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ORIGINAL ARTICLE

Taxonomic notes on some species of *Neolucanus* Thomson (Coleoptera: Lucanidae) from China

Qian Zhang, Yang Ge, Yuanyuan Wu, Xia Wan*

Department of Ecology, School of Resources & Engineering, Anhui University, Hefei 230601, China
**Corresponding author, E-mail: wanxia@ahu.edu.cn*

Abstract As a part of ongoing investigations on *Neolucanus* from Chinese fauna, *N. swinhoei hengshanensis* Ichikawa & Fujita, 1987 is confirmed as a junior synonym of *N. imitator* Kriesche, 1935 based on the types examination. Holotype of the little-known species of *N. tao* Kriesche, 1935 and the male genitalia are illustrated for the first time, in comparison with the sympatric species of *N. guangxi* Schenk, 2009. Wrong diagnoses of *N. nitidus* (Saunders, 1854) are pointed out in two widely used books published by Japanese researchers. In order to correct these errors, type specimen of this species and its intraspecific variations are exhibited, with brief discussion on its problematic subspecies. The poorly known species of *N. pallescens* Leuthner, 1885 is redescribed with the discovery of its false type specimen. All of the type habitus, figures of male genitalia including female genitalia are given.

Key words Coleoptera, Lucanidae, *Neolucanus*, taxonomic notes, China.

1 Introduction

The genus *Neolucanus* Thomson is mainly distributed in the Oriental Realm. More than 80 species and subspecies have been recorded in the world. The earlier systematic research of *Neolucanus* was in the monograph of Leuthner (1885) on Odontolabinae, with the descriptions of 14 species. After this work, many species of this genus were published from Indo-China Region (Didier & Séguy, 1953; Benesh, 1960; Mizunuma & Nagai, 1994; Krajcik, 2001, 2003; Bartolozzi & Spercher, 2006). The latest identifications of this genus were in the book of Fujita (2010), in which 68 species and subspecies were illustrated. In the field, this kind of stag beetles can recognize by the shiny color (dark, yellow, or reddish), large size (40–60 mm long), convex body and slightly rounded elytra. Mandibles of most of species are relatively short, slightly longer or no more than the length of head. Usually, male mandibles are stout and thick being the dorsally upper and ventrally lower margin. Merely mandibles of large and medium-sized males are longer than the length of head in few species, such as *N. permarmatus* Didier, 1925 and *N. brochieri* Bomans & Miyashita, 1997. In spite of their large size and easy recognition in Chinese fauna, most of them are not easy to determine the taxonomic position due to their remarkable intraspecific variation including extremely different body color patterns. As Leuthner wrote in his monograph, “The study of types is more important in the Lucanidae than in almost any other group, for without this assistance many riddles would remain insoluble”.

There is a rich species diversity of *Neolucanus* in China. So far, more than 40 species and subspecies are known from this region (Wan & Yang, 2007; Wan *et al*., 2010). Taxonomic studies of them are difficult because most of them are controversially polytypic taxa, which often have a large number of problematic subspecies.

In this paper, taxonomic notes are given to discuss some species in *Neolucanus* from China based on type examinations. Types of two poorly known species of *N. tao* and *N. imitator*, their intraspecific variations are illustrated for

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the first time. The subspecies of *N. swinhoei hengshanensis* is confirmed as a junior synonym of *N. imitator*. The comparisons between *N. tao* and its sympatric species of *N. guangxi* are given to distinguish them. Type of *N. nitidus* in the OXUM, its intraspecific variations and male and female genitalia are figured for the correct identification of this species. Also, a specimen with type labels of the particularly little known species *N. pallescens* is found in the MNHN. However, morphology of the medium-sized male is not consistent with the original description, which could prove that it is not the real type of this species. Fortunately, the original description and figure of this species are very clear so that we could diagnose some materials as *N. pallescens* from Guangdong and redescribe it with the first illustration of male genitalia.

2 Materials and methods

Terminology used here is referred to the work by Holloway (2007). Measurements are in millimeters (mm). Abbreviations are used for morphology:

AG—accessory gland;
BC—bursa copulatrix;
BP—basal piece;
HS— hemisternite;
ML—median lobe;
MO—median oviduct;
PA—paramere;
PES—permanently everted internal sac;
S— spermatheca;
SD—spermathecal duct;
SG—spermathecal gland;
Materials studied in this work from the following institution:
BMNH—The Natural History Museum, London, UK;
MAHU—Museum of Anhui University, Hefei, China;
MNHN—The Museum National d' Histoire Naturelle, Paris, France;
MZUF—Zoological Museum 'La Specola', University of Florence, Firenze, Italy;
MZAFU—Museum of Zhejiang Agriculture & Forestry University, Hangzhou, China;
MNAFU—Museum of Northwest Agriculture & Forestry University, Xi′an, China;
NZMC—National Zoological Museum of China. Beijing, China;
OXUM—Oxford University Museum of Natural History, Oxford, UK;
SMTD—Staatliches Museum für Tierkunde, Dresden, Germany;
SYSUC—Collection of Sun Yat-Sen University, Guangzhou, China.

3 Taxonomy

Genus *Neolucanus* Thomson, 1862

Neolucanus Thomson, 1862. *Ann. Soc. Ent. Fr*., 2 (4): 415. Type species: *Odontolabis baladeva* Hope, 1842.

Lucanus (*Odontolabis*) Hope & Westwood, 1845. *Cat. Lucan. Coleop*.: 5 (nec Hope, 1842). Type species: *Lucanus delesserti* Hope. (nec Guérin-Méneville, 1839). Some species in the current *Neolucanus* had been placed under this subgenus.

Anoplocnemus Burmeister, 1847. *Handb. Ent.*, 5: 357. Type species: *Lucanus alces* Fabricius, 1775. Hope (1843: 279) firstly used it for a monotype species *Anoplocnemus burvicisleri*. Parry (1864: 12) proposed this species as a synonym of *Odontolabis cuvera* (Hope, 1842). The name was also occupied by *Anoplocnemis* Stål in Hemioptera in 1873.

Odontolabris Saunders, 1854. *Trans. Ent. Soc. Lond. (N. S.)*, 3 (2): 47. It was most likely a clerical error or a misprint.

Anodontolabis Parry, 1863. *Trans. Ent. Soc. Lond*., 1 (3): 447. Type species: *Odontolabis baladeva* Hope, 1842. The name was synonymized by Leuthner (1885: 420).

Calcodes Arrow, 1935. *Trans. R. Ent. Soc. Lond.*, 83 (1): 107. Some species in *Neolucanus* were moved into *Calcodes* by Arrow, which was not completely as same as the genus *Calcodes* Westwood, 1834.

Remarks. In the field, members of *Neolucanus* can distinguish from those of *Odontolabis* by external characters. In *Neolucanus*, head in male is relatively small, shorter and narrower than the pronotum, postocular margins often distinctly convex without sharp spine; hind angles of pronotum in female is obtuse, mentum has long and dense hairs or a pair of ridges on the surface. While in *Odontolabis*, head in male is large, longer and broader than the pronotum, post-ocular margins convex with very sharp spines; hind angles of pronotum in female is sharp, mentum looks flatten, often with very sparse hairs. However, few species in the two genera are so similar in the external morphology that they are difficult to differ. Such as the large male of *N. pallescens* resembles to the medium-sized and small male of *O. sinensis*, their females are also very similar to each other. Male and female genitalia of the two genera are also present highly structural similarities. They have close phylogenetic relationship due to their morphology. Systematics of the two genera, including other allied genera, *Calcodes* and *Heterochthes* (in the catalogue of Parry, 1864: 17) are in need of detailed study in future.

***Neolucanus tao* Kriesche, 1935** (Figs 1–4, 43–45)

Neolucanus tao Kriesche, 1935. *Koleop. Rundsch.*, 21: 170.

Neolucanus taos Benesh, 1960. *Coleop. Cat.*, 8 (Suppl.): 125 (lapsus calami).

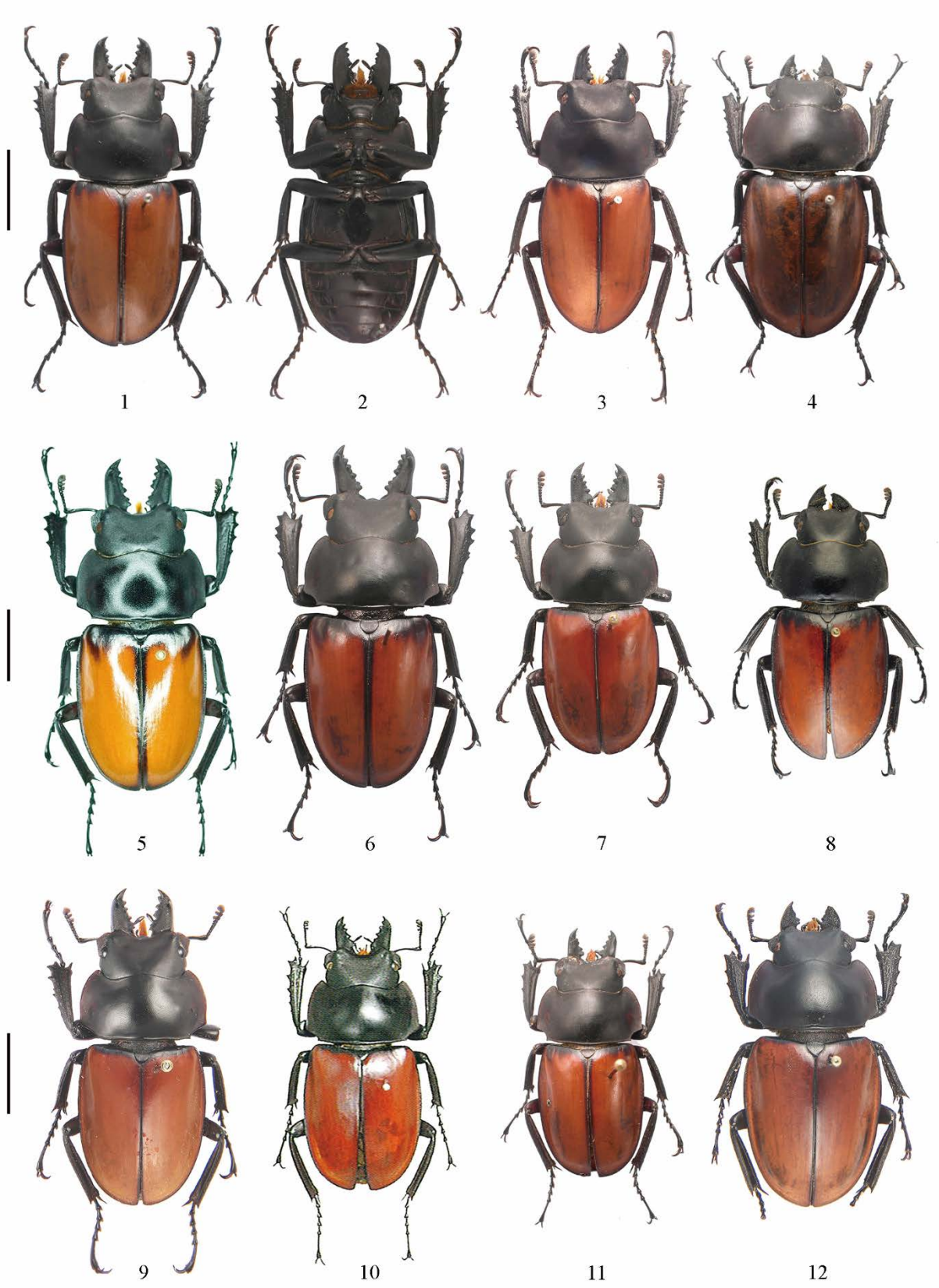
Length (including mandible) 36.0–40.0 mm. Width 13.0–15.0 mm. Surface. Dark except for partly reddish brown elytra (Figs 1–4). Main surface smooth, small punctures presented on mandibles and the surrounding of eyes; legs with large and dense punctures. Head. Almost rectangular, gloomy, about 2.6 times wider than long. Anterior margin concaved at middle, frontal region shallowly depressed with a large triangular depression. Vertex slightly raised. Male mandibles. Curved at middle, about 1.4 times the length of head in large male. The apex sharp, slightly curved inwards. A large, upwardly erected sub-apical tooth presented on the upper margin. Other 6–7 small sharp teeth serrated along the lower margin from the base to the apex. Female mandibles. Much shorter than the length of head, covering with punctures; the apex sharp and curved inwards; the sub-apical tooth absent on the upper margin, 2–3 small blunt teeth presented at the middle of the lower margin. Eyes. Large, little produced, completely divided into the upper and lower part by canthi. Canthi laminated and expanded, almost equilaterally triangular with a rounded apex angle in male; those of female almost semicircular. Post-ocular margins slightly swollen and short, about as long as the half of the head length. Mentum. Almost semicircular, the anterior angles rounded, covering with long yellow brown hairs. Labrum. Small, triangular in male and almost semicircular in female. Antennae. Club 3-segmented, terminal segment totally pubescent, other 2 segments partially pubescent. Scape slightly curved, pedicel approximately symmetrical. The 3rd, 4th, 5th segment almost equal, the 7th segment with 3–4 apical setae. Pronotum. Transverse, about 1.8 times wider than long; about 2.1 times the length of head. Disc gently convex. Anterior margin sinuated, sharply projected at middle. Front angles relatively blunt. Lateral margins slightly divergent on 3/4 anteriorly, then strongly convergent on 1/4 posteriorly and meet the posterior margins. Hind angles sharp. Scutellum. Wider than long, blunt heart-shape, scattered with small punctures. Elytra. More shiny than head and pronotum; quite convex, about 1.4 times longer than wide, about as wide as that of pronotum at the widest. Mainly reddish brown except for the basal part around the shoulders, elytral suture and outer margins dark. Wings. Fully developed. Legs. Front tibiae very stout, narrow at base, strongly expanded and forked at apex, with 3–5 small teeth laterally; spurs sub-cylindrical and curved, short in male. Middle and hind tibiae moderately stout, the apex not expanded strongly, lateral tooth absent except for spines at apex. Aedeagus (Figs 43–44). BP moderately stout, about 1.4 times the length of PA; the 3/4 proximal part closed to PA broad, the distal 1/4 part narrow and sharp. PA relatively long with almost straight outer margins; the apex bluntly rounded from the dorsal view, but sharp from the lateral view. ML distinctly asymmetric; the left lobe slightly longer than the right one. PES quite stout, about 2.2 times the total length of BP+PA; main outer surface of PES smooth and membranous, covering with short dense dark brown hairs from the middle to the apical part. Female genitalia (Fig. 45). HS strongly sclerotized, the anteriorly 4/5 part plate-liked, almost rectangular with rounded distal margin; the posteriorly 1/5 part stoutly stick-liked, thin and slightly oblique. AG pale, slender. MO brown, short and stout. BC long, stout, tubiform and longitudinally folded. SD dark brown, joining in BC and distinctly expanded. S situated at the apex of SD, bulb-shaped symmetrically with rounded apex. SG absent.

Type material examined. Holotype of *Neolucanus tao*, ♂ (Figs 1–2), in SMTD, labelled: type 1 (red lable) / China, Province Kwangsi, Mt. Toyenchan / *Neolucanus tao* K. Type! (handwritten) / 1961 / Sammlung Kriesche Ankauf 1974 / Staatl. Museum für Tierkunde, Dresden. Paratype of *N. tao*, ♀ (Fig. 4), in SMTD, same locality data as holotype.

Additional material examined. Specimens of *N. tao*: Guangxi, 2♂2♀, Jinxiu, Mt. Dayao, 20 July 2011, leg. Yinghua Wu (MAHU). Specimens of the sympatric species of *N. guangxi*: Guangxi, Jinxiu, 22 September 1981, 1♂1♀, collector unknown; 1♂, only with the lable ‘Guangxi’ (NZMC); 4♂1♀, Mt. Dayao, 26 July 2013, leg. Baosheng Su (MAHU).

Distribution. China (Guangxi).

Remarks. *N. tao* was a poorly known species after published. It is similar to the sympatric species of *N. guangxi*



Figures 1–12. *Neolucanus* spp., dorsal view except Fig. 2 (ventral view). 1–4. *N. tao*. 5–8. *N. guangxi*. 9–12. *N. imitator*. 1–3, 5–7, 9–10. Male; 1, 5–6, 9. large; 3. small; 7, 10. medium-sized. 4, 8, 12. Female. 1–2, 5, 11. Holotype. 4, 10. Paratype. 5. Figure from Schenk (2009). 10. Figure of *N. swinhoei hengshanensis*, confirmed synonym of *N. imitator*, from Fujita (2010). Scale bars = 10 mm.

(Figs 5–8, 25–29) which published by Schenk (2009) due to their reddish-brown color and short mandibles in males. But they can differ on the characters of body shape, head, pronotum and aedeagus. In *N. tao* (Figs 1–4): body slender; frontal region with a large shallow depression about taking up the 1/2 part of the frontal region; post-ocular margin short, about as long as the half length of the head, slightly swollen; canthus broadly triangular with a little rounded angle laterally; pronotum longer than the head with even disc; PA of aedeagus long, about 1.4 times BP, PES about 2.2 times the total length of BP+PA. While in *N. guangxi*, body convex; frontal region with a small deep depression about taking up the 1/3 part of the frontal region; post-ocular margin long, about as long as the 2/3 length of the head, strongly swollen; canthus broadly triangular with sharp angle laterally; pronotum shorter than or about as long as the head with convex disc; PA of aedeagus short, almost as long as the length of BP; PES about 2.6 times the total length of BP+PA.

***Neolucanus imitator* Kriesche, 1935** (Figs 9–12, 30–33)

Neolucanus imitator Kriesche, 1935. *Koleop. Rundsch.*, 21: 170.
Neolucnaus swinhoei hengshanensis Ichikawa & Fujita, 1987, *Gekkan Mushi*, 197: 12.
Neolucnaus nitidus hengshanensis: Mizunuma & Nagai, 1994, *The Lucanid Beetles of the World*: 218, pl.19.

Length 30.0–38.0 mm (including mandibles). Width 12.0–15.0 mm. Surface. Whole dark except for partly yellow to reddish brown elytra (Figs 9–12). Main surface smooth, small punctures presented on mandibles and the surrounding of eyes; legs with large and dense punctures. Head. Almost rectangular, 1.8–2.4 times wider than long. Anterior margin at middle concaved, frontal region with f a large, deep, triangularly depression in male, that of female much smaller and quite shallow. Vertex slightly raised. Male mandibles. Relatively straight and thick, about as long as the length of head in large and medium-sized male, but shorter than that of head in small male. The apex sharp and slightly curved inwards. A large, upwardly erected sub-apical tooth presented on the upper mandibular margin (or dismissed into an obsolete tooth rudiment in small male). Other 4–7 small blunt teeth serrated along the lower mandibular margin from the base to the apex. Female mandibles. Almost triangular, shorter than that of head, covering with punctures; the apex sharp, slightly curved inwards; sub-apical tooth absent on the upper margin; 2–3 blunt teeth serrated along the lower mandibular margin. Eyes. Completely divided into the upper and lower part by canthi. Canthi laminated and expanded, roughly equilaterally triangular with a blunt apex angle in male; that of female broad, almost semicircular. Post-ocular margins short, about as long as the 1/3 length of head, slightly swollen. Mentum. Rectangular, with rounded anterior angles; surface almost flatten, covering with long yellow brown hairs in male. In female, no hairs presented except for the distal margin, but with a pair of ridges extended from the anterior angles to the middle of mentum. Labrum. Small and triangular in male; rectangular in female, the distal margin with a small projection at middle. Antennae. Slightly sexually dimorphic, longer and stronger in male. Club 3-segmented, terminal segment totally pubescent, other 2 segments partially pubescent; scape slightly curved; pedicel almost symmetrical; the 3rd, 4th, 5th segment almost equal, the 7th segment with 3–5 apical setae. Pronotum. Transverse, slightly shiny, about 2.0 times wider than long; 1.8–2.5 times the length of head. Disc distinctly convex. Anterior margin sinuate, sharply projected at middle. Front angles relatively blunt. Lateral margins strongly divergent on 3/4 anteriorly, then strongly convergent on 1/4 posteriorly and meet the posterior margins, often concaved at the intersection of lateral margins. Hind angles sharp. Scutellum. Blunt heart-shape, with several small punctures. Elytra. More shiny than head and pronotum, distinctly convex; about 1.3 times longer than wide, almost as wide as that of pronotum at the widest. Mainly yellow to reddish brown except for the bases of shoulders, elytral suture and outer margins dark. Wings. Fully developed. Legs. Long and stout. Front tibiae narrow at base, strongly expanded and forked at apex, with 4–5 small teeth laterally; spurs sub-cylindrical and curved, short in male, relatively longer in female. Middle and hind tibiae highly similar to that of front tibiae, but no lateral tooth presented except for spines at apex. Aedeagus (Figs 30–33). BP slender, about 1.5 times the length of PA; the 2/3 proximal part closed to PA broad and the 1/3 distal part blunt. PA relatively long with almost straight outer margins; the apex bluntly rounded from the dorsal and ventral view, but slightly sharp from the lateral view. ML distinctly asymmetric, slender; the left lobe slightly longer than the right one. PES (Fig. 33) quite stout, about 2.6 times the total length of BP+PA; main outer surface of PES smooth and membranous, covering with short dense dark brown hairs from the middle to the apical part. Female genitalia is unknown because abdomen of this only one examined female specimen was worm-eaten.

Type material examined. Holotype of *N. imitator*, ♂ (Figs 7–8), in SMTD, labelled: China, Hunan Province Sinning. /3356 / typ (red label) / *Neolucanus imitator* n. Type! (handwritten) / Sammlung Kriesche Ankauf, 1974/ Staatl. Museum für Tierkunde. Dresden. Syntypes of the allied species, *N. swinhoei swinhoei* Bates, 1866: 2♂1♀, in BMNH. 1♂, labeled: type / *Neolucanus swinhoei*, ♂, Bates. Proc. Z. Soc. Fromosa (handwritten) / 85/ 28 / BMNH (E) # 600520; 1♂, labeled: / Fig. I / *N. swinhoei*, ♂, Fromosa / BMNH (E) # 600521; 1♀, labeled: Syntype / Fig. I / *Neolucanus swinhoei*, ♀, Bates. Proc. Z. Soc. Fromosa (handwritten) / 85/ 28 / BMNH (E) # 600522.

Figures 13–24. *Neolucanus* spp. 13–18. *N. nitidus*. 19–24. *N. pallenscens*. 13, 15–17, 19, 21, 23. Dorsal view. 14, 18, 20, 22, 24. Ventral view. 13–15, 17–24. Male; 13–14, 21–24. large; 15, 17–20. medium-sized. 16. Female. 17–18. Holotype. 19. False holotype of *N. pallenscens*. 13–16. From Zhejiang, Mt. Tianmu. 21–23. From Guangdong,Mt. Loufu. Scale bars = 10 mm.

Additional material examined. Diagnosed specimens of *N. swinhoei hengshanensis*, Hunan, Mt. Heng, 9 August 1985, 1♂1♀, leg. Yalin Zhang, Yong Cai. (MNAFU).

Distribution: China (Hunan).

Remarks. This species has been little known since published in 1935. A small male was described (Fig. 11) by Kriesche from Hunan Province, which is little similar to the species of *N. tao* in their body color (dark except for the partly yellow brown elytra). But its body is stout with short and slender mandibles; head with deep depression on the frontal region, post-ocular margin slight swollen, canthus broad triangular with bluntly apex angle laterally. Most of characters of this species are also very similar to the subspecies of *N. swinhoei hengshanensis* which published by Ichikawa & Fujita (1987) from Hunan province. The authors possibly did not know the species of *N. imitator* and not mentioned it in their paper. Mizunuma & Nagai (1994) transferred the subspecies as *N. nitidus hengshanensis* without full discussions of the status change. Schenk (2012) initially proposed the name of *N. nitidus hengshanensis* (from Mizunuma &Nagai, 1994) as a junior synonym of *N. imitator*. During this study, we have examined the holotype of *N. imitator*, two diagnosed specimens of *N. swinhoei hengshanensis* from the same locality as that of type materials (Mt. Heng, Hunan Province, Figs 9, 12), paratype photo of *N. swinhoei henshanensis* (Fig. 10) from the illustration of Fujita (2010), type materials of its allied species of *N. swinhoei swinhoei* Bates (in BMNH) and *N. nitidus* (in OXUM). The comparison indicated that *N. swinhoei hengshanensis* should be confirmed as a junior synonym of *N. imitator*. They shared those key characters in the head, (mandibles, frontal depression, post-ocular margin, canthus), pronotum, elytra and aedeagus.

All these above-mentioned characters also can be used to distinguish *N. imitator* from *N. nitidus* which shall be discussed as below. Especially, the aedeagus of *N. imitator* (Figs. 30–33) are markedly different from that of *N. nitidus* (Figs. 35–38) in the characters of PA, BP and PES, which can furthermore denote that *N. swinhoei henshanensis* (=*N. imitator*) is not a subspecies of *N. nitidus* as Mizunuma & Nagai (1994) and Fujita (2010) treated. Their subspecies status changes could result from the wrong diagnoses of *N. nitidus* and *N. swinhoei swinhoei* Bates, 1866 as we have found in their books.

***Neolucanus nitidus* (Saunders, 1854)** (Figs 13–18, 35–38)

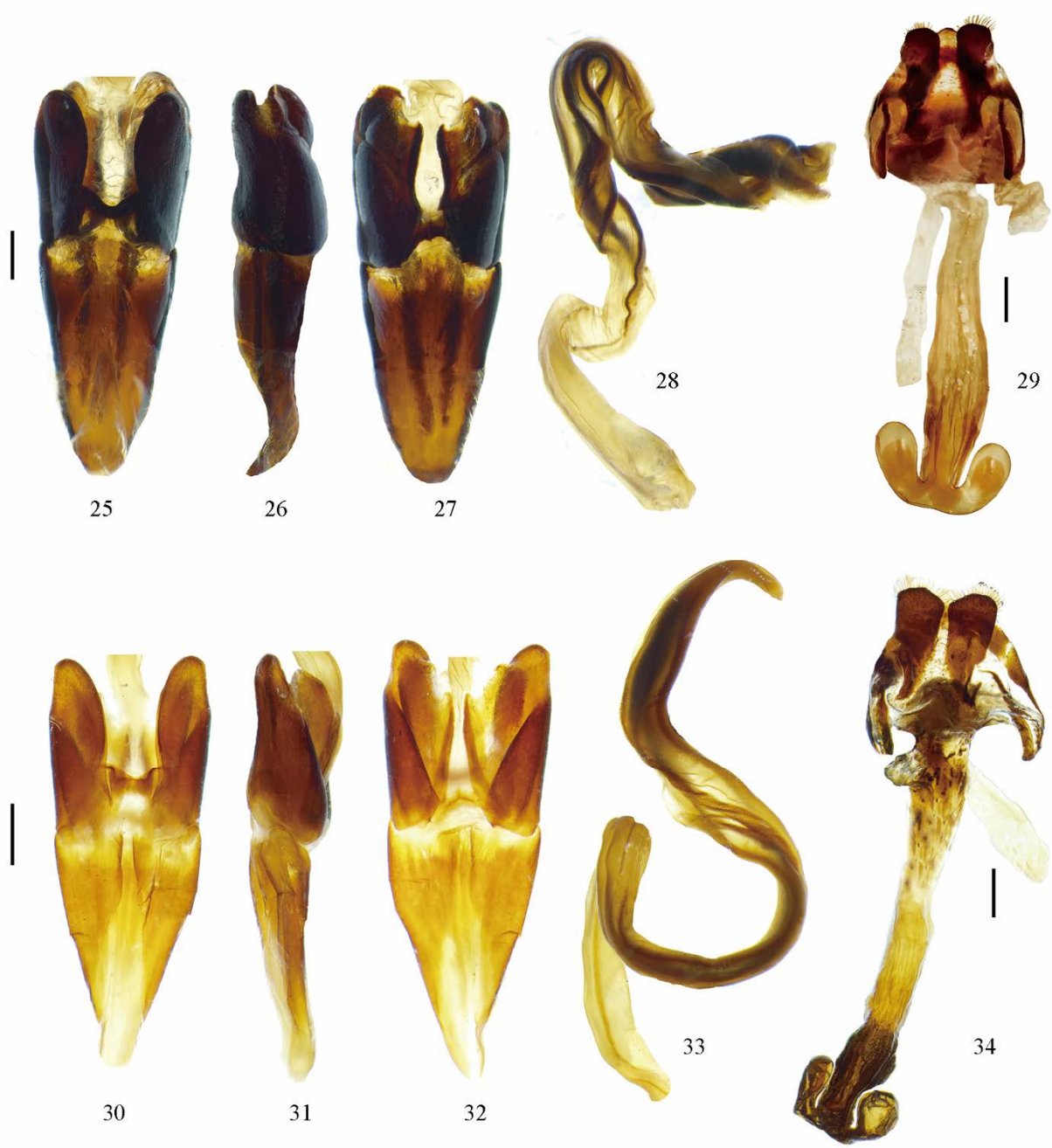
Odontolabis nitidus Saunders, 1854. *Trans. Ent. Soc. Lond (N. S..*, 3(2): 47.

Neolucanus nitidus: Leuthner, 1885. *Trans. Zool. Soc. Lond.*, 11: 427.

Neolucanus nitidus nitidus: Mizunuma & Nagai, 1994. *The Lucanid Beetles of the World*: 128, pl.19.

Length about 36.0–45.0 mm (including mandibles). Width 15.0–17.0 mm (Figs 13–18). Surface. Dark and shiny, elytra more shiny than other parts. Main surface smooth, small punctures presented on mandibles, the surrounding of eyes. Legs with large and dense punctures. Head. Almost rectangular, gloomy, 2.0–3.0 times wider than long. Anterior margin at middle concaved, with forming a large, triangularly frontal depression in male, that of female much smaller and shallow.

Vertex slightly raised. Male mandibles. Relatively straight, about 1.0–1.2 times the length of head in large male, but shorter in small male. The apex sharp, slightly curved inwards. A large, upwardly erected sub-apical tooth presented on the upper mandibular margin. Other 5–6 small blunt teeth serrated along the lower mandibular margin. Female mandibles. Almost triangular, shorter than the length of head, covering with punctures; the apex sharp and curved inwards; the upper mandibular margin without sub-apical tooth, the lower mandibular margin with 2–3 blunt teeth. Eyes. Relatively small, unproduced, completely divided into the upper and lower part by the canthi. Canthi slightly laminated and expanded, narrowly sub-rectangular with a bluntly rounded apex angle in male, almost semicircular in female. Post-ocular margins little produced, slightly swollen. Mentum. Almost semicircular, anterior angle rounded, covering with long yellow brown hairs; that of female semicircular, no hairs presented except for the distal margin, but with a pair of ridges extended from anterior angle to the middle part of mentum. Labrum. Small and triangular in male; almost rectangular with a small projection on the distal margin at middle in female. Antennae. Sexually dimorphic, longer and stronger in male. Club 3-segmented, terminal segment totally pubescent, other 2 segments partially pubescent. Scape slightly curved, pedicel almost symmetrical; the 3rd, 4th, 5th segment almost equal, the 7th segment with 4–5 apical setae. Pronotum. Transverse, 1.7–2.0 times wider than long, about 1.6–2.4 times the length of head. Disc strongly convex. Anterior margin sinuated, quite gently projected at middle. Front angles blunt. Lateral margins slightly divergent on 4/5 anteriorly, then gently convergent on 1/5 posteriorly and meet the posterior margins. Hind angles sharp. Scutellum. Wider than long, blunt heart-shape, with several small punctures. Elytra. Dark, very shiny and convex; 1.25 times longer than wide, almost as wide as that of pronotum. Wings. Fully developed. Legs. Long and stout. Front tibiae narrow at base, strongly expanded and forked at apex, with 3–6 sharply small lateral teeth; spurs sub-cylindrical and curved, short in male, relatively longer in female. Middle and hind tibiae no lateral tooth presented except for spines at apex. Aedeagus (Figs 35–38). BP slender, about as long as the length of PA; the 2/3 proximal part closed to PA broad and the 1/3 distal part blunt. PA relatively



Figures 25–34. *Neolucanus* spp., genitalia. 25–28. *N. guangxi*, aedeagus. 29. *N. guangxi*, female genitalia. 30–33. *N. swinhoei hengshanensis*, aedeagus, confirmed synonym of *N. imitator*. 34. *N. nitidus*, female genitalia. 25, 30. Dorsal view. 26, 31. Lateral view. 27, 32. Ventral view. 28, 33. PES. Scale bars = 1 mm.

short, the apex rounded from the dorsal and ventral view, but slightly sharp from the lateral view. ML distinctly asymmetric, broad, the left lobe little longer than the right one. PES (Fig. 38) very stout, about 2.0 times the total length of BP+PA; mainly outer surface of PES smooth and membranous, densely covering with short dense dark brown hairs from the middle to the apical part. Female genitalia (Fig. 34). HS strongly sclerotized, the anteriorly 4/5 part plate-liked, rather broad, almost rectangular with little rounded distal margin; the posteriorly 1/5 part stick-liked, thin and slightly oblique. AG pale, slender. MO yellow brown, short, stout. BC very long, stout, tubiform and longitudinally folded. SD dark brown, joining in BC and distinctly expanded. S situated at the apex of SD, bulb–shaped symmetrically with expanded apex. SG absent.

Type material examined. Holotype of *Neolucanus nitidus*, ♂ (Figs 17–18), in OXUM, labelled: *nitidus*, *Saunders* (handwritten yellow label) / type, col. 382, *Odontolabris nitidus* Saund., Hope Dept. Oxford.

Figures 35–42. *Neolucanus* spp., aedeagus. 35–38. *N. nitidus*. 39–42. *N. pallenscens*. 35, 39. Dorsal view. 36, 40. Lateral view. 37, 41. Ventral view. 38, 42. PES. Scale bars = 1 mm.

Additional material examined. China, Fukien, Kuatun, 11 August 1946, 1♂1♀, leg. Tschung Sen (MZUF). Anhui, Mt. Huangshan, alt. 700–1 000 m, 17–20 August 1978, 12♂1♀, leg. Shuyong Wang; Zhejiang, West Mt. Tianmushan, Kaishan Laodian, 3 August 2010, 3♂1♀, leg Kai Shi. (MZAFU); Zhejiang, Mt. Tianmushan, Sanmutian, 1♂, 5 August 2011, leg. Qian Zhang. Fujian, Mt. Wuyishan, 11 August 2009, 2♂, leg. Xiaoyan Hu and Fang Zhong; Mt. Wuyi, 13 August 2012, 1♂, leg. Yuyan Cao (MAHU).

Distribution. China (Anhui, Jiangxi, Zhejiang, Fujian).

Remarks. Holotype of *Neolucanus nitidus* is a medium-sized male without mandibles in OXUM, as Saunders wrote that “mandibles wanting in all the specimens sent home”. In the field, *N. nitidus* can be easily recognized by its shiny dark body color, short and stout mandibles and narrowly subrectangular canthus. However, there are wrong species diagnoses in the two widely used books published by Mizunuma & Nagai (1994) and Fujita (2010). In the former book, specimens of the figures (126–1, 2, 5 in pl. 19) were *N. nitidus* actually, but those of the figures (126–3, 4, 6, 7–10) should belong to other species. Specimens of the figures (305–5, 6 in pl. 50) in the book of Fujita were wrongly diagnosed, too. In order to

identify this species well, its holotype (Figs 17–18) and intraspecific variations (Figs 13–16) are given in this study.

As mentioned above, this species also has the puzzle of "subspecies". Fujita (2010) recorded six subspecies of *N. nitidus* without full discussions. Two of them, *N. nitidus nitidus* and *N. nitidus hengshanensis*, have been compared before. Relationships of other four ones, *N. nitidus robustus* Boileau, 1914 (from Laos); *N. nitidus maekajanensis* Ichikawa & Fujita, 1987 (from Northern Thailand), *N. nitidus rutilans* Bomans, 1989 (from Fujian, China) and *N. nitidus hainanensis* Mizunuma, 1994 (from Hainan, China) need to study in detail. We have briefly examined type specimens and type photos of them. In our opinion, three of them (*robstus*, *hainanensis* and *rutilans*) could be fully separate species, and *maekajanensis* could be a synonym of *robustus*. But it is difficult to clarify their taxonomic status unless a good number of specimens of these "subspecies" are examined. Because of this, we treated *N. nitidus* as a monotypic species temporarily in this paper.

***Neolucanus pallescens* Leuthner, 1885** (Figs 19–24, 39–42)

Neolucanus pallescens Leuthner, 1885. *Trans. Zool. Soc. Lond.*, 11: 426, 427.

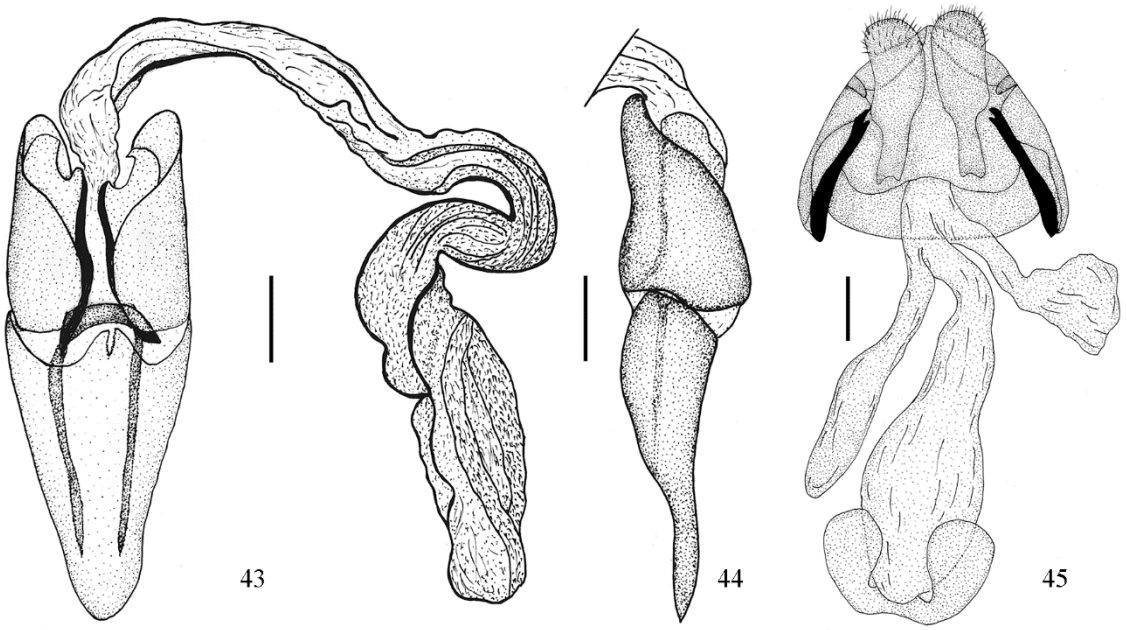
Length 34.0–45.0 mm (including mandibles). Width 14.0–18.0 mm (Figs 19–24). Surface. Whole dark except for the elytra with longitudinally reddish brown narrow spots near to outer margins. Main surface smooth, small punctures presented on mandibles, the surrounding of eyes; legs with large and dense punctures. Head. Almost rectangular, gloomy, 2.4–2.7 times wider than long. Anterior margin at middle concaved with forming a large, shallow, triangularly frontal depression. Vertex strongly raised. Male mandibles. Straight and thick, about 1.0–1.3 times the length of head in large male. The apex very sharp, curved inwards. A large, upwardly erected sub-apical tooth presented on the upper mandibular margin near to the apex. 7–8 small blunt teeth serrated along the lower mandibular margin. Eyes. Large, little produced, completely divided into the upper and lower part by canthi. Canthi strongly laminated and expanded, broad equilaterally triangular with a sharp apex angle. Post-ocular margins distinctly produced, strongly swollen. Mentum. Almost semicircular, anterior angles rounded, covering with long yellow brown hairs. Labrum. Small and almost triangular in male. Antennae. Club 3-segmented, terminal segment totally pubescent, other 2 segments partially pubescent; scape curved; pedicel almost symmetrical; the 3rd, 4th, 5th segment almost equal, the 7th segment with 4 apical setae. Pronotum. Transverse, much shiny than head; about 2.0 times wider than long, 1.8–2.0 times as long as the length of head. Disc strongly convex. Anterior margin sinuated, gently projected at middle. Front angles blunt. Lateral margins slightly divergent on 4/5 anteriorly, then gently convergent on 1/5 posteriorly and meet the posterior margins. Hind angles sharp. Scutellum. Blunt heart-shape, with several small punctures. Elytra. Shiny, strongly convex, 1.3 times longer than wide; about as wide as that of pronotum at the widest. Mainly dark except the longitudinally reddish brown narrow spots extended from shoulders to the apex close to outer margins. In some specimens, the spots not very distinct, but quite broad, faintly reddish brown (Figs 17–18). Wings. Fully developed. Legs. Long and stout. Front tibiae narrow at base strongly expanded, forked at apex, with 3–4 sharply small lateral teeth; spurs sub-cylindrical and curved. Middle and hind tibiae no lateral tooth presented except for spines at apex. Aedeagus (Figs 39–42). BP slender, about 1.3 times the length of PA; the 2/3 proximal part closed to PA broad and the 1/3 distal part blunt. PA relatively short with almost straight outer margins; the apex blunt rounded from the dorsal and ventral view, but slightly sharp from the lateral view. ML distinctly asymmetric, broad, the left lobe slightly longer than the right one. PES (Fig. 42) very stout, about 2.0 times the total length of BP+PA; mainly outer surface of PES smooth and membranous, covering with short dense dark brown hairs from the middle to the apical part. Female genitalia unknown, no female specimen examined.

Type material exmained. Medium-sized ♂, in MNHN (Figs 19–20), labelled: type (red label, looks quite new) / type ! (handwritten) /*Neolucanus pallescens leuthn.* (handwritten). (This specimen is not the real type. See the "Remarks" below)

Additional material examined. Guangdong, Longmen, Mt. Nankun, 7 August 1983, 1♂, leg. Zhenguang Chen; Kwangtung, S. China, Mt. Loh Fau, Big Peal, 2680 ft., 25 August 1933, 1♂, leg. E. R. Hrkham; Hainan, Mt. Jianfengling, Fenqu Wu, 25 August 1981, 1♂, leg. Shaoying Liang (SYSUC).

Distribution. China (Hongkong, Guangdong).

Remarks. Type depository of *N. pallescens* has been unknown since it published in 1885. Type was a large male, long 42 mm, mandible full-developed with 8 small teeth along the lower margin. A medium-sized male (Figs 19–20) in the MNHN was attached with a handwritten label of "type", which was obviously not consistent with the original description and figure of *N. pallescens*, especially in body size and mandible, although it belonged to this species. We also tried to search the real type in BMNH and OXUM where might be the potential depositories. So far, we have not found it in the two museums. Since Leuthner gave a clear description and figure of *N. pallescens*, we could diagnose some materials from Guangdong (Figs 21–24) as this species with the first illustrations of male variations and male genitalia (Figs 39–42).



Figures 43–45. *Neolucanus tao*, types. 43–44. Aedeagus. 45. Female genitalia. 43, 45. Ventral view. 44. Lateral view. Scale bars = 1 mm.

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