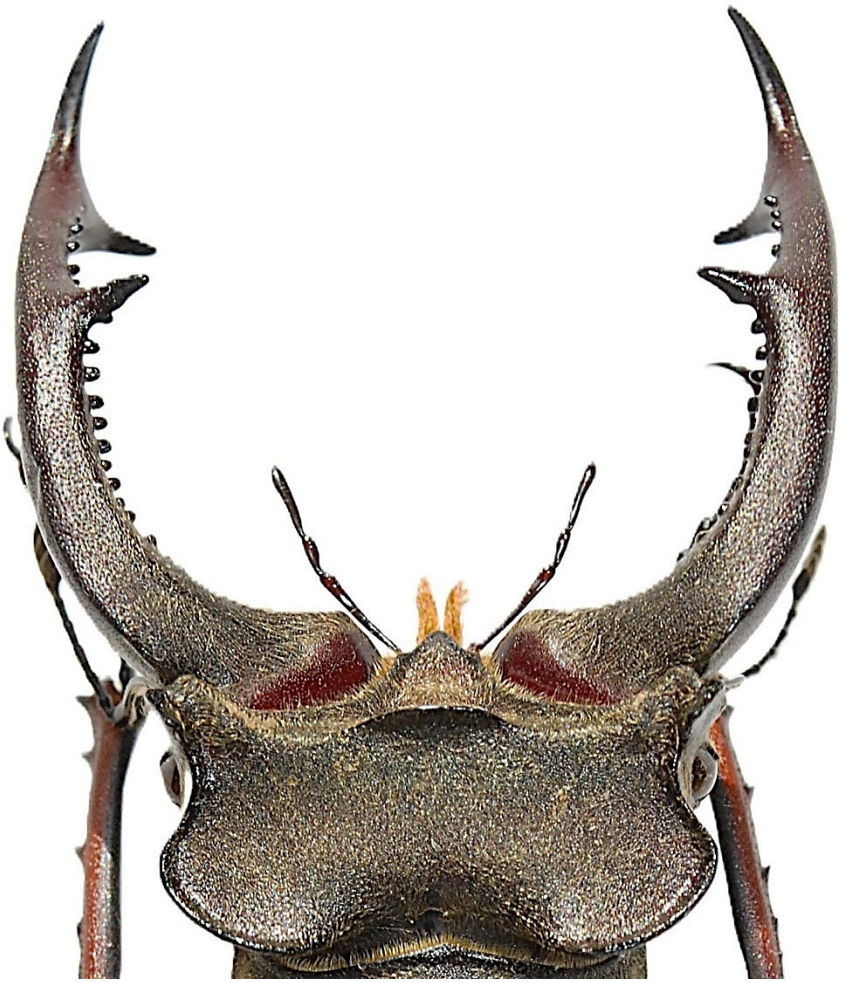

Fig. 3: ***Lucanus puchneri*** spec. nov., ♂ head enlarged

Description and diagnosis

Holotype (Fig. 2 and 3), ♂, total length 65,6 mm, mandibles length 21,8 mm, prothorax width 14,5 mm, elytra length 25,4 mm, elytra width 17,4 mm.

Head, mandibles, prothorax and elytra dark brown, surface of head prothorax and elytra covered with a whitish vestiture. The femora and tibiae are orange brown fringed by black. The Mandibles long, regularly incurved; major inner mandibular tooth located in front of the middle, pointing slightly forward and upward. There are 11 small inner mandibular teeth between the major inner mandibular tooth and the basis at the left mandible and 9 teeth at the right mandible; 4 small inner mandibular teeth are located between the major mandibular tooth and the apical forks. The apical mandibular forks are strongly developed and widely opened anteriorly; the upper branches of apical forks are longer than the lower branches which are directed downward. The carina of the anterior margin of the head is well developed.

Posterolateral margin of head angulated, less wide than anterolateral ridges; the clypeolabrum is acute protruding. The antennal clubs have 4 lamellae. Lateral margines of pronotum are nearly parallel, somewhat protruding at median angle. Elytra slender, widest at about the middle.

Anterior femora orange fringed by blackish brown, anterior tibia orange brown. Middle femora and tibia and hind femora and tibia orange brown fringed by blackish brown. Anterior tibia with 4 well-developed spines, metatibia with 3 long spines and hind tibia with 3 very short spines. Mentum trapezoidal, bare. Downside and sternite with long whitish hairs.

Size of ♂ paratypes: 55,9 mm – 66,1 mm

♀ paratype (allotype) (Fig. 2). The female was collected together with the holotype and represents most likely the female of *L. puchneri* spec. nov..

Total length 35,7 mm, mandibles length 3,8 mm, prothorax width 12,4 mm, elytra length 19,9 mm, elytra width 13,5 mm. Upside and downside blackish brown covered with short whitish tegument same as the ♂. Head and mandibles strongly punctured; canthi parallel. Mandibles short, evenly bend inside. Inner margines with broad and flat ridges, left mandible with a gap behind apex. Prothorax more minutely punctured, with well-defined median and hind angles. Elytra densely and very finely punctured. Anterior tibiae with 2 teeth behind anterior fork, middle tibia with 3 spines and hind tibia with only one small spine.

Lucanus puchneri spec. nov. is close to *L. nobilis* Didier, 1925, *Lucanus jeanvoinei* Didier, 1927 and *Lucanus speciosus* Didier, 1925. *L. jeanvoinei* was described after two big males collected near Chapa, Tonkin (now Vietnam, Sapa) and *L. speciosus* after a single pair in the same publication together with *L. nobilis* Didier, 1925. Despite the Lucanus-fauna of the Sapa region has been investigated very intensively in the past years no further record of *L. jeanvoinei* or *L. speciosus* have been published in the entomological literature. Therefor some entomologists are regarding *L. jeanvoinei* and *L. speciosus* as synonyms of *L. nobilis*. The possible relationship between *L. nobilis, L. speciosus* and *L. jeanvoinei* was discussed extensively by Huang et Chen (2010, pp 86-88).

The author has compared *L. puchneri* spec. nov. with 26 ♂♂ and 2 ♀♀ of *L. nobilis* from northern Vietnam (Lao Cai Province, Sapa region and Yen Bai Province Mu Cang Chai) and 6 ♂♂ and 2 ♀♀ from China (southern Yunnan, Jinping County) as well with the figures of the type-specimens of *L. speciosus* and *L. jeanvoinei* published by Araya (2001).

L. puchneri spec. nov. can be separated from *L. nobilis*, *L. jeanvoinei* and *L. speciosus* by the following external morphological characters:

- Body slenderer and more densely covered by a vestiture of whitish hairs.
- Mandibles with 9-11 small inner mandibular teeth between the major inner mandibular tooth and the basis.
- Mandibular fork more widely opened and lower branch of fork directed more downward.
- Hind lobes of the head more rounded and more raised up.
- Femora and tibiae orange brown fringed by black
  (*L. nobilis* and *L. jeanvoinei* legs black).

It is likely that *L. puchneri* spec. nov. is represented in the close by Ngeh An Province of Vietnam also.

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Revisional notes and new descriptions of stag beetles from China 2 (Coleoptera: Lucanidae)

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Abstract

The recent research on the genus *Neolucanus* Thomson, 1862 is briefly reviewed. Some *Neolucanus* species are discussed, including the just described *N. yemaoi* Wang & He, 2024. Two new species of *Neolucanus* are described: *N. zhilini* **sp. nov.** from Cenwanglaoshan, Guangxi; and *N. liuzhei* **sp. nov.** from Wuzhishan, Hainan. *Dorcus wuchaoi* **sp. nov.** is described from Dulongjiang, northwest Yunnan. The female of *Dorcus nosei* Nagai, 2000 is reported for the first time. A new subspecies of *Lucanus fanjingshanus* Huang & Chen, 2010 is described from Houhe, Hubei, namely *Lucanus fanjingshanus wangpingi* **ssp. nov.** The identity of *Lucanus furcifer* Arrow, 1950 is clarified in accordance with the International Code of Zoological Nomenclature. The status of *Lucanus liuyei* Huang & Chen, 2010 is discussed; it is concluded that the relationship between *L. liuyei* and *L. wuyishanensis* Schenk, 1999 is uncertain and requires further research on more nuclear markers in the future.

Keywords

Neolucanus, Dorcus, *Lucanus, liuyei, furcifer, fanjingshanus,* new species, new subspecies, China

Introduction

This year, five new species of Lucanidae have been described from China (Wang & He, 2024a, 2024b & 2024c; Qi et al., 2024; Lin et al., 2024). Additionally, we have discovered four more new taxa in China, which are described herein.

Material and methods

In this paper, the length of the body (LB) is measured from the apex of the mandible to the end of the elytra. Terminology of hindwing follows Kukalova-Peck & Lawrence (1993). The specimens utilized in this work are deposited in the following public and private collections:
SHNU - Department of Biology, Shanghai Normal University, China
CCCC - The private collection of Chang-Chin Chen, Tianjin, China

For DNA analysis of *Neolucanus*, the primer sets employed to amplify one mitochondrial gene, COI, and two nuclear genes, 28S rDNA and wingless, are presented below, following Tsai et al. (2014).

COI	Cl-Neo-F (AACATTATACTTCCTRCTAGGTA) Cl-Neo-R (AAGAAGGTAGTGTTTAGATTTCG)	612 bp
28S	28Se (TCCGTAACTTCGGAACAAGGATT) 28Sf (TGTACCGCCCCAGTCAAACT)	836 bp
Wingless	Wg-Neo-1F (CAAGACATGCTGGATGAGRCTT) Wg2a1 (TGCGCAACACCAGTGGAATGTGCAATT)	472 bp

Sequence matrices were aligned by Cluster W and edited manually using MEGA 11. Genetic distances were also calculated in MEGA 11 by Kimura-2-parameter models (K2P). Construction of the phylogenetic tree was performed by Maximum likelihood (ML) method using IQ-TREE as implemented in the web online server. In addition to the 11 *Neolucanus* species sequenced (Accession numbers: PQ662791-662804), *Neolucanus* species from Taiwan with their COI genes obtained from NCBI GenBank were also included in the molecular analysis.

Taxonomic accounts

***Neolucanus* Thomson, 1862**

In addition to the earlier genus catalogue made by Benesh (1960), Maes (1995-2024) and Krajcik (2001 & 2003) published their catalogs. A brief overview of the recent taxonomic studies on the genus after 1994 is as follows. Fujita (2010) illustrated most species of *Neolucanus* in his beautiful book and described several species new to science. Wan et al. (2007) and Zhang et al. (2016) discussed a few Chinese species of this genus. Schenk (2003 - 2021) described a number of new taxa. He (Schenk, 2014b) published an annotated checklist of the genus and provided some taxonomic changes. The remaining studies were carried out by Bomans & Miyashita (1997), Araya (2000), Nagai (2000, 2001a, 2001b), Baba (1995, 2002), Okuda (2009), Tsukawaki (2011), Nguyen (2013), Nguyen & Schenk (2013), Lin & Chou (2021), Lin (2022) and Wang & He (2024).

Genitalia. The genitalia morphology has been demonstrated to be useful for separating species in most genera of Lucanidae, with the exception of *Neolucanus* and a few others. This genus is an extremely difficult group in taxonomy as the external features and genitalia morphology show very little variation among species but have considerable individual and geographical variations. Studying this genus takes much more time than expected, and we still haven't reached a final conclusion. However, the following observations are worthy of note.

Male genitalia:

1. The last abdominal tergite in males (wide or normal; evenly curved or a little angled at the lateral sides) is sometimes useful for separating some species.
2. The length and width of the permanently everted internal sac seem useless in taxonomy as these characters have considerable individual or geographical variations.
3. The lateral pleurites of the 9th abdominal segment (separated by membrane or central plate) seem useful for separating some species.
4. The caudal medial lobe on the ventral surface of the basal piece is individually variable in length and width, but the shape of the pigmented part (bifurcated or not) seems useful.
5. The medial non-pigmented part on the ventral surface of the median lobe (longer or shorter) seems useful.
6. The medial pigmented part and the lateral apical pigmented part of the median lobe (fused or well separated) seem useful.

Female genitalia:

7. The supra anal projection (plain, slightly protruding or strongly protruding) seems useful.
8. The length of the bursa copulatrix appears to be useful only when a sufficient number of specimens are examined.

Other morphological characters. Generally, the following characters are widely utilized in *Neolucanus* as well as in other genera: details of mandibles; canthus; postocular margin; shape of pronotum; details of protibia. Here, we introduce some important characters that might be overlooked by researchers.

1. Mentum of male: densely pubescent or sparsely pubescent. Based on this character, Schenk's (2014) suggestion that *N. curvidens* Lacroix, 1878 is a synonym of *N. pseudopacus intermedius* Houlbert, 1914 is incorrect. It should be noted that the pubescence on the mentum can be worn off in some individuals. Therefore, a large number of specimens need to be examined when using this character.

2. Ligula of labium: wide or narrow; long or short. This character appears useful for separating some externally similar-looking sympatric species from some close localities. However, its importance in taxonomy requires further investigation. It appears that ligula exhibits geographical variations for some species.
3. Hindwing: slightly pigmented, strongly pigmented or partly pigmented; details of venation. These characters seem useful in dividing groups or distinguishing some similar-looking sympatric species.

Molecular data. It seems that there is no alternative but to use molecular sequences as a tool to clarify the classification of *Neolucanus* in the near future. Tsai et al. (2014 & 2021) were the first to conduct molecular research on *Neolucanus* species from Taiwan, using two mitochondrial markers (COI + 16S rDNA) and two nuclear markers (28S rDNA + wingless). However, when no obvious gap is found among the clades on the phylogeny tree, there is still debate about where the species boundaries are on the tree. A friend of ours found a similar phylogenetic tree of Taiwanese *Neolucanus* but tended to regard some major lineages of *N. swinhoei* Bates, 1866 as full species, while Tsai et al. (2014) regarded all these lineages as a single species.
In her master's degree thesis, Liu (2019) conducted an analysis on seven species using complete mitochondrial genomes. As a result, two widely separated major lineages were clearly distinguished at the base of the *Neolucanus* clade: *N. perarmatus* Didier, 1925 + *N. giganteus* Pouillaude, 1914 are widely separated from all others at the base. When she analyzed more species with incomplete data from several multi-gene fragments (COI + 16S rDNA + Cytb + 28S rDNA + wingless), a problematic phylogenetic tree was obtained, with many species appearing on some widely separated branches. There may have been some errors in the identification of specimens or the sequencing process in Liu's work.
We also conducted a simple molecular phylogenetic analysis on 11 *Neolucanus* species, using two nuclear genes and one mitochondrial gene. The purpose was merely to detect the approximate phylogenetic position of the new species. Due to the poor quality of some specimens collected over ten years ago, usable sequences could not be obtained for some of the old species used for comparison. Therefore, the molecular phylogenetic analysis of *Neolucanus* will be a major task to be carried out in the future. Now we have the following findings:
1. The 28S gene is too conserved in *Neolucanus*, with no differences among the 11 species tested. Thus, it is not suitable for phylogenetic analysis. However, the Wingless gene is usable and can provide some phylogenetic information.
2. The COI tree (fig. 51) and the Wingless tree can provide sufficient phylogenetic information for species with distant relationships, but they cannot provide phylogenetic information that can be used to determine species boundaries for species with very close relationships. There are rarely obvious gaps presented on the phylogenetic trees for determining species boundaries. And the analysis of specific examples also indicates that relying solely on the phylogenetic trees of these two genes is unable to determine species boundaries. The combined data analysis of the COI gene and the Wingless gene also cannot provide sufficient phylogenetic information to analyze the relationships between very closely related species.
3. Specific examples: *N. castanopterus* (Hope, 1831), *N. vicinus* Pouillaude, 1913, *N. rufus* Nagel, 1941 and *N. zhilini* **sp. nov.** cannot be clearly distinguished in terms of COI distance (< 0.014; fig. 50) and Wingless distance (< 0.007). However, these species are all distributed in a very narrow area, and there are clear and stable distinctions in morphology (including the characteristics of ligula and hind wings). Moreover, *N. castanopterus* and *N. vicinus* are sympatric at Huanglianshan, Luchun, Yunnan; *N. vicinus* and *N. zhilini* **sp. nov.** are sympatric at Cenwanglaoshan, Guangxi; although there is no record of *N. vicinus* and *N. rufus* being collected in the same locality in Jinping and Pingbian Counties, their distributional ranges are interlaced and in a mixed state. Therefore, these species should have clear reproductive isolation in nature. It will be necessary to obtain a large number of nuclear gene markers through next-generation sequencing technology in the future to verify the genetic distances of these closely related species.

4. We speculate that mitochondrial DNA is unable to obtain the phylogenetic relationships between very closely related species, probably because the divergence time of many closely related species is too short. And nuclear gene analysis may be the way to solve the problem. However, the small number of nuclear gene markers that can be provided by the current first-generation sequencing technology are also useless for conclusive analysis due to the small amount of data. The solution should be to obtain a large number of nuclear gene markers through next-generation sequencing technology for combined data analysis.

Neolucanus fuscus Didier, 1926 (fig. 3)

Remarks. Most of the subsequent authors after Didier (1926) incorrectly used this name as the senior synonym of *N. armatus* Lacroix, 1972 (with ssp. *zhongguo* Schenk, 2012). However, the unique female holotype (MNHN, figured by Mizunuma & Nagai, 1994) does not match the black female of *N. armatus* (figs. 1-2) by having a shorter and more evenly curved mandible and four continuous denticles at the outer margin of the protibia (not counting the apical one). The holotype (fig. 3) is measured 36 mm for LB. Therefore, it cannot be the female of *N. yemaoi* Wang & He, 2024 (fully discussed below). Its real identity needs a further research in future.

Neolucanus delicatus Didier, 1927 (figs. 4-6, 10, 14-16)

Remarks. This species was originally described based on two male syntypes from “Tourane (Annam)”. One of the syntypes in major form (fig. 4) was illustrated by Mizunuma & Nagai (1994) and Baba (1995) erroneously as the holotype. The male specimen from central Vietnam (ex coll. Okuda) examined by us is a little longer in LB and has a longer mandible than the syntype in major form, measuring 34 mm compared to 31 mm. They are concordant with each other in most external characters. As pointed out by Schenk (2011), this species had been confused with *N. fuscus* or *N. armatus* for a long time (Mizunuma & Nagai, 1994; Baba, 1995) and was rediscovered only recently (Okuda, 2009). This species is not distributed in China. The most of the records of this species from China belong to *N. armatus*.

Neolucanus yemaoi Wang & He, 2024
(figs. 7-9, 11-13, 17)

Material. 27 ♂♂ (CCCC, CHH; figs. 8-9, 11-12 & 17), Yunnan province: Honghe Pref., Pingbian, Daweishan, 1800-2000 m, 11.VI.2012, local collector leg., 20-21.V.2009, W.-X. Bi leg.; V.-VII.2010, W.-H. Lin leg.; 11.VI.2011, X.-D. Yang leg.; V.-VI., 2012-2014, local collectors leg.; 1 ♀ (CCCC), 12.V.2014, C. Wu leg. 3 ♂♂ & 1 ♀ dissected.

Diagnosis. This species is close to *Neolucanus delicatus* Didier, 1927 (figs. 4-6, 10, 14-16), but can be distinguished from the latter by the following combination of characters:
♂♂ in corresponding sizes:
1) mandible longer in dorsal view and straighter in lateral view;
2) mandible of small-sized male not differing from that of large-sized male in shape, with smooth inner margin at basal half;
3) pronotum shorter but elytra longer;
4) dorsal surface of body bicolor, with black head-pronotum and reddish elytra;
5) mentum nearly glabrous, not densely pubescent;
6) ligula shorter;
7) hindwing more evenly pigmented, with the pigmented part paler;
8) permanently everted internal sac of aedeagus longer and with wider basal part;
9) median lobe of aedeagus with longer and wider non-pigmented medial part on ventral surface;
10) last abdominal tergite more produced at lateral angles, not evenly rounded;
11) 9th abdominal segment with paired pleurites (lateral plates) widely separated by membrane, not by dorsal caudal plate;

♀♀:
12) anterior canthus shorter, not covering the entire outer margin of eye;
13) last abdominal tergite wider;
14) supra anal projection less protruding at middle;
15) bursa copulatrix much longer.

Remarks. The males of this species show little variation in the form of mandible as shown in Fig. 17. This species belongs to *N. fuscus* group (sensu Schenk, 2011), which includes *N. fuscus, N. armatus, N. delicatus, N. lehmanni* Baba, 1995, *N. brochieri* Bomans & Miyashita, 1997, *N. inaharai* Okuda, 2009, and probably also *N. baongocae* Nguyen, 2013.
Approximately ten years ago, we realized that *Neolucanus fuscus* and *Neolucanus delicatus* were major problems in determining the identity of *Neolucanus yemaoi*. However, we failed to obtain any specimens of *Neolucanus delicatus* for a comprehensive study at the time. A few years later, Mr. Yang Huan planned to publish this as a new species but did not do so for an unknown reason. The story surrounding this species is far more interesting than the species itself. We heard that just after we submitted the manuscript to Beetles World, Dr. Wang Chen-Bin learned that another team (Dr. Song Hai-Tian and Mr. Qi Zhi-Hao) was going to describe this species as new. Thus, he made a very quick publication to name this species. We do not care about the name of this new species. But such an interesting story around this *Neolucanus* species merits being recorded.
LB. ♂♂: 30.4-39.4 mm. ♀: 25.4 mm.
Distribution. SE Yunnan.

Neolucanus liuzhei Huang & Chen, sp. nov.
(figs. 18, 22-27)

Type material. CHINA: Hainan: **Holotype:** ♂ (SHNU; fig. 18-L2), Wuzhishan City, Wuzhishan Nature Reserve, 700m, 1.X.2024, Z. Liu leg.; **Paratypes**: 1 ♂, 1 ♀ (CHH), same locality as holotype, 700m, 25.IX. & 1.X., 2024, Z. Liu leg., all dissected.
Etymology. This new species is named in honour of Mr. Liu Zhe, a butterfly enthusiast who discovered this amazing species.

Diagnosis. In terms of external features, the male of this new species is rather similar to that of *Neolucanus punctulatus* Nguyen & Schenk, 2013 from central Vietnam in having a pair of slender and strongly up-curved mandibles. However, the former can be distinguished from the latter by the following combination of characters.
♂♂ in fully developed forms:
1) head markedly wider and longer;
2) anterior angle of canthus rounded, not produced or pointed;
3) posterior angle of pronotum rounded, not sharply produced;
4) dorsal surface of head, pronotum and elytra more finely punctured, appearing smoother, with much smaller punctures everywhere;
5) mandible thinner near apex;
6) elytra uniform black or at most with ill-defined reddish patches at lateral sides, not with clearly defined orange-yellow patches.

Remarks. This new species is found to be located at the base of the second main clade of *Neolucanus* on the COI tree (fig. 51).
The external difference between this new species and *Neolucanus punctulatus* Nguyen & Schenk is remarkable. However, due to the poor quality of the figure of *Neolucanus punctulatus* in the original description, a detailed comparison of male genitalia is impossible. It is highly likely that the two species have no consistent difference in male genitalia as male genitalia vary very little among species of this group.
N. brevis Boileau, 1899 (TL: Catcin Cauri, Birmanie), *N. guiardi* Didier, 1926 (TL: Xieng-Khouang, Laos), and *N. rondoni* Lacroix, 1972 (TL: Tonpheng, Vientiane, Laos) most probably belong to the same group as the above-discussed species since all of them possess

up-curved mandibles in males. A comparison between *N. brevis, N. rondoni,* and *N. liuzhei* **sp. nov.** (the specimens of *N. guiardi* are not available to us) based on a close examination shows that there is no consistent difference in male genitalia between them. Apart from the striking external differences in mandible and measurements of mandible, head, pronotum, and elytra, *N. liuzhei* **sp. nov.** has significant differences from both *N. brevis* and *N. rondoni* in hindwing venation.

N. liuzhei **sp. nov.** can be distinguished from *N. brevis* and *N. rondoni* by the following combination of characters in fully developed males.

1. The head is wider.
2. The pronotum and elytra are longer.
3. The mandible is much longer, with a much thinner apical part.
4. The sub-mentum (structure below the mentum) is pubescent, not glabrous.
5. The hindwing is more pigmented and darker as a whole, with the outside area of Vein AA_{1+2} more strongly pigmented, and Veins MP_3 and MP_4 nearly reaching the posterior margin of the hindwing.

LB. ♂♂: 30.5-32.2 mm (holotype: 30.5 mm). ♀: 28.3 mm.
Distribution. Hainan (only known from Wuzhishan).

Neolucanus brevis Boileau, 1899 (figs. 20-25, 27)

Remarks. Two male specimens from Xishuangbanna, Southern Yunnan have been carefully examined. The pair of syntypes in the Muséum national d'histoire naturelle (MNHN) have been inspected through photos (fig. 21). This species is distinct from *N. guiardi* in that it has a more convex postocular margin and a mandible that is more evenly curved, with the base of the outer margin not expanding outwards. The pair of syntypes of *N. guiardi* was illustrated by Mizunuma & Nagai (1994).

Neolucanus rondoni Lacroix, 1972 (figs. 19, 22-25, 27)

Remarks. Two male specimens from Laos have been examined. The photo of one of the paratypes illustrated by Fujita (2010) clearly shows that the male mandible of this species is strongly bent at the upper outer margin near the apex. Although *N. rondoni* and *N. brevis* are hardly separable by most external characters and male genitalia, they are clearly distinguishable from each other by the shape of the mandible. Their relationship requires a further study on molecular sequences in future.

Neolucanus rufus Nagel, 1941 (figs. 27, 29, 32-36)

Remarks. This species was described based on a single male specimen from Chapa, Tonkin (now Sapa, northern Vietnam). The holotype was reportedly deposited in Nagel's collection. However, it was destroyed during the 1943 bombing of ZIZM (Weidner, 1976). Earlier that year, ZIZM was the depository of Nagel's personal collection (Gaedike & Groll, 2001). A survey of other German museums failed to locate these Nagel specimens.

Nevertheless, the original description and the sketch of the holotype (Nagel, 1941: fig. 2) are informative for recognizing this peculiar species. Twelve males and seven females (CCCC) from Pingbian (near the China-Vietnam border) have been examined and they match the original description.

This species is rather similar to the sympatric *N. vicinus* Pouillaude, 1913 (TL: Tonkin) in that males have a straight canthus and both sexes have opaque orange elytra. However, it can be distinguished from the latter by having a laterally bifurcate male mandible, a much shorter ligula, a more slender and less curved female mandible, pigmented Space AA3+4 of the hindwing, a more angled last abdominal tergite of the male, a non-bifurcate caudal lobe of the basal piece of male genitalia, more fused pigmented parts on the ventral surface of the median lobe, and a less developed supra anal projection of the female.

Schenk (2014) considered *N. pseudovicinus* Fujita, 2010 (type locality: Ha Giang, northern Vietnam) as a synonym of this species.

However, *N. pseudovicinus* differs from *N. rufus* in having a much narrower body in males of the same size and a much shorter mandible with a rounded outer margin. Further investigation is needed.

Neolucanus vicinus Pouillaude, 1913 (figs. 27, 30, 32-36)

Remarks. This species was described based on a single male specimen from Tonkin. The holotype (deposited in MNHN) was illustrated with a high-quality black-and-white photo by its author. This species resembles *Neolucanus castanopterus* (Hope, 1931), but it is described as being different from the latter due to the suture of the elytra being marked by a black band with smoky edges.
Thirteen males and eight females from southeastern Yunnan (Jinping) and western Guangxi (Cenwanglaoshan) have been closely examined and compared to a series of specimens of *N. castanopterus*. The following additional differences can be noted: the elytra are opaque and less shiny; the female mandible is short and more curved at the outer margin; the ligula is narrower; Space AA3+4 of the hindwing is non-pigmented; the caudal lobe of the basal piece is bifurcate.
This species appears to be closer to *N. castanopterus* than to all other species due to having similar external features in males, the same hindwing venation, an evenly curved last abdominal tergite in males, well-separated pigmented parts on the ventral surface of the median lobe, and a protruding supra anal projection of the female genitalia.
The following individual variations have been observed. In a few males, the elytra can be dark brownish with much wider black margins and a wider black band on the suture. In very few females, the elytra can be entirely black.

Neolucanus castanopterus (Hope, 1831) (figs. 27, 31-36)
Lucanus castanopterus Hope, 1831: 22 (TL: Nepalia) [♂ syntype in OXUM examined]
Anoplocnemus bicolor Burmeister, 1847: 360 (TL: Nepal)
Neolucanus castanopterus elongatulus Mollenkamp, 1907: 109 (TL: Yunnan) [♂ holotype in MNHN examined]
Neolucanus pallidus Boileau, 1914: 73 (TL: Yunnan-Sen) [♂ syntype in MNHN examined]
? *Neolucanus flavipennis* Boileau, 1914: 107 (TL: Ruby Mines, Birmanie) [♂ holotype in MNHN examined, with abnormal antennae]
Neolucanus parvus Nagel, 1941: 54 (TL: Shillong, Assam) [♂ holotype destroyed]
Neolucanus castanopterus kinrami Nagai, 2000: 95 (TL: N Katctin = Kachin, Myanmar)

Remarks. A long series of specimens collected from Nepal and Jilong in Tibet Autonomous Region in the west to Lvchun in Yunnan Province in the east have been examined. However, we are still unable to reach a conclusion on the validity of the various taxa under this species. There seems to be no remarkable difference in the genitalia of both males and females among different geographical populations. Furthermore, the relationships between this species, *N. melas* Didier, 1930 (TL: Naga Hills) and *N. tibetanus* Schenk, 2003 (TL: Motuo, SE Tibet) require further study.

Neolucanus zhilini Huang & Chen, sp. nov.
(figs. 28, 32-36)

Type material. CHINA: Guangxi: **Holotype:** ♂ (SHNU; fig. 28-Z1), Baise City, Tianlin County, Cenwanglaoshan Nature Reserve, 1836 m, 23.VII.2020, Y.-Q. Lu leg.; **Paratypes**: 2 ♂♂ (CCCC), same locality as holotype, 23-30.VII.2020, Y.-Q. Lu leg.; 1 ♀ (CCCC), same locality as holotype, 28.VIII.2020, Y.-Q. Lu leg.; 6 ♂♂ (CCCC, CHH), same locality as holotype, 17.VII-4.VIII, 2021, Y.-Q. Lu leg. 3 ♂♂ & 1 ♀ dissected.
Etymology. This new species is named in honor of our friend, Dr. Chen Zhi-Lin from Guilin, who has generously assisted us in multiple ways.

Diagnosis. With a pair of orange patches on the elytra, this new species is similar to the *N. parryi* Leuthner, 1885 complex and *N. armatus* Lacroix, 1972. However, a detailed examination of more morphological characteristics shows that this new species is more closely related to *N. rufus* Nagel. This new species can be distinguished from *N. rufus* by the following combination of characters:
1) male mandible in lateral view more widely bifurcated, with two tips farther apart from each other;
2) female mandible in dorsal view stouter, with tip of inner tooth farther from outer margin of mandible;
3) elytra with a pair of clearly defined orange patches similar to those in *N. parryi*;
4) caudal lobe of basal piece of male genitalia with pigmented part bifurcated;
5) permanently everted internal sac significantly shorter;
6) bursa copulatrix of female genitalia significantly shorter (more specimens need to be examined).

Remarks. The COI phylogeny (fig. 51) shows that this new species is closely related to *N. rufus* and widely separated from *N. armatus*.
Both this new species and *N. rufus* have the following remarkable differences from other species such as *N. vicinus* and *N. castanopterus*: the ligula is very short and hardly bifurcated, with rounded lateral apexes; the male mandible is markedly bifurcated laterally; the last abdominal tergite is more or less angled at the lateral sides; the pigmented parts of the ventral surface of the median lobe are fused; the supra anal projection of the female genitalia is plain and not protruding medially.
This new species can be distinguished from *N. armatus armatus* and *N. armatus zhongguo* by having a shorter but more laterally bifurcated mandible in males of corresponding size, a shorter and more transverse head and pronotum, shorter elytra, an opaque and non-shiny dorsal surface of the body, a rounded ligula, more pigmented hindwing, a bifurcate caudal lobe of the basal piece of the male genitalia, and a much longer flagellum of the male genitalia.
LB. ♂♂: 29-34 mm (holotype: 32.8 mm). ♀: 28.8 mm.
Distribution. Guangxi.

Dorcus nosei Nagai, 2000 (fig. 40)
Dorcus nosei Nagai, 2000: 106 (TL: Putao, Myanmar), fig. 159-164 for ♂♂; Fujita, 2010: 262, pl. 172, fig. 771-1; Huang & Chen, 2017: 60, first record from China, 61, figs. for ♂♂ from Weishan, Yunnan.
Dorcus kyawi: Fujita, 2010: 255, partim on female, pl. 163, fig. 755-3 for ♀; Huang & Chen, 2013: 510, partim on ♀♀, figs. for ♀♀ and their genitalia. Misidentification

Remarks. When describing *Dorcus kyawi* Nagai & Maeda, 2009 as new, Nagai & Maeda (2009) did not list any female paratype. Fujita (2010) figured a female specimen labeled as female paratype, which is an error. Further study shows that the females identified by Fujita (2010) and Huang & Chen (2013) as *Dorcus kyawi* actually belong to *Dorcus nosei* Nagai.
A few female specimens of *D. nosei* were collected by our friends from Weishan and Wuliangshan in northern Yunnan. Along with these, some males were also collected. Subsequently, Mr. Guo B.-X. reared a few males and females from a wild female. One of the WF1 females was dissected for a study of the genitalia (fig. 40).

Dorcus wuchaoi Huang & Chen sp. nov.
(figs. 37-39)

Type material. CHINA: Yunnan province: Holotype ♂ (CCCC, will be deposited in SHNU; figs. 37-W1 & 38-W1), Nujiang Pref., Gongshan County, Dulongjiang, Maku, Qinlangdang, 1300 m, 5.IX.2016, C. Wu leg.; **Paratypes**: 2 ♂♂ & 4 ♀♀ (CCCC), same locality as holotype, 1300-1538 m, 29.VI-5.IX, 2016, C. Wu & X.-D. Yang leg. **MYANMAR**: Kachin state: Paratype: 1 ♂ (CCCC), Putao, 2 km NW of Ziradum, 1080 m, collector unknown, 18.XII.2016.
Etymology. This new species is named in honour of our friend, Mr. Wu Chao, Beijing.

Diagnosis. The male of this new species is highly similar to that of *Dorcus cervulus* (Boileau, 1901), yet its genitalia resemble those of *Dorcus nosei* and *D. chayuensis* Huang & Chen, 2017. The female of this new species is similar to that of *D. chayuensis*, but its genitalia are similar to those of *D. nosei*.

The male of this new species can be differentiated from that of *D. cervulus* by the following combination of characteristics:
1) mandible more evenly curved, with subapical tooth more reduced in the corresponding sized form;
2) permanently everted internal sac of male genitalia more than 2.5 times longer than aedeagus, much longer than that of *D. cervulus*, and its apex not associated with a seta-tuft (The hair-like structure in the figure is an illusion caused by the folds of the membrane, which are associated with extremely minute microsetae.).

The male genitalia of this new species can be distinguished from those of *D. nosei* and *D. chayuensis* by the following combination of characteristics:
1) permanently everted internal sac not trifurcate and with no small branches;
2) apex of permanently everted internal sac expanded laterally, shorter than that of *D. nosei* but longer than that of *D. chayuensis*, with microsetae well developed and not obsolete as in *D. chayuensis*;
3) aedeagus slenderer in shape and with a larger length-width ratio.

The female of this new species can be differentiated from that of *D. chayuensis* by the following combination of characteristics:
1) fourth carina (counting from suture) markedly higher and wider.
2) spermatheca bifurcate at apex.

The female of this new species can be distinguished from that of *D. nosei* by the following combination of characteristics:
1) pronotum more heavily punctured everywhere, with medial area and submarginal areas marked by very large punctures;
2) spermathecal branches strongly curved, not straight.

Remarks. The following new taxa of *Dorcus* have been described after 2017: *Dorcus tianlongi* Wang & Zhou, 2019 from Guizhou; *Dorcus taoi* Huang & Chen, 2020 from Sichuan; *Dorcus linzhiensis* Huang et al., 2020 from Motuo, SE Tibet; *Dorcus tatsuhikoi* Okuda, 2020 from C & S Vietnam; *Dorcus elegans tani* (Okuda & Maeda, 2020) from NE India; *Dorcus apatani aka* (Okuda & Maeda, 2020) from NE India; *Dorcus motuoensis wuchiae* (Okuda & Maeda, 2020) from NE India; *Dorcus mattisi* Schenk, 2022 from Armenia; *Dorcus jinghongi* Huang & Chen, 2023 from Guangxi and Guizhou; *Dorcus hartmanni* Schenk, 2023 from W Nepal and NW India; *Dorcus himalayaensis* Schenk, 2023 from E Nepal; *Dorcus suturalis weigeli* Schenk, 2023 from W Nepal; *Dorcus zhouchaoi* Wang & He, 2024 from S Sichuan.
LB. ♂♂: 39.7-47.4 mm (holotype: 44.2 mm). ♀♀: 26.5-30.3 mm.
Distribution. NW Yunnan, Kachin of Myanmar.

Lucanus fanjingshanus wangpingi Huang & Chen, ssp. nov.
(figs. 41-42, 44, 46, 48)

Type material. CHINA: Hubei province: Holotype ♂ (CCCC, will be deposited in SHNU; figs. 41-F1 & 44-F1), Yichang City, Wufeng County, Houhe Nature Reserve, 1554 m, 7.VII.2024, Y.-Q. Lu leg.; **Paratypes**: 10 ♂♂ & 14 ♀♀ (CCCC, CHH), same locality as holotype, 14.VI-19.VII, 2024, Y.-Q. Lu leg.
Etymology. This new species is named in honour of Dr. Wang Ping, Yangtze University, Jinzhou.

Diagnosis. This new subspecies can be distinguished from the nominotypical subspecies of *Lucanus fanjingshanus* Huang & Chen, 2010 from Guizhou and Sichuan (figs. 42-left & 47) by the following combination of characters:
1) male mandible more curved, not straight at central part;
2) basal tooth of male mandible fully developed in all forms;
3) lateral carina of head abruptly expanded laterally and more raised dorsally in fully developed males;
4) female body with a more shiny dorsal surface.

Remarks. There is no difference in the genitalia of males and females between the two subspecies. A phylogenetic tree inferred from COI barcode sequences reveals that the two subspecies form a monophyletic group. *Lucanus lhasaensis* Schenk, 2006 **stat. rev.** is the sister taxon to *Lucanus fanjingshanus*. The two subspecies of *Lucanus fanjingshanus* are not well separated on the tree, suggesting a recent divergence between them. However, an analysis of nuclear DNA sequences is necessary in the future to clarify the relationship between the two subspecies.
LB. ♂♂: 45.7-63.9mm (holotype: 58.2 mm). ♀♀: 28.5-35.6 mm.
Distribution. Hubei.

Lucanus thibetanus furcifer Arrow, 1950 & ***Lucanus cheni*** Huang, 2011

Remarks. We noticed that Yi (2023: 157, pl. 143) still used the name "*Lucanus furcifer*" to represent *Lucanus cheni* Huang, 2011. Recently, when the senior author studied the International Code of Zoological Nomenclature (ICZN), he realized that he had made a serious mistake in regarding the male specimen selected by Bacchus (1978) as the lectotype of *Lucanus furcifer* Arrow. In fact, Bacchus' (1978) lectotype designation is invalid and unnecessary.
According to Article 73.1.1 of the ICZN, "If an author when establishing a new nominal species-group taxon states in the original publication that one specimen, and only one, is the holotype, or "the type", or uses some equivalent expression, that specimen is the holotype fixed by original designation." Arrow (1950: 47) only used words related to type specimens once and clearly stated "Type (from Yunnan) in the British Museum". Therefore, **this "Type" from Yunnan is the holotype**, not a syntype or lectotype.
Someone might argue that the specimen found by Bacchus (1978) and illustrated by Huang et al. (2011) is probably not the specimen studied by Arrow (1950), and there could be another specimen representing the real holotype. However, it is widely known that *Lucanus cheni* is not distributed in Yunnan at all. Arrow (1950) clearly stated, "the species described above (referring to *Lucanus furcifer*) is that described and illustrated by Planet in 1903 as *Lucanus singularis*". Arrow studied these Planet specimens and selected the male specimen misidentified by Planet (1903) as *Lucanus singularis* as the holotype of *Lucanus furcifer*. One of the labels of the holotype indicates that it is just the one studied first by Planet (1903) and then by Arrow (1950).

Someone might argue that the "Type" mentioned by Arrow (1950) could include more than one specimen, ignoring that "Type" is in singular form. If Arrow really used "Type" for more than one specimen from Yunnan, all the specimens from Sikkim should be excluded from the type series, according to Article 72.4.6 of the ICZN ("If an author when establishing a nominal species-group taxon nominates either "syntypes" (by that term, or by use of one of the terms "cotypes" or "types" alone), or "holotype and paratypes" used together (or by use of the term "type" together with "allotype" or "cotypes"), and also lists other specimens, the separate mention of the latter expressly excludes them from the type series").
Regarding Yi's (2023) suspicions, the specimen illustrated by Arrow (1950) without any label of type specimens (Arrow did label all the type specimens of the other species in his book with "Type") is actually a paratype, as well as all other specimens studied by Arrow at that time, according to Article 72.4.5 ("When an author designates a holotype [Art. 73.1], then the other specimens of the type series are paratypes.

The latter do not become syntypes and cannot be used for lectotype selection [Art. 74] if the holotype is lost or destroyed; however, they are eligible for neotype selection").
In short, Arrow (1950) made an error in identifying two different species as a single species under his *Lucanus furcifer*, but he chose a male specimen from Yunnan as the name-bearing type. Therefore, all the specimens from Sikkim are not name-bearing specimens. As a conclusion, *Lucanus cheni* Huang is a valid name for the species from Tibet and Sikkim. This taxonomic problem is actually a simple one, but most taxonomic researchers, including Bacchus and us, were not familiar with the ICZN.

Lucanus liuyei Huang & Chen, 2010 (fig. 49)

Remarks. When the senior author was preparing his last paper on Lucanidae at the end of 2023, he noticed that Zhou et al. (2022) synonymized *Lucanus liuyei* Huang & Chen with *Lucanus wuyishanensis* Schenk, 1999 based on a phylogenetic analysis declared to be conducted using mitochondrial (16S rDNA, COI) and nuclear (28S rDNA, Wingless) genes. However, at that time, all the involved data were not yet available on the GenBank website (ncbi.nlm.nih.gov/genbank/). Now, all the data used in this paper are accessible. And the senior author found that there are only data of both species limited to the cytochrome c oxidase subunit I gene, the large subunit ribosomal RNA gene, and the wingless gene. That means that the nuclear 28S rDNA gene is not used in Zhou et al.'s (2022) analysis, at least for the part involving *Lucanus liuyei* Huang & Chen and *Lucanus wuyishanensis* Schenk.
(1) There is an important misunderstanding in molecular analysis: The mitochondrial tree represents everything, reflecting species boundaries and evolutionary relationships. However, in fact, multiple factors can affect the mitochondrial tree: 1) Hybridization leads to gene flow; 2) Uneven evolution. A specific example is that in places with high environmental change pressures, species may evolve rapidly but this cannot be reflected in the degree of difference in mitochondria. The issues related to *Prosopocoilus blanchardi* (Parry, 1873) in the previous article (Zhou et al., 2019) were mainly due to the fact that the mitochondrial tree could not reflect the real evolutionary process because of uneven evolution. And for the issues of *Lucanus liuyei* and *L. wuyishanensis* being discussed now, it is highly likely that they are caused by gene flow resulting from hybridization or extremely rapid evolution, leading to a lack of differentiation in mitochondrial DNA..
(2) There is another misunderstanding in molecular analysis: that the combined analysis of mitochondrial data and nuclear gene data can be applied in all situations. Indeed, in the vast majority of cases with clear differentiation, the combined data can maximize the efficiency of data utilization. However, there are also situations where it is not applicable. For example, when discussing the relationships between some species that are very closely related, the mitochondrial data should be analyzed separately from the nuclear gene data (Khan et al., 2023). Because mitochondrial DNA may have a large amount of gene flow caused by hybridization, it cannot reflect the overall evolutionary relationship and may interfere with the inference of the evolutionary relationship. In fact, there are some closely related species that can be clearly distinguished by nuclear genes but are intertwined in terms of mitochondrial DNA, such as the examples in the recent article on *Saturnia* (Khan et al., 2023). And it is possible that *Lucanus liuyei* and *Lucanus wuyishanensis* fall into this category, as there are relatively obvious distinctions in their genitalia based on the comparison of multiple specimens. After we constructed a phylogenetic tree for *Lucanus* taxa using the wingless nuclear gene data downloaded from Genbank, three samples of *Lucanus wuyishanensis* (WUZJ5, WUZJ6, WUFJ7) ended up in the *Lucanus fortunei* + *Lucanus swinhoei* group or the *Lucanus maculifemoratus* group + *Lucanus thibetanus* group. Since the wingless gene is very conservative and because these three samples were clustered together in Zhou et al.'s (2022) combined data analysis, it is very likely that Zhou et al. (2022) made an error in the sequencing process of wingless for these samples, resulting in the wingless gene data of these several samples being untrue. Therefore, it is also possible that the wingless of sample WUFJ5 in the clade of *Lucanus liuyei* on the wingless evolutionary tree is also incorrect data. *Lucanus liueyi* examples are all clustered together on the wingless tree and do not show an interleaved relationship with the samples of *Lucanus wuyishanensis*. This may be an obvious signal

indicating that the two species are different in nuclear genes. The reason why the two cannot be clearly separated as different clades on the wingless tree is obviously due to the small amount of data provided by the wingless gene. At such a small amount of data of the wingless gene, many closely related species of *Lucanus* cannot be distinguished.
Conclusion: The relationship between *Lucanus wuyishanensis* and *L. liuyei* is still unresolved. Judging from the existing genital evidence and the performance of the wingless tree, the two may be either the same species or different species. The final determination requires the introduction of a large number of nuclear markers using next-generation sequencing (NGS) technology for analysis.

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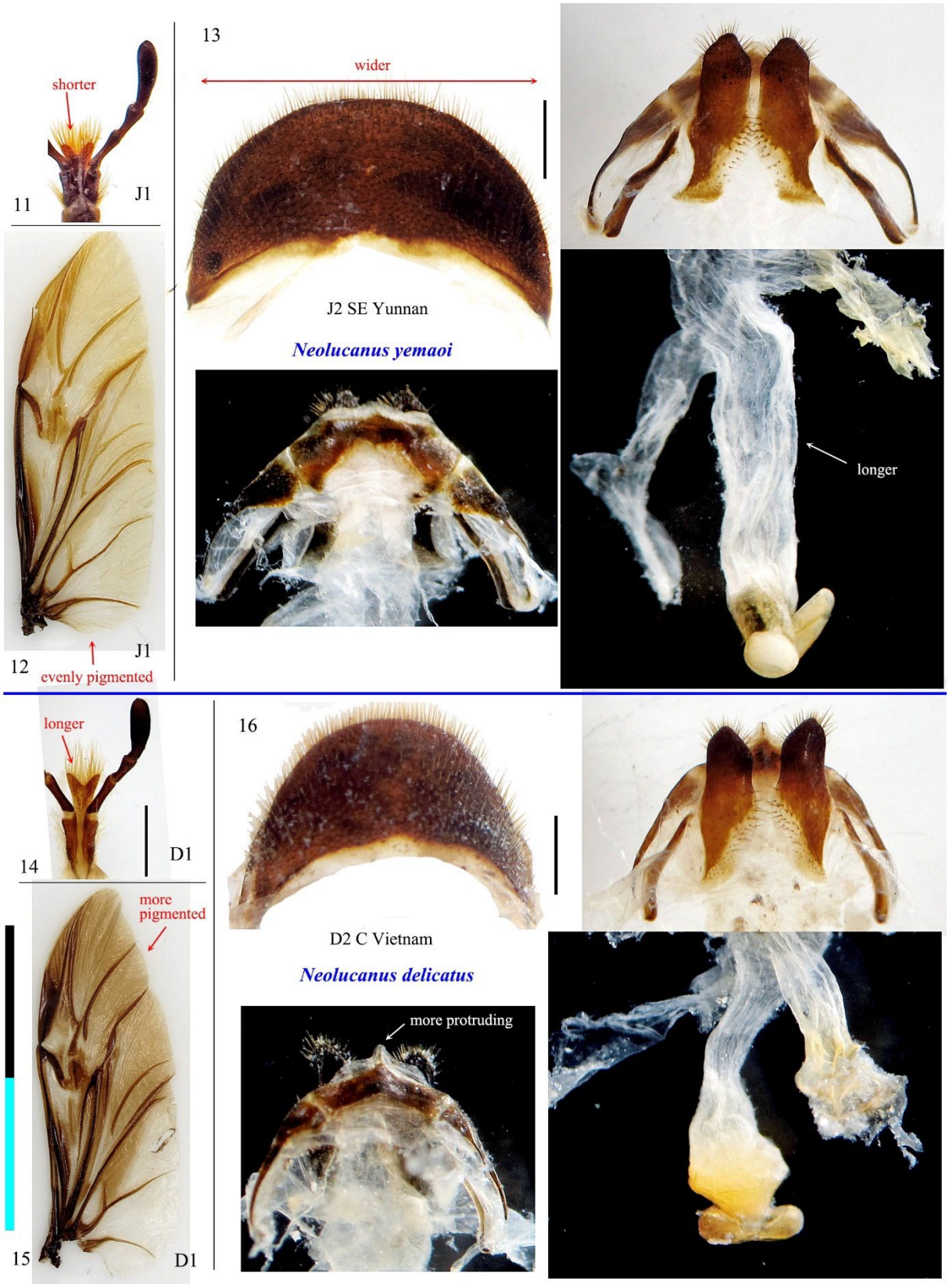
FIGURES 1–8. Species of *Neolucanus delicatus* group at same scale with enlarged morphological characters.

FIGURES 9–10. Male genitalia of *Neolucanus* species at same scale (scale bar = 1 mm).



FIGURES 11–16. Male ligula, male hindwing and female genitalia of *Neolucanus* species at same scale (scale bars = 1 mm or 1 cm).

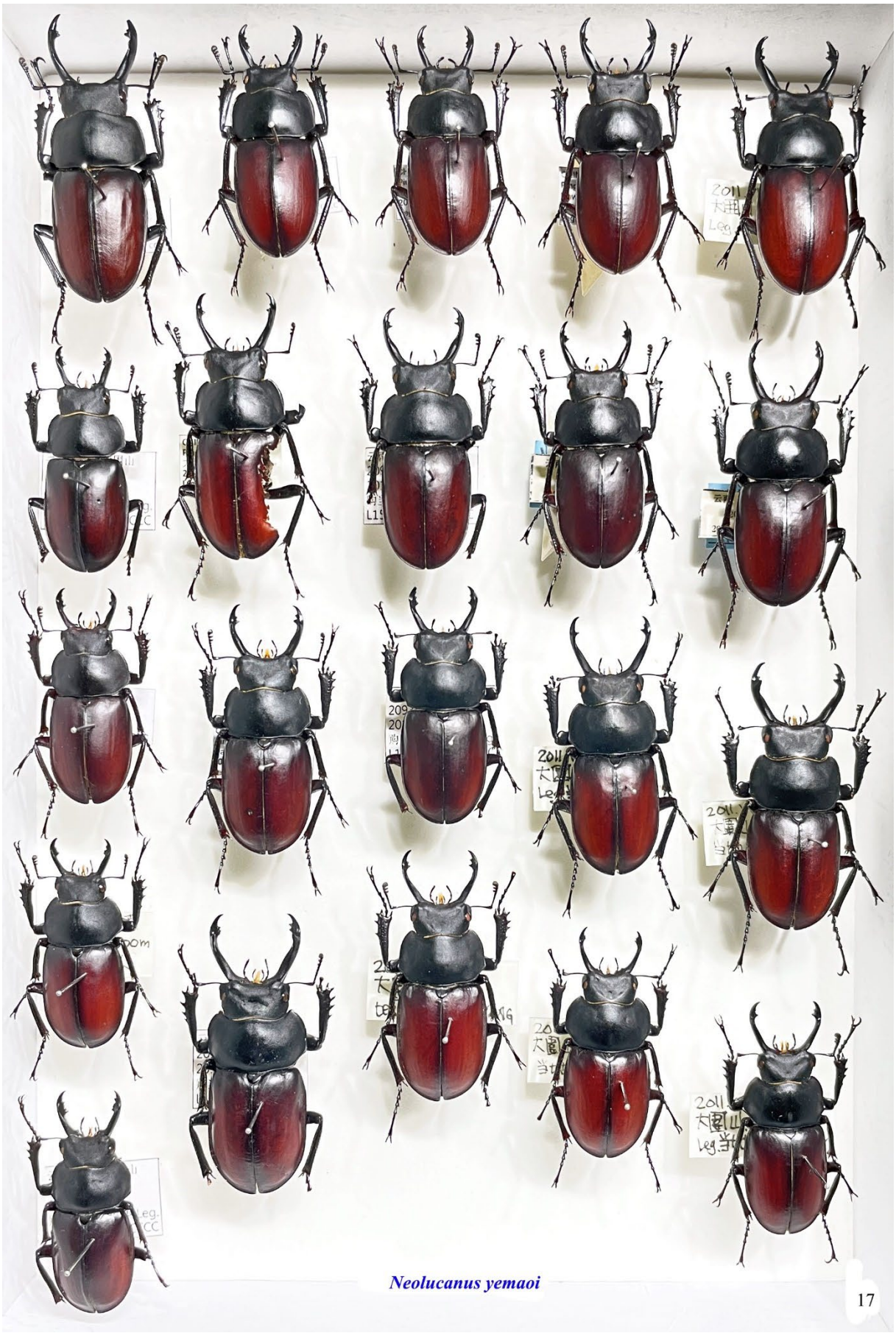


FIGURE 17. *Neolucanus yemaoi* male specimens in various forms.

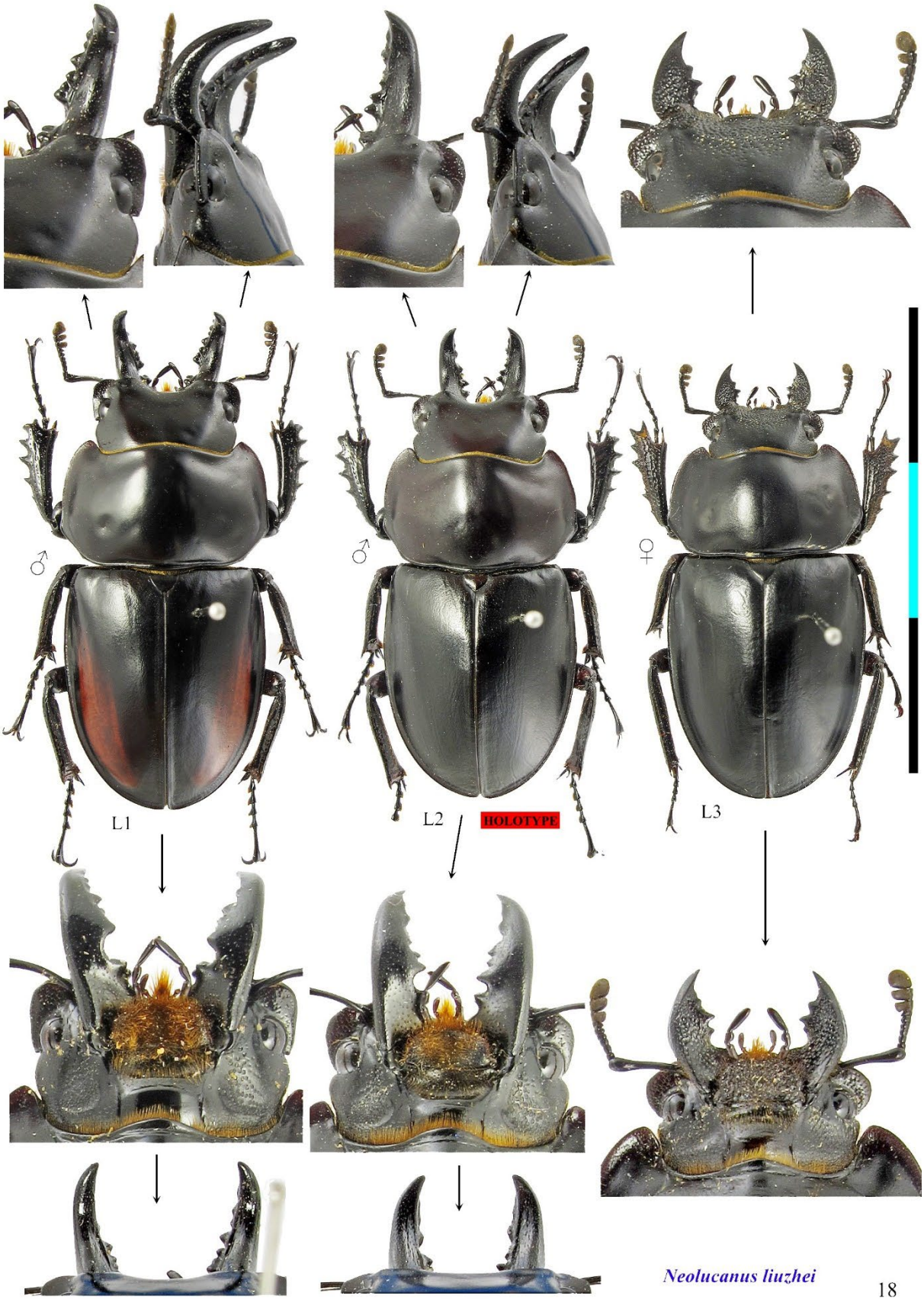
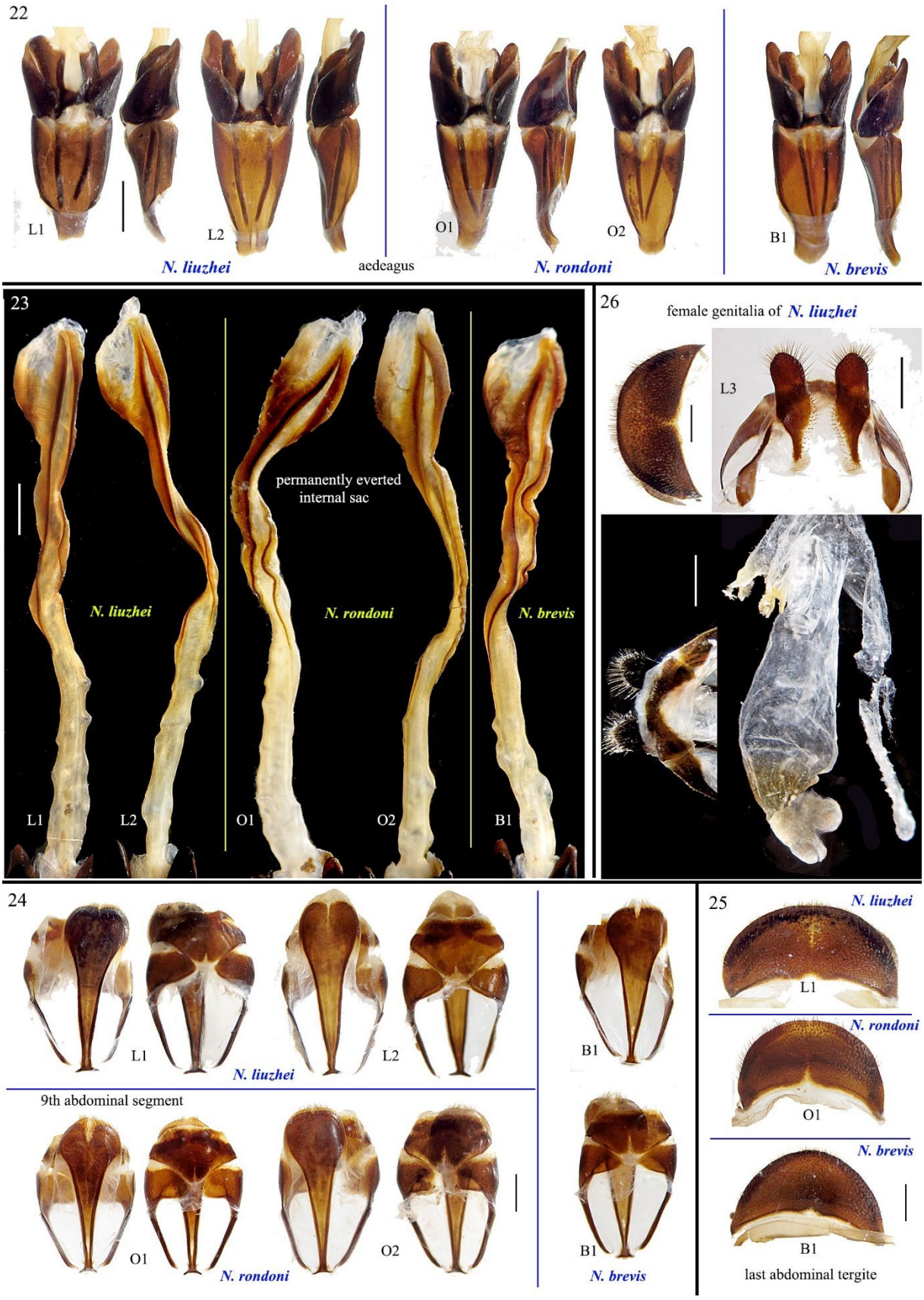


FIGURE 18. Habitus of *Neolucanus liuzhei*.

FIGURES 19–21. Habitus of *Neolucanus* species at same scale.



FIGURES 22-26. Male and female genitalia of *Neolucanus* species at same scale.

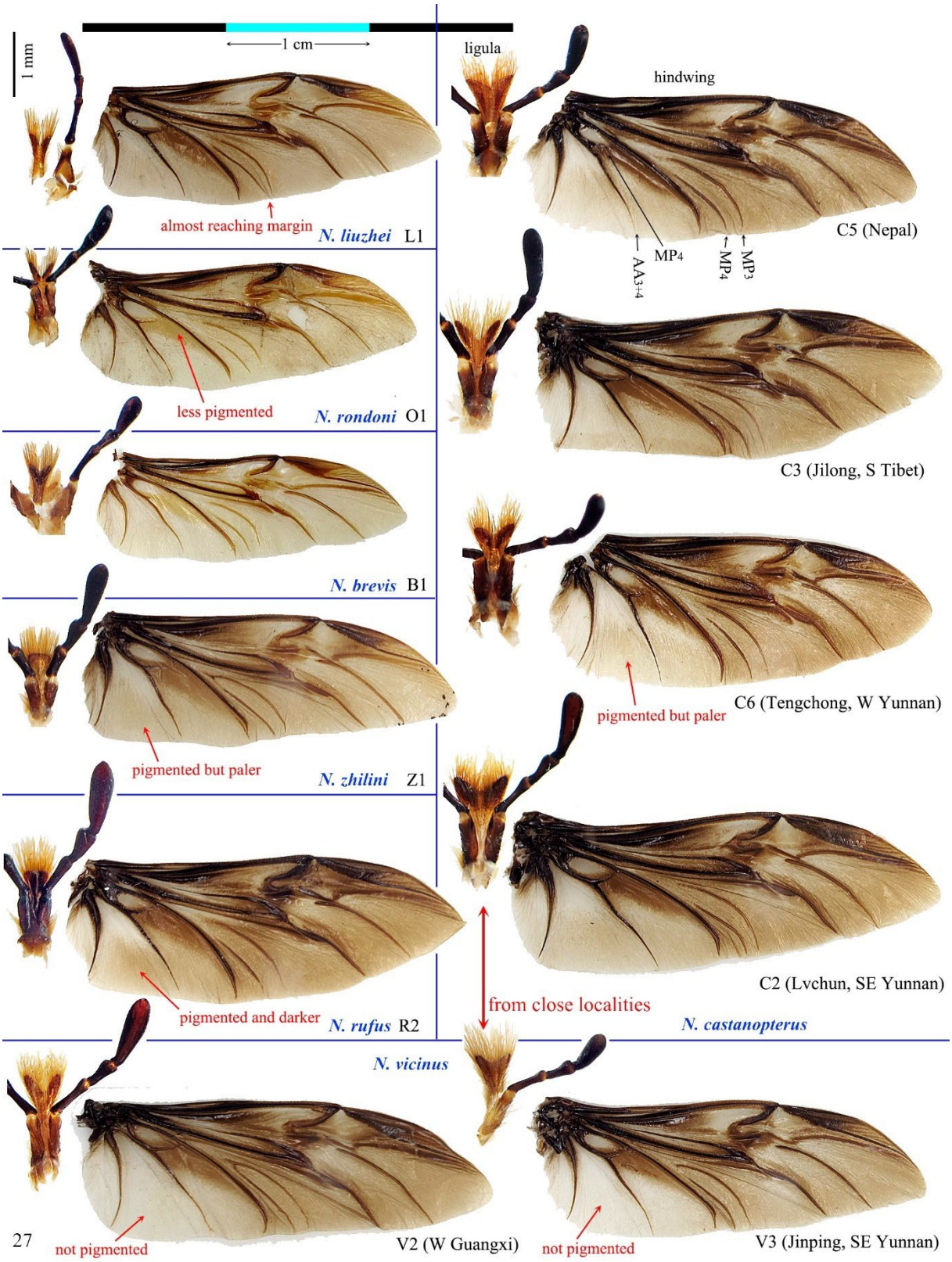
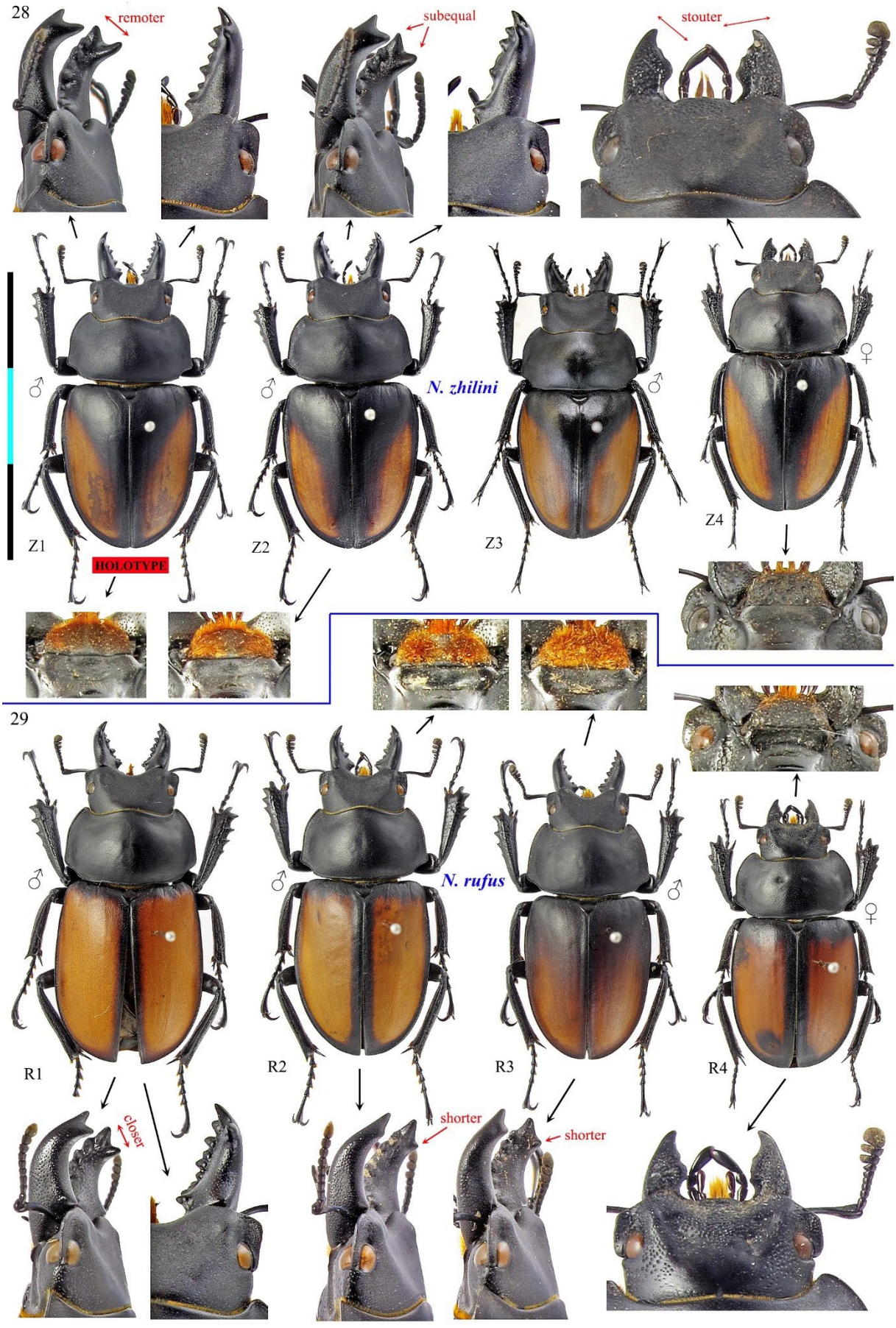
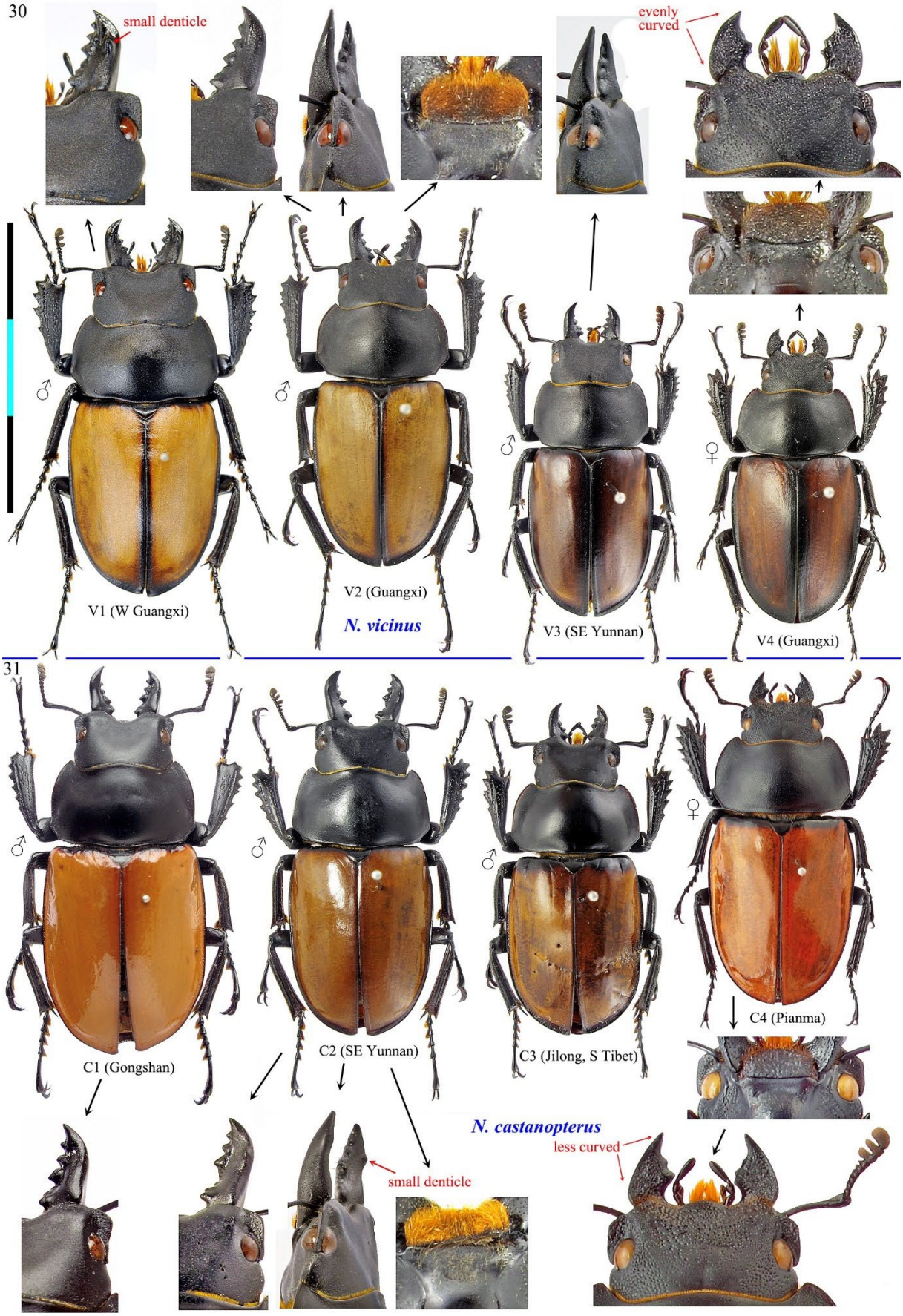


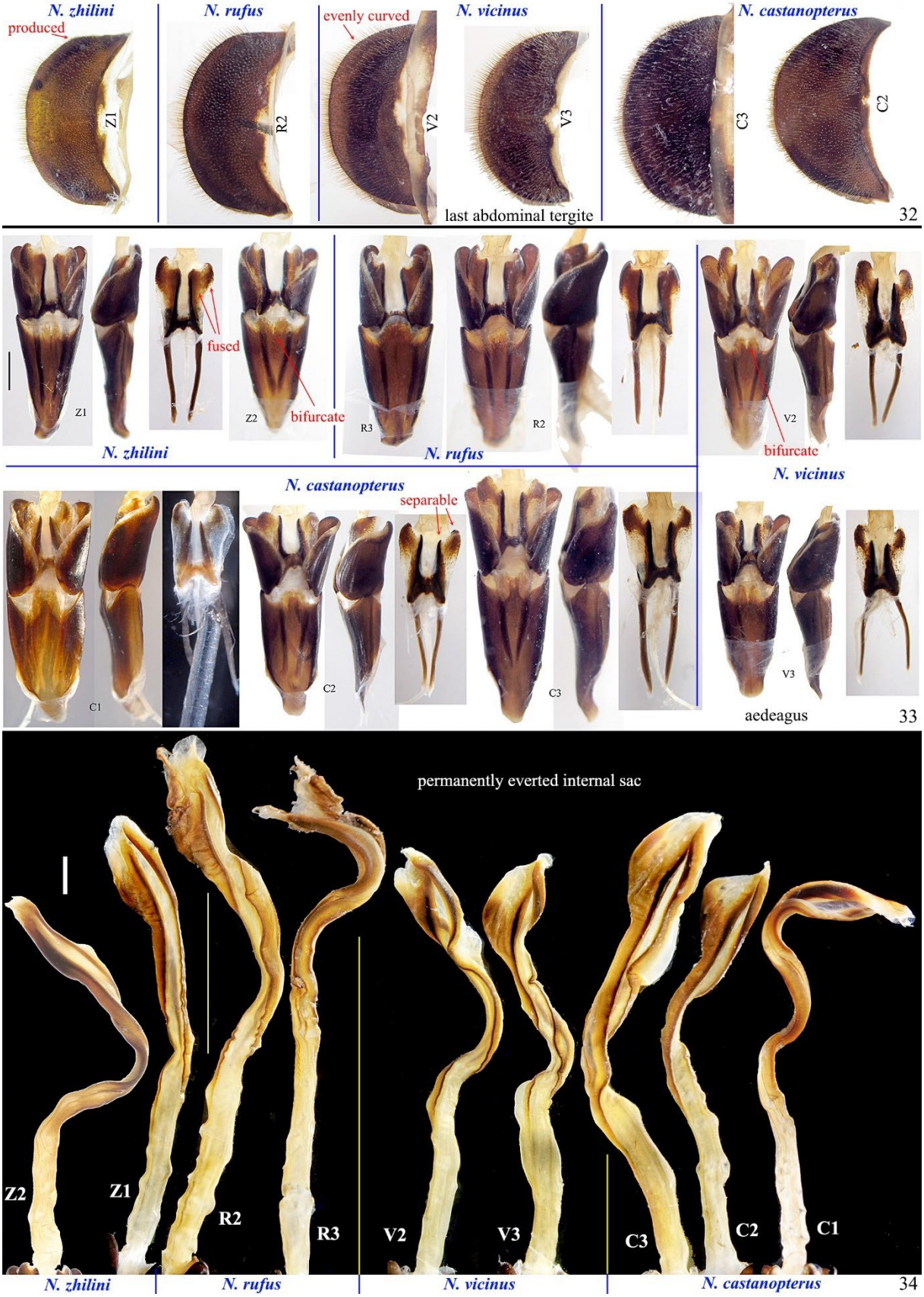
FIGURE 27. Male ligula and male hindwing of *Neolucanus* species at same scale.



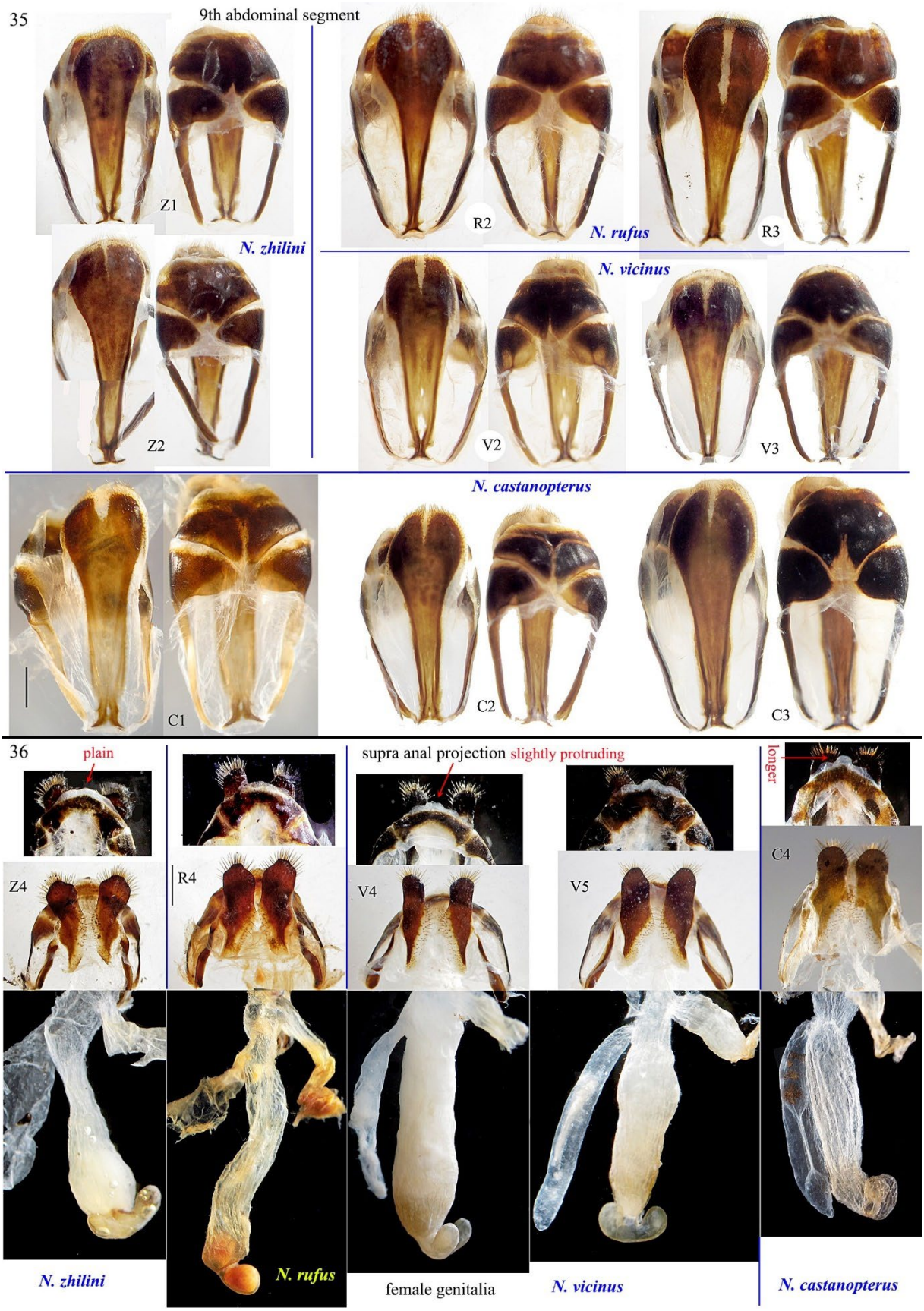
FIGURES 28-29. Habitus of *Neolucanus zhilini* and *N. rufus* at same scale.



FIGURES 30-31. Habitus of *Neolucanus vicinus* and *N. castanopterus* at same scale.



FIGURES 32–34. Male genitalia of *Neolucanus* species at same scale (scale bars = 1 mm).



FIGURES 35–36. 9th abdominal segment of male and female genitalia of *Neolucanus* species at same scale (scale bars = 1 mm).

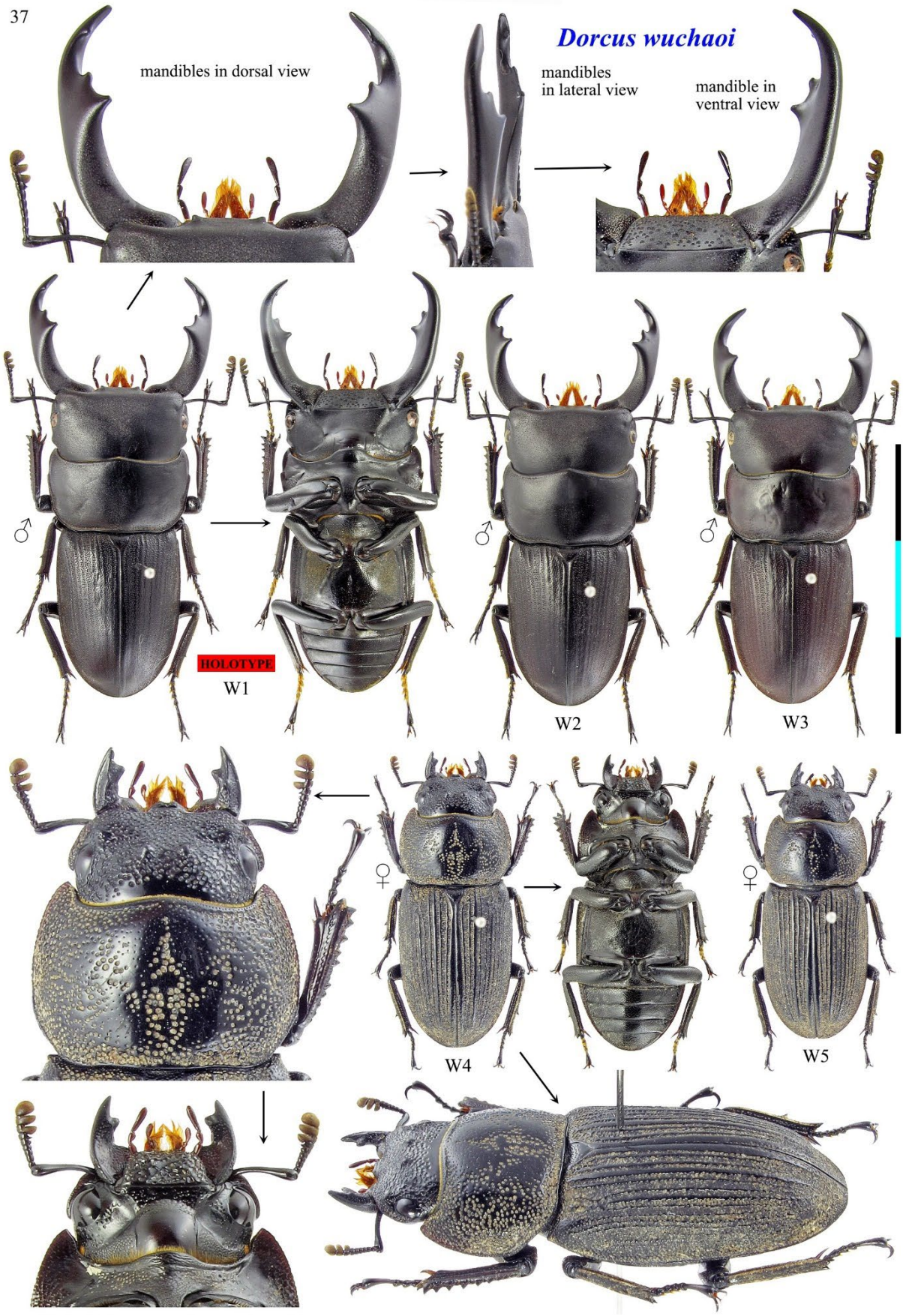


FIGURE 37. Habitus of *Dorcus wuchaoi*.

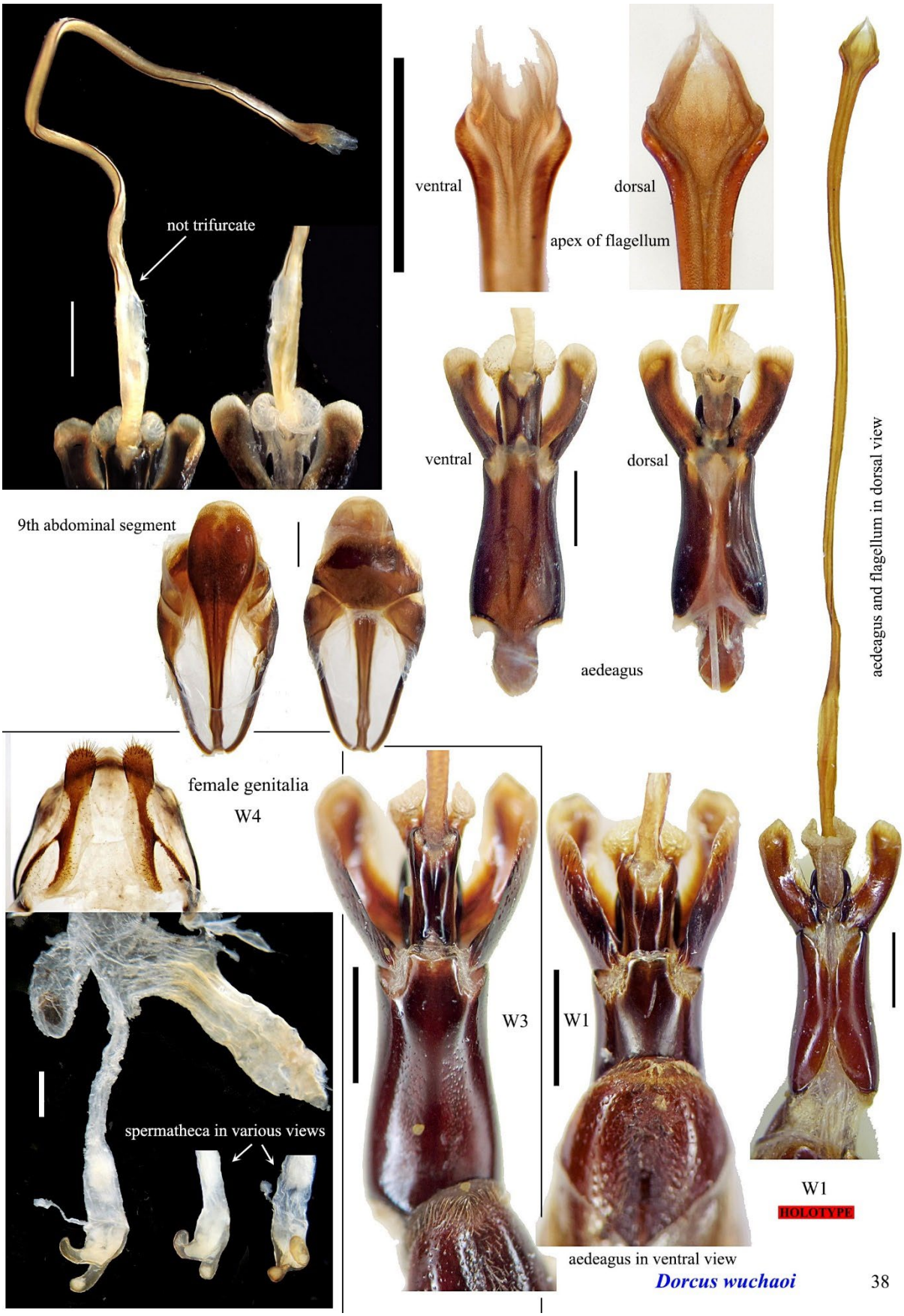
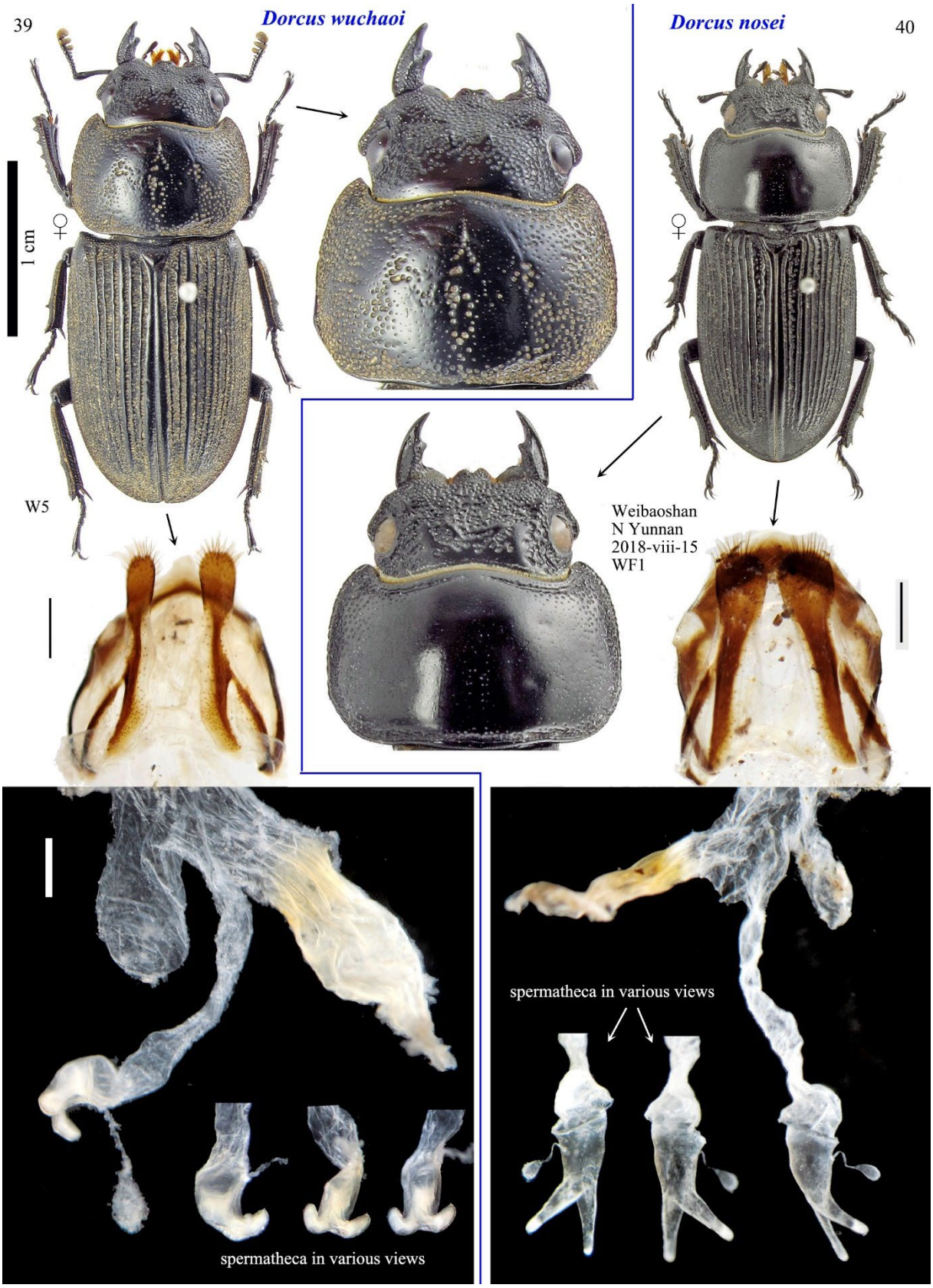


FIGURE 38. Male and female genitalia of *Dorcus wuchaoi*.



FIGURES 39-40. Female habitus and genitalia of *Dorcus wuchaoi* and *D. nosei* at same scale.

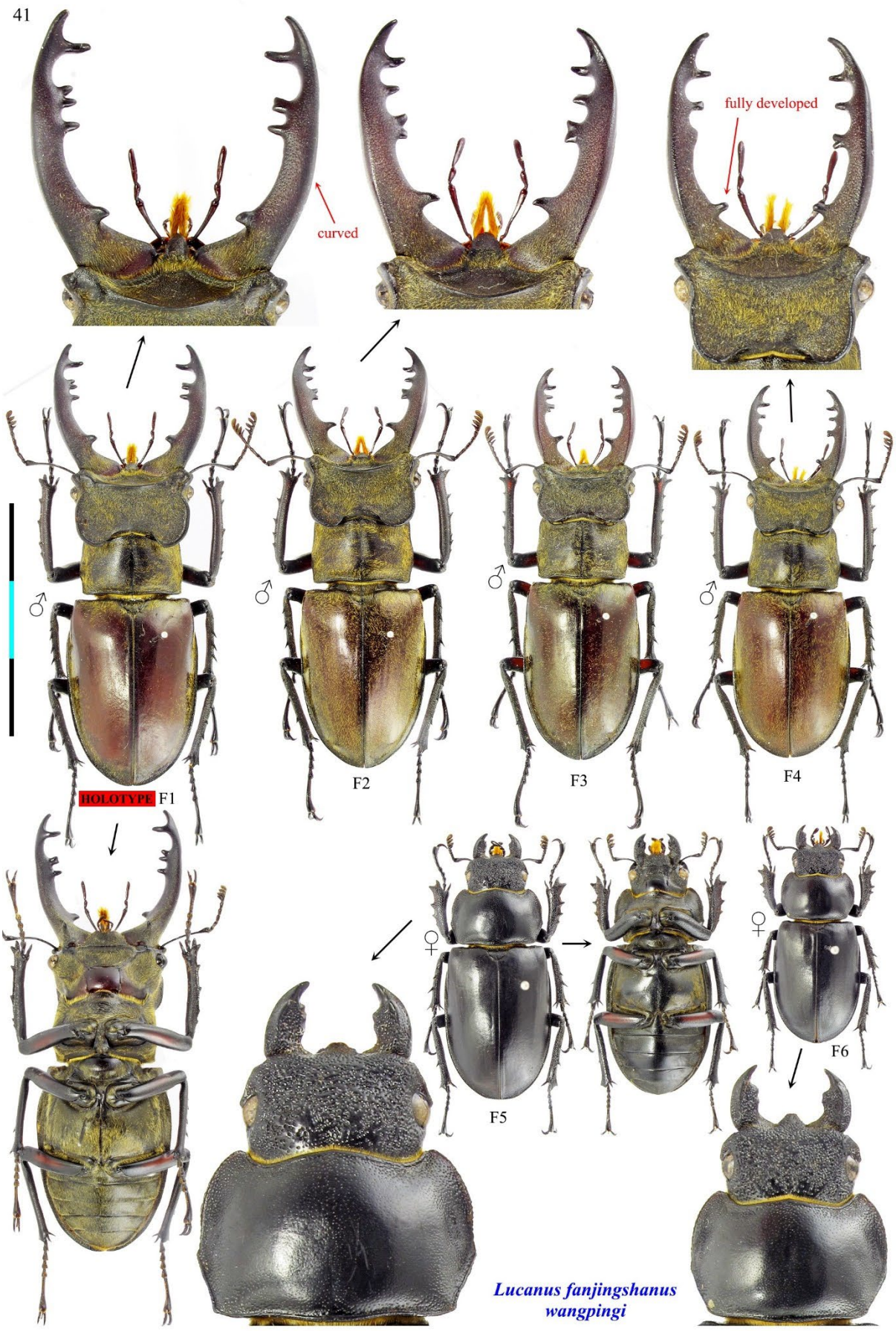
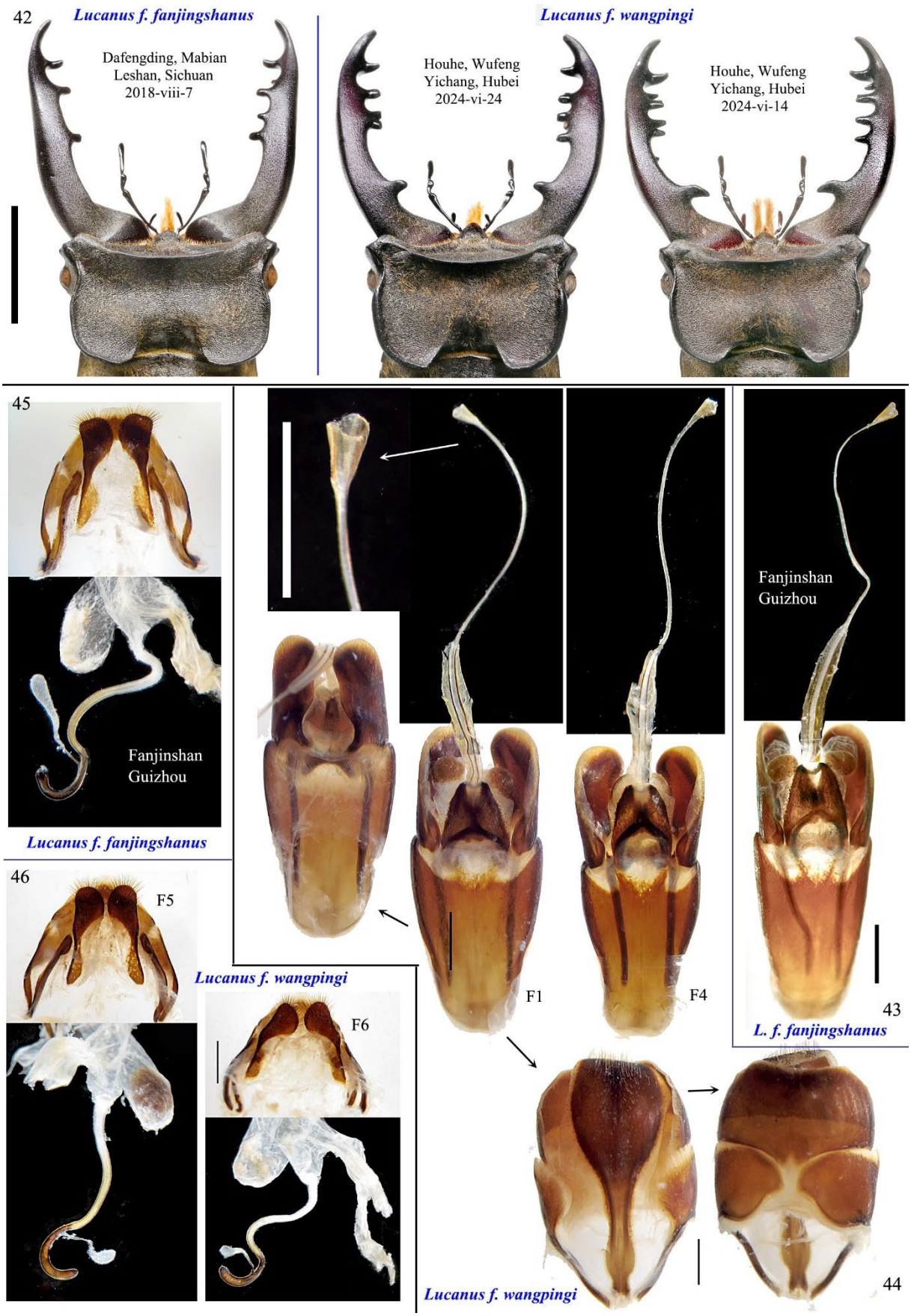
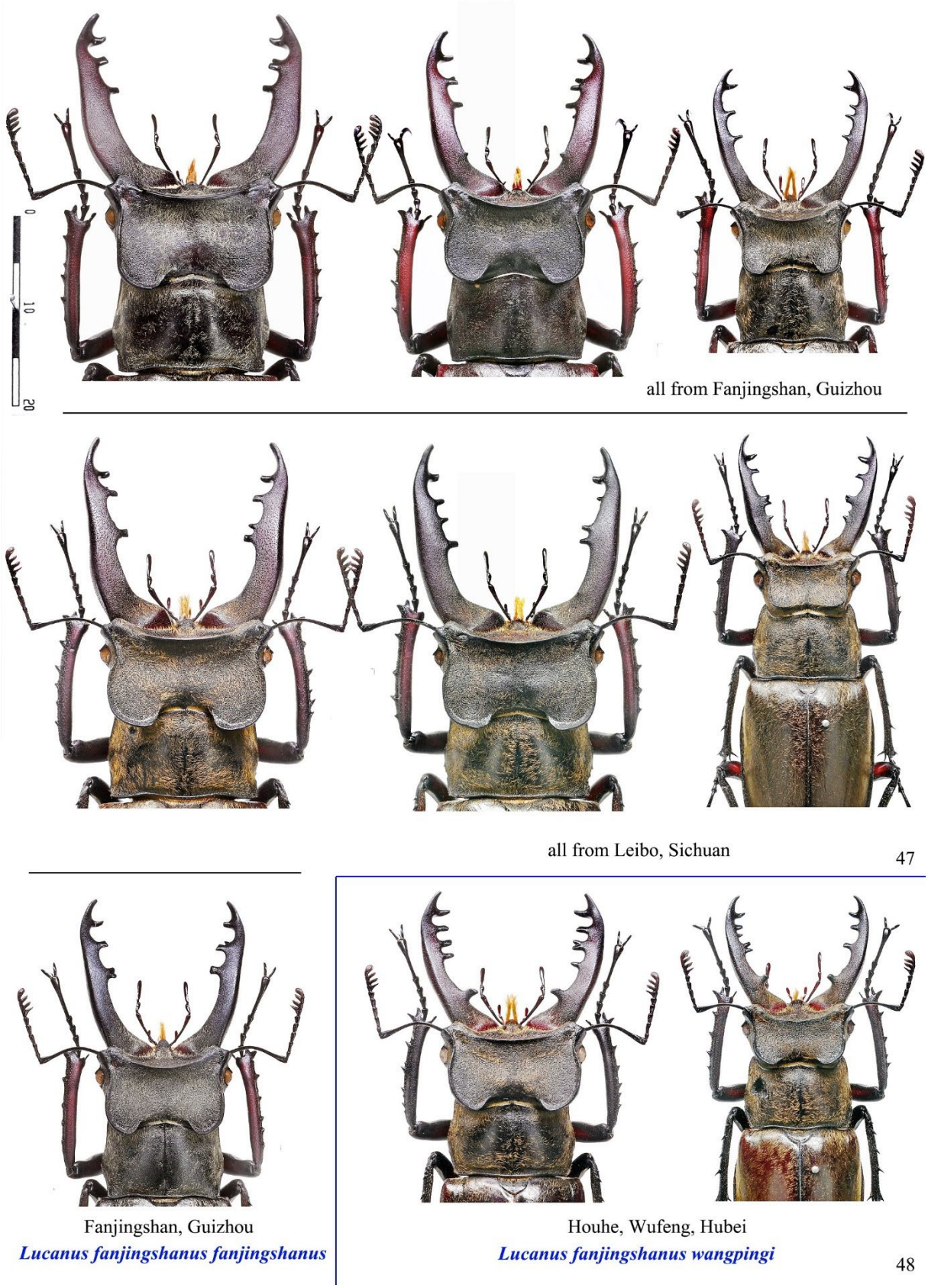


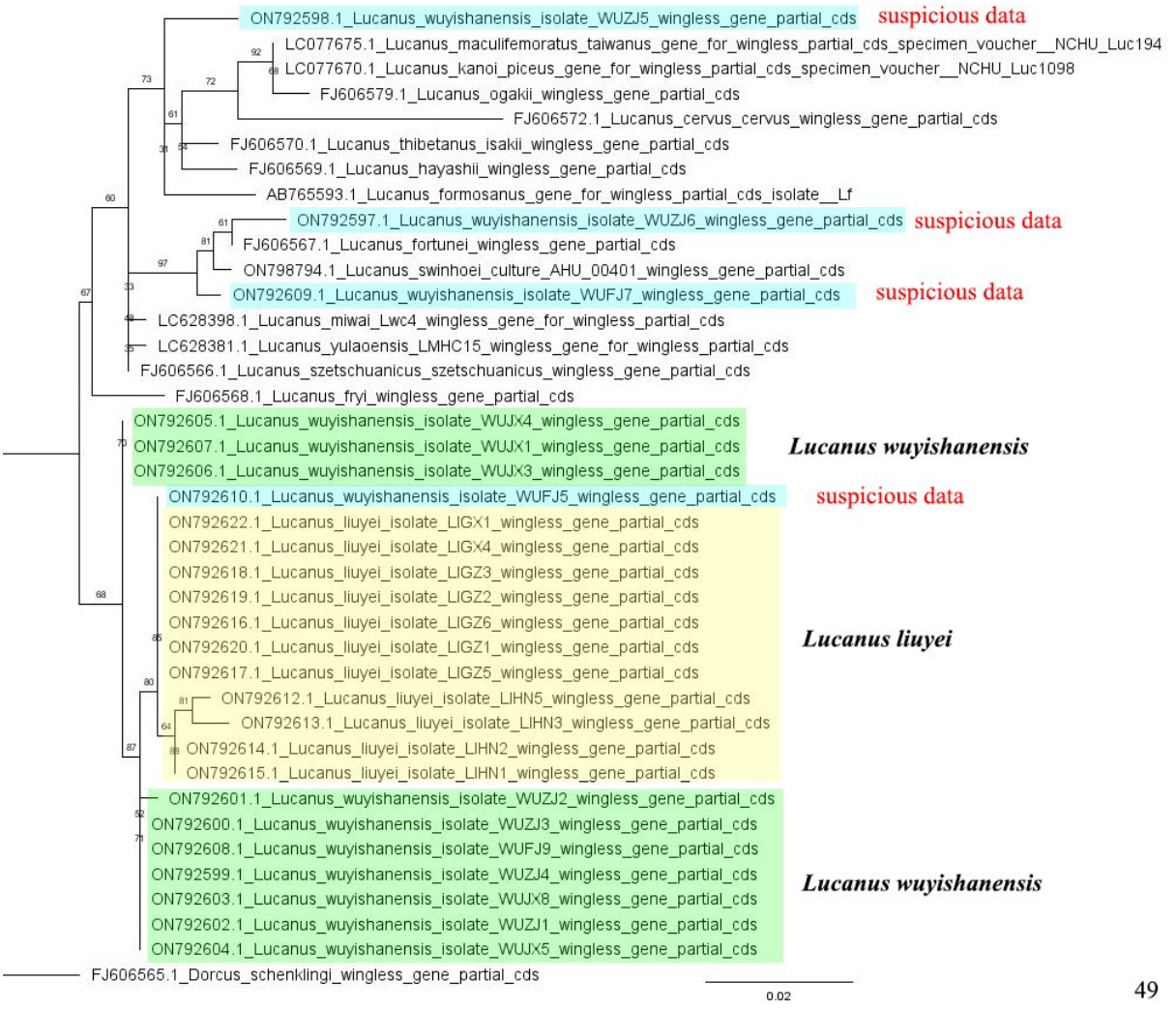
FIGURE 41. Habitus of *Lucanus fanjingshanus wangpingi*.



FIGURES 42-46. Male head, male genitalia and female genitalia of *Lucanus fanjingshanus*.



FIGURES 47-48. Male head and pronotum of *Lucanus fanjingshanus* at same scale.



		1	2	3	4	5	6	7	8	9	10	11	12
1	N_zhilini												
2	N_rufus	0.011											
3	N_castanopterus	0.014	0.003										
4	N_liuzhei	0.183	0.183	0.183									
5	N_donckeri	0.020	0.020	0.024	0.188								
6	N_vicinus	0.014	0.003	0.000	0.183	0.024							
7	N_armatus	0.037	0.033	0.033	0.182	0.031	0.033						
8	N_nitidus	0.033	0.033	0.037	0.176	0.031	0.037	0.049					
9	N_robustus	0.029	0.029	0.033	0.174	0.031	0.033	0.045	0.049				
10	N_tao	0.031	0.027	0.027	0.185	0.026	0.027	0.043	0.012	0.047			
11	N_baladeva	0.182	0.176	0.182	0.185	0.171	0.182	0.172	0.177	0.179	0.180		
12	N_waterhousei	0.177	0.171	0.177	0.196	0.171	0.177	0.174	0.177	0.180	0.180	0.014	

50

FIGURE 49-50. 49- Phylogenetic tree of *Lucanus* species inferred from maximum likelihood analysis of 444 bps of the wingless gene. 50- The Kimura 2-parameter COI distance between samples of *Neolucanus*.

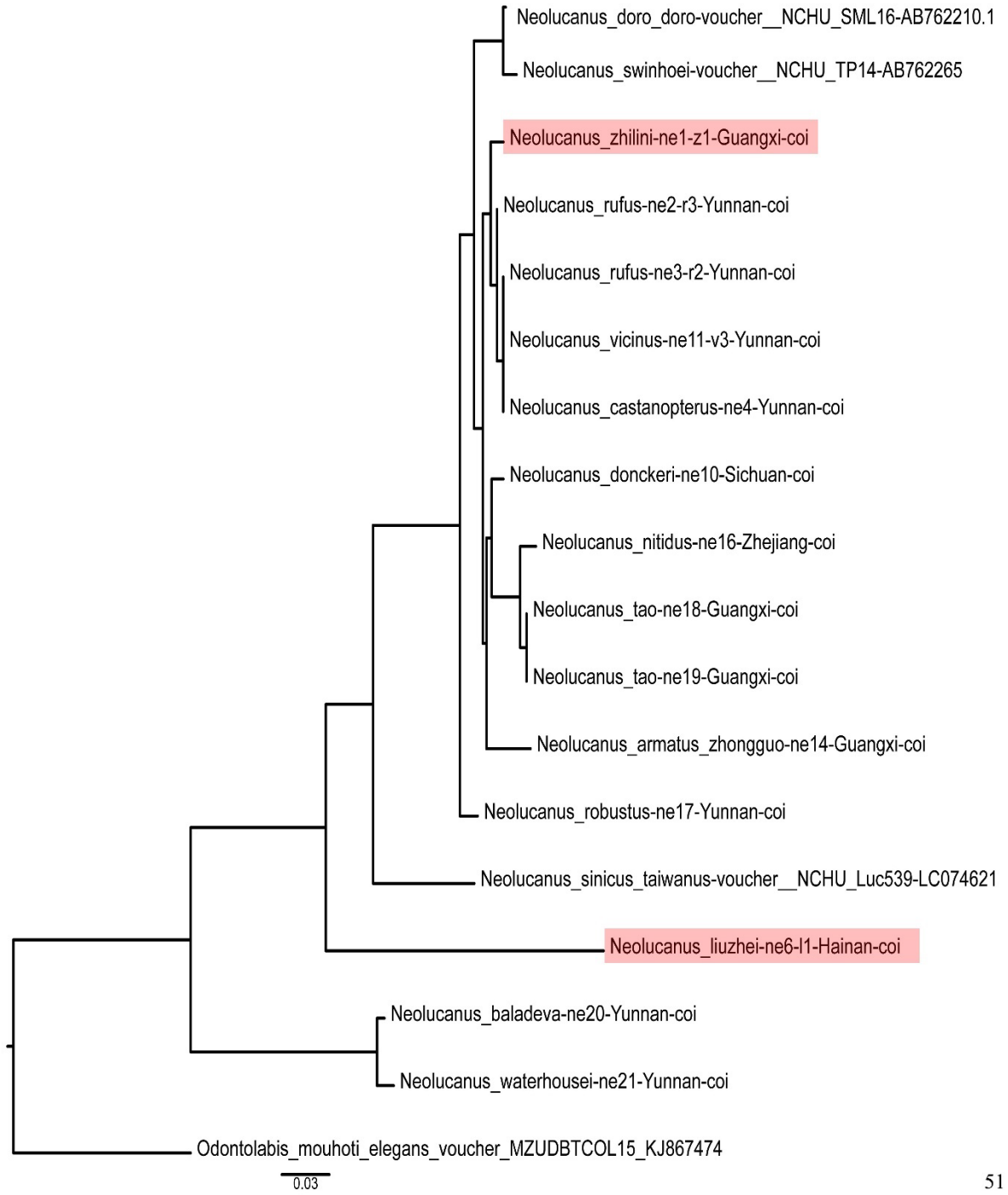


FIGURE 51. Phylogenetic tree of *Neolucanus* species inferred from maximum likelihood analysis of 565 bps of the COI gene.

Notes on the genus *Neolucanus* with description of new taxa (*Coleoptera, Lucanidae*)

Klaus-Dirk Schenk

Abstract

Neolucanus yunnanensis spec. nov. from Xima area of Yunnan Province, China, *Neolucanus fridoi* spec. nov. from Hà Giang Province, Vietnam, *Neolucanus chinhillensis* spec. nov. from north-west Myanmar, Chin Hills *Neolucanus castanopterus laoticus* sspec. nov. from Laos, *Neolucanus puchneri* spec. nov. from Laos and *Neolucanus alfredi* from Laos are described, figured and compared with related taxa. *Neolucanus suzumurai* Fujita, 2010 is identified as a synonym of *Neolucanus chiangmaiensis* Schenk, 2006.

Key words

Coleoptera, Lucanidae, *Neolucanus yunnanensis, Neolucanus baladeva, Neolucanus chinhillensis, Neolucanus fridoi, Neolucanus castanopterus laoticus, Neolucanus puchneri, Neolucanus alfredi, Neolucanus chiangmaiensis, Neolucanus suzumurai,* China, Yunnan, India, Vietnam, Myanmar, Laos, new taxa.

Introduction

The genus *Neolucanus* Thomson, 1862 is restricted to Asia. About 100 species and subspecies are distributed from the Himalaya mountains to the Sunda Islands. Some taxa are very localised and scarce, other are common. The genus was reviewed by Schenk (2014). *Neolucanus atayal* Lin & Chou, 2021 and *Neolucanus yemaoi* Wang & He, 2024 have been described after this review. The new species *Neolucanus liuzhei* and *Neolucanus zhilini* are described by Hunang & Chen in this journal. Following further new taxa of the genus *Neolucanus* are described.

Neolucanus yunnanensis spec. nov.

In 2022 the author did receive a male *Neolucanus* specimen collected at Xima, Yingjiang, Yunnan Province of China looking similar to *Neolucanus baladeva* from India. Later he could acquire further 6 males from the same locality in Yunnan. The careful examination of those specimens and the comparison with 30 ♂ of *N. baladeva* (Hope, 1842) from India (Meghalaya, Darjeeling) confirmed that the specimens from Yunnan are representing a new species described herein as *Neolucanus yunnanensis*.

Holotype. ♂, China, Yunnan Province, Yingjiang, Xima, ca. 1000m, VIII. 2021, local collector, in coll. Dr. K. - D. Schenk, Wehretal, Germany.

Paratypes. 4 ♂, same collecting data, 2 ♂, China, Yunnan Province, Yingjiang, Xima, VI.2020, local collector, all in in coll. Dr. K. - D. Schenk, Wehretal Germany.

Etymology. The name is indicating to the type locality Yunnan Province, China.

Description and diagnosis

♂ holotype (Fig. 1), total length 63,6 mm, length of mandibles 11,2 mm, head width 20,4 mm, prothorax width 25,6 mm, prothorax length 15,1 mm, elytra width 24,3 mm, elytra length 32,1 mm. Total length of the ♂ paratypes 54,3 - 64,1 mm.

Neolucanus yunnanensis spec. nov. has been compared with 30 males of *N. baladeva* from India (25 ♂ Meghalaya, Khasi Hills, 4 ♂ West Bengal, Kurseong and 1 ♂ Darjeeling). It differs by the following morphological characters from the similar *Neolucanus baladeva:*

- Entirely black, head dull, pronotum moderate shining, elytra very shining (*N. baladeva*: body blackish brown, elytra dark reddish brown, blackish brown near scutellum, sides of pronotum entirely opaque).
- Body more elongate and more parallel-sited compared to *N. baladeva*.
- Margins of elytra densely covered with short, yellow hairs (*N. baladeva*: elytra almost devoid of hair or setae).
- Upper surface of mandibles rounded (*N. baladeva*: mandibles above more carinated).
- Mandibles without a well-defined uprising tooth (*N. baladeva*: the carina of mandibles of bigger males is elevated into a sharp erect tooth).
- Canthi more prominent and more sharply angular laterally compared to *N. baladeva*.
- Median angles of prothorax less spiniform.
- Anterior tibia with 5-6 acute teeth (*N. baladeva* 3-5 teeth).

The ♀ of Neolucanus yunnanensis spec. nov. is unknown to the author.

Fig. 1: ***Neolucanus yunnanensis*** spec. nov., ♂ holotype (63,6 mm), China, Yunnan, Jingjiang, Xima

Discussion

The type locality of *Neolucanus baladeva* (Hope, 1842) is Sylhet (now northern Bangladesh) and the species is known today from India (Meghalaya, Sikkim, West Bengal, Arunachal Pradesh), West Nepal, Bhutan and Myanmar. Reports from China, Yunnan are obviously misidentifications of the new species *N. yunnanensis*. The author has never seen *N. baladeva* from Thailand (reported in the internet).

Fig. 2: ***Neolucanus baladeva***, ♂ (63,6 mm) and ♀ (51,4 mm), N India, West Bengal, Kurseong, VI.-VII.1956, Sircar leg

Neolucanus fridoi spec. nov.

The author recently got 5 *Neolucanus*-specimens from Vietnam, Hà Giang Province. The comparison with similar taxa of the genus *Neolucanus* revealed that the specimens are representing a new species which is described here as *Neolucanus fridoi.*

Holotype. ♂, Northern Vietnam, Hà Giang Province, Dong Van Distr., Ta Pin VI. 2023, local collector, in coll. Dr. K. - D. Schenk, Wehretal, Germany.

Paratypes. 4 ♂, same collecting data, all in coll. K. - D. Schenk, Wehretal Germany.

Etymology. The name is dedicated to Frido, a grandson of the author.

Description and diagnosis

♂ holotype (Fig. 3), total length 34,5 mm, length of mandibles 4,5 mm, prothorax width 11,8 mm, elytra width 12,8 mm, elytra length 18,0 mm. Total length of the ♂ paratypes 31,5 mm – 34,9 mm. Head, mandibles and prothorax black, totally dull. Elytra orange brown with anterior 1/3, suture and lateral margines black. The transition from black to orange is irregular. The surface of the head is smooth. The vertex is concave and slightly depressed. The eyes are completely divided by the parallel sited canthi.

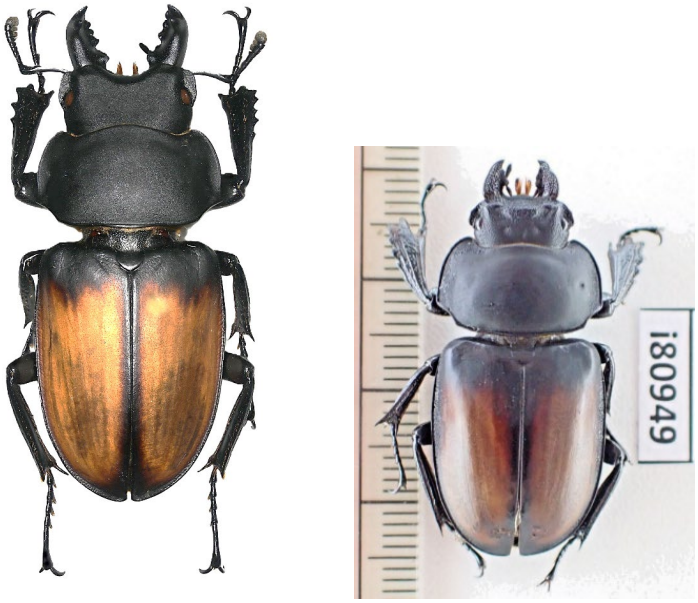


Fig. 3: ***Neolucanus fridoi*** spec. nov., ♂ holotype (34,5 mm), Vietnam, Hà Giang Province and ♀ seen on the internet

The mandibles are about as long as the head, regularly bend inside and strongly curved upward. There are 5-6 irregular teeth at the inner margin and a vertical fork with an uprising apical tooth. The antennal clubs are formed by 3 lamellate antennomeres. The pronotum is dull same as the head. The lateral margines are convex, the median angles are not acute same as the posterior angles. The elytra are elongate oval shaped, about as wide as the prothorax. The surface is smooth and dull. The protibia have 3 teeth behind the apical fork. The other tibias are without teeth. The downside is black; more shining than the ventral surface The mentum is covered by dark orange hairs.

The author has seen a ♀ of the new species on the internet characterised by the same colour than the ♂ (Fig. 3).

Discussion

N. fridoi spec. nov. belongs obviously to the *Neolucanus sinicus* species group which is characterised by a matt surface of the body and mandibles with a vertical fork. *N. fridoi* can be easily distinguished from the other taxa of this group by the characteristic coloration of the elytra, the shape of mandibles, the smaller body size etc.

Neolucanus chinhillensis spec. nov.

This *Neolucanus* from northwest Myanmar, Chin Hills is known for many years but is still an unnamed and undescribed taxon (compare Yi, 2023, plate 136, 862-1 and 862-2).
The author has now carefully examined several *Neolucanus* specimens from West Myanmar, Chin Hills (11 ♂ and 9 ♀) and describes and names the taxon as *Neolucanus chinhillensis.*

Fig. 4: ***Neolucanus chinhillensis*** spec. nov., ♂ holotype (47,9 mm) and ♀ allotype (41,3 mm), NW Myanmar, Chin Hills

Holotype. ♂, Northwest Myanmar, Chin Hills, Kennedy peak, 800-1000m, 10.-25. VIII. 1999, local collectors, in coll. Dr. K. - D. Schenk, Wehretal, Germany.

Paratypes. 10 ♂ and 9 ♀, same collecting data, in coll. Dr. K. - D. Schenk, Wehretal Germany.

Etymology. The species is named after its type locality Chin Hills, northwest Myanmar.

Description and diagnosis

♂ holotype (Fig. 4), total length 47,9 mm, length of mandibles 7,6 mm, prothorax width 18,5 mm elytra width 19,1 mm, elytra length 24,2 mm.

Total length of the ♂ paratypes 42,8 – 48,2 mm.

Body chestnut brown, head, mandibles, centre of prothorax, suture of elytra and downside darker. Head and mandibles dull and smooth, prothorax and elytra shining. The surface of the head is smooth. The vertex is concave. the eyes are completely divided by the acute but not spiny canthi.

Mandibles are about as long as the head, first slightly concave, incurved and upcurved at tip but without an uprising tooth. Inner margines with 5 irregular teeth. The antennal clubs are formed by 3 lamellate antennomeres. The lateral margines of the prothorax are convex, the median angles distinct but not spiny. The elytra are oval, about as wide as the prothorax. The surface is smooth. Protibia with 5 lateral spines.

N. chinhillensis spec. nov. can be separated easily from *N. baladeva* by the following external characters:

- Body significant smaller.
- Colour of elytra brighter.
- Body totally smooth without any hairs or setae.
- Mandibles without an uprising tooth.

♀ allotype (Fig. 4), total length 41,3 mm.
♀ almost same characters of the body than ♂, but elytra darker and less bright.

Total length of the ♀ paratypes 34,6 – 42,4 mm.

Discussion

In the past *Neolucanus chinhillensis* spec. nov. was sometimes misidentified as *Neolucanus waterhousei*. But *N. waterhousei* has been described from Sikkim, a location far away from Chin Hills. Boileau (1899) named in a short description a male specimen as *Neolucanus waterhousei* regarded before as the male of *Neolucanus marginatus by* Waterhouse 1872 without any description or figure. *N. waterhousei* is regarded today by most entomologists as a synonym of *N. baladeva* and remains in the opinion of the author an uncertain taxon (species incertae sedis).

Fujita (1999) figured a ♀ of *N. chinhillensis* from Myanmar, Chin Hills, Kennedy Peak but regarded it wrongly as a ♀ of *Odontolabis* and Yi (2023) figured a pair from Myanmar, Chin as *Neolucanus* spec. (plate 136, 862-1 and 862-2).

Neolucanus castanopterus laoticus sspec. nov.

The author has examined 10 *Neolucanus*-specimens from northern Laos, Mt. Phu Phan identical with the *Neolucanus castanopterus* sspec. figured by Yi (compare Yi, 2023, plate 133, 836c-1).

The comparison with *Neolucanus castanopterus* revealed that the specimens are representing a new subspecies described here as *Neolucanus castanopterus laoticus.*

Holotype. ♂, N Laos, Houaphan province, near Phon Xai, Mt. Pan (Phu Phan), 2060m, VI. 2013, local collector, in coll. Dr. K. - D. Schenk, Wehretal, Germany.

Paratypes. 9 ♂, same collecting data, all in coll. Dr. K. - D. Schenk, Wehretal Germany.

Etymology. The name is referring to the country of origin, Laos.

Fig. 5: ***Neolucanus castanopterus laoticus*** sspec. nov., ♂ holotype (35,1 mm), North Laos, Mt. Phu Phan

Description and diagnosis

♂ holotype (Fig. 5), total length 35,1 mm, length of mandibles 4,7 mm, prothorax width 12,7 mm, elytra width 14,1 mm, elytra length 18,0 mm.
Total length of the ♂ paratypes 29,5 – 35,6 mm

Neolucanus castanopterus laoticus sspec. nov. differs from *N. castanopterus castanopterus* and the known subspecies by the following external features:

- Body more elongate.
- Elytra brighter and without or reduced small black band at anterior margin.
- Mandibles slightly longer.
- Anterior tibia longer.

N. castanopterus laoticus sspec. nov. can be separated easily from the somewhat similar *N. vicinus* Pouillaude, 1913 by the significantly more shining pronotum and elytra.

The ♀ of *N. castanopterus laoticus* sspec. nov. is unknown to the author.

Discussion

Neolucanus castanopterus is widely distributed and is divided in the following subspecies:

- *Neolucanus castanopterus castanopterus* Hope, 1831
  Nepal*, Bhutan, India (Assam, Sikkim, Uttar Pradesh)
- *Neolucanus castanopterus melas* Didier, 1930
  (Naga Hills*, Meghalaya)
- *Neolucanus castanopterus elongatulus* Möllenkamp, 1907
  China (Yunnan*), Vietnam
- *Neolucanus castanopterus flavipennis* Boileau, 1914
  Myanmar*, Thailand
- *Neolucanus castanopterus kinrami* Nagai, 2000
  Myanmar (Kachin*)
- *Neolucanus castanopterus laoticus* Schenk, 2024
  N Laos*, Vietnam (?)

Yi (2023) figured a ♂ of *N. castanopterus laoticus* sspec. nov. from N. Laos as *N. castanopterus* sspec. (plate 133, 836c-1).

Neolucanus puchneri spec. nov.

The author recently had the opportunity to examine numerous *Lucanidae* from Laos. Among the specimens were a very small pair of *Neolucanus*, which upon closer inspection turned out to be a new species and is described here as *Neolucanus puchneri*.

Fig 6: ***Neolucanus puchneri*** spec. nov., ♂ holotype (23,8 mm) and ♀ allotype(25,6 mm), Laos, Xiangkhouang Province, Poungchou

Holotype. ♂, Laos, Xiangkhouang Province, Poungchou, 1355m, 19°57`17`` N, 103°42`12``E, VIII-XI 2019, Keomalavong leg., in coll. Dr. K. - D. Schenk, Wehretal, Germany.

Paratypes. 1 ♀, same collecting data, in coll. Dr. K. - D. Schenk, Wehretal Germany.

Etymology. The new species is named after the dedicated entomologist Alfred Puchner from Austria, who provided the type material.

Description and diagnosis

♂ holotype (Fig. 6), total length 23,8 mm.

Very small species with an oval body. Completely black, moderately shiny and smooth. Head transverse, front edge convex, the canthi do not separate the eyes completely, the postocular processes are clearly pronounced. The mandibles are shorter than the head and moderately curved inwards. There are 5-6 small teeth on the inside of the mandibles.

The sides of the prothorax are convex, the medial angles are rounded and the posterior angles are rather acute but not spiny. The elytra are oval and slightly smoother than the head and prothorax. The prothibiae have an elongated terminal fork and 4 lateral spines. The mentum is semicircular and bare.

♀ allotype, total length 25,6 mm.

Color and structure of the body similar to the male. Head and mandibles clearly punctured. Mandibles curved inside, inner margins with 2 blunt teeth. Anterior tibiae widened, strongly punctured and with 4 lateral spines.

The male *of N. puchneri* spec. nov. can be distinguished from all other small *Neolucanus* taxa by the form of mandibles, the postocular processes and the incomplete separation of the eyes by the canthi. The female was collected together with the male.

Neolucanus alfredi spec. nov.

The 2 males and 3 females of this new species from the same location in Laos as the before described *N. puchneri* were also provided by A. Puchner.

Fig 7: ***Neolucanus alfredi*** spec. nov., ♂ holotype (59,1 mm) and ♀ allotype (50,6 mm), Laos, Xiangkhouang Province, Poungchou, for comparison: ***Neolucanus giganteus***, ♂, North Vietnam, Tam Dao.

Holotype. ♂, Laos, Xiangkhouang Province, Poungchou, 1355m, 19°57`17`` N, 103°42`12``E, VIII-XI 2019, Keomalavong leg., in coll. Dr. K. - D. Schenk, Wehretal, Germany.

Paratypes. 1 ♀, same collecting data, in coll. Dr. K. - D. Schenk, Wehretal Germany, 1 ♂ and 2 ♀, same collecting data, in coll. Alfred Puchner, Oberdanegg, Austria.

Etymology. This new species is named after the surname of Alfred Puchner from Austria.

Description and diagnosis

♂ holotype (Fig. 7), total length 59,1 mm, total length of the ♂ paratype 60,0 mm.

Neolucanus alfredi spec. nov. can be classified between *Neolucanus giganteus* Pouillaude, 1914 from North Vietnam (Fig. 7) and *Neolucanus katsuraorum* Tsukawaki, 2011 from South Vietnam.

It can be separated from *N. giganteus* by the following external morphological characters:

- Body totally black, less elongate, less shining (elytra of N. giganteus more or less reddish brown).
- Mandibles shorter, stronger carinated dorsal. Carina at the base of the mandible convexly arches inwards.
- Epistome semicircular (N. giganteus bilobed).
- Tips of the canthi spinier, directed slightly forward.
- Central angles and posterior angles of the prothorax sharper.
- Anterior tibiae with 5-6 spines (N. giganteus 3-4 spines).

Neolucanus alfredi spec. nov. can be easily distinguished from *N. katsuraorum* by the absence of the uprising tooth at the base of the mandible.

♀ allotype (Fig. 7), total length 50,6 mm, total length of the ♀ paratypes 44,9 and 50,0 mm. ♀ same colour and almost same characteristics of the body than ♂.

Neolucanus chiangmaiensis Schenk, 2006 =
Neolucanus suzumurai Fujita, 2010 **syn. nov.**

Neolucanus chiangmaiensis Schenk, 2006 has been described from North Thailand, Chiang Mai area (SCHENK, 2006) and *Neolucanus suzumurai* Fujita 2010 from North Thailand, Chiang Mai Pov., Doi Inthanon (FUJITA, 2010). W. Pathomwattananurak from Thailand recently examined several *Neolucanus* specimens from Chiang Mai and found out that *N. suzumurai* has a quite high variation from completely black to slightly pale yellow/orange striped elytra.

In his opinion *N. suzumurai* should be regarded as a junior synonym of *N. chiangmaiensis* (personal communication). The author did compare the Type of *N. chiangmaiensis* with a specimen determined as *N. suzumurai* (Fig. 8) and angry with this diagnosis and place *N. suzumurai* as junior synonym of *N. chiangmaiensis* (**syn. nov.**).

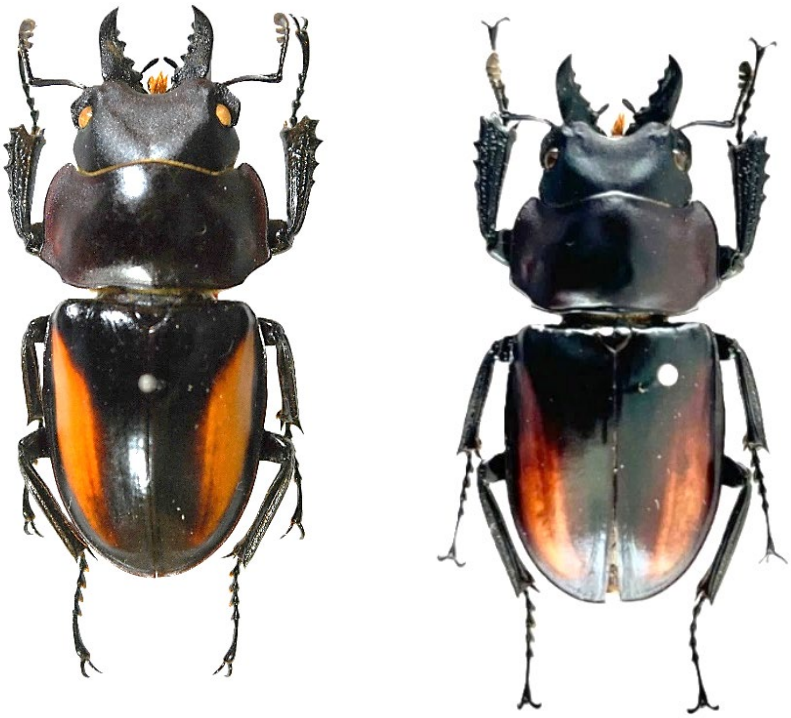


Fig. 8: ***Neolucanus chiangmaiensis*** Schenk, 2006, ♂ holotype (41,3 mm),
Thailand, Chiang Mai area (left),
Neolucanus suzumurai, Fujita, 2010, ♂ (40,5 mm)
Thailand, Doi Inthanon (right)

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