Studies and Reports
Taxonomical Series 17 (1): 189-200, 2021

Descriptions of four new species of genus *Anomala* Samouelle, 1819 from South China (Coleoptera: Scarabaeidae: Rutelinae)

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Taxonomy, descriptions, new species, new records, Coleoptera, Scarabaeidae, Rutelinae, Anomalini, *Anomala*, China

Abstract. Four new species of genus *Anomala* Samouelle, 1819 from South China are described and compared as follows: *A. chenyilini* sp. nov. from Yunnan, *A. chouwenyii* sp. nov. from Hainan, *A. huangguiqiangi* sp. nov. from Yunnan, *A. songhaitiani* sp. nov. from Yunnan. The habitus and male genitalia of new species are illustrated.

INTRODUCTION

Before the present investigation, more than 210 species from genus *Anomala* Samouelle, 1819 had been recorded from China with most of them described before the last decade (Krajčík 2012, Zorn & Bezděk 2016). In recent five years, only three species of this genus were described from China by Huang & Wang (2019) and Zhao (2019).

Over 2016-2019, the author received several Rutelinae specimens collected from South China by Wen-Yi Chou, Hai-Tian Song, Shao-Fu Chen, and Wei-Zong Yang. After reviewing congenerics, four new species of the tribe *Anomala* are described as new to science, from among them two species from the Yingjiang County (*A. chenyilini* sp. nov. and *A. songhaitiani* sp. nov.) and one species from the Xinping County (*A. huangguiqiangi* sp. nov.) in Yunnan; one species, *A. chouwenyii* sp. nov., was collected from Yinggeling Natural Reserve (Qiongzhong Li and Miao Autonomous County) and Jingfengling National Forest Park (Ledong Li Autonomous County), the Hainan Island.

MATERIAL AND METHODS

Abbreviations for collections with their owners in parentheses are provided below.

CFLW Fa-Lei Wang, private collection, Chongqing, China;
CQNU Chongqing Normal University, Chongqing, China;
CWNU China West Normal University, Nanchong, China;
LPSNU Liupanshui Normal University, Liupanshui, China;
MYNU Mianyang Normal University, Mianyang, China;
MYPC Mao Ye, private collection, Xiangyang, China
SYSU The Museum of Biology, Sun Yat-sen University, Guangzhou, China;
ZMPC Ming-Zhi Zhao Personal Collection, Guangzhou, China.

The body length was measured from the apex of the clypeus to the apex of the pygidium. Type specimens of the species described in the present paper bear the following labels: "HOLOTYPU" or "PARATYPU", "*Anomala* [species name] sp. nov.", "det. F.L. Wang [year]". Habitus photos and male genitalia were taken using a Canon® D60 digital camera with Canon® AF 100 mm macro lens. All photographs were modified in Adobe Photoshop® CC 2019.

The following specimens of the tribe *Anomala* were used for comparison:

A. amarginata Zhang & Lin, 2008: (1 ♂, 1 ♀): China: Yunnan, (CFLW).
A. cariniventris Lin, 2002: (1♂): China: Hainan, (CFLW).
A. collotra Zhang & Lin, 2008: (10 ♂♂, 15 ♀♀): China: Sichuan, Yunnan, (CFLW).
A. coxalis Bates, 1891: (17 ♂♂, 21 ♀♀): China: Fujian, Guangdong, Guizhou, Guangxi, Hubei, Hunan, Sichuan, Yunnan, Zhejiang, (CFLW, CWNU, LPSNU, MYPC).
A. cupripes (Hope, 1839): (2 ♂♂, 3 ♀♀): China: Yunnan, (CFLW).
A. dentifera Lin, 2002: (2 ♂♂): China: Yunnan, (CFLW).
A. exoleta Faldermann, 1835: (4 ♂♂, 1 ♀): China: Shandong, (CFLW).
A. exoletoides Lin, 2000: (2 ♂♂): China: Sichuan (new record), (CFLW).
A. expansa (Bates, 1866): (1 ♂): China: Taiwan, (CFLW).
A. expansa lutaoensis Nomura, 1977: (1 ♀): China: Taiwan, (CFLW).
A. granuliformis Lin, 1996: (2 ♂♂, 2 ♀♀): China: Yunnan, (CFLW).
A. ignipes Lin, 1996: (2 ♂♂, 6 ♀♀): China: Guangxi, Hainan, (CQNU, SYSU).
A. microda Zhang & Lin, 2008: (2 ♂♂, 2 ♀♀): China: Yunnan, (CFLW).
A. millestriga asticta Lin, 2002: (6 ♂♂, 9 ♀♀): China: Fujian, Hubei, (CFLW).
A. millestriga millestriga Bates, 1891: (17 ♂♂, 21 ♀♀): China: Guizhou, Shannxi, Sichuan, Yunnan, (CFLW, CWNU).
A. obliquisulcata Lin, 2002: (17 ♂♂, 21 ♀♀): China: Fujian, Guangxi, Hubei, (CFLW).
A. perplexa diana Zhang & Lin, 2008: (9 ♂♂, 12 ♀♀): China: Yunnan, (CFLW).
A. perplexa perplexa (Hope, 1839): (12 ♂♂, 6 ♀♀): China: Xizang, Yunnan, (CFLW).
A. pyxexcavata Zhang & Lin, 2008: (1 ♂, 1 ♀): China: Yunnan, (CFLW).
A. rubripes rubripes Lin, 1996: (5 ♂♂, 15 ♀♀): China: Fujian, Guangdong, Guangxi, Hainan, Jiangsu (new record), Jiangxi, (CFLW, CQNU, MYPC).
A. rubripes virescens Lin, 1996: (1 ♂): China: Taiwan, (CFLW).
A. truncata chlorochelys Arrow, 1912: (5 ♂♂, 15 ♀♀): China: Yunnan; Vietnam, (CFLW).
A. truncate truncate Bates, 1890: (1 ♂, 4 ♀♀): China: Sichuan, Guizhou, (CFLW, CWNU, LPSNU, MYPC).
A. virens Lin, 1996: (32 ♂♂, 41 ♀♀): China: Anhui, Chongqing, Fujian, Guangdong, Guizhou, Guangxi, Hubei, Hunan, Hainan, Sichuan, Yunnan, Zhejiang, (CFLW, CWNU, LPSNU, MYPC).
A. xantholoma Lin, 1981: (4 ♂♂, 6 ♀♀): China: Xizang, (CFLW).

DESCRIPTION

Anomala chenyilini sp. nov.
(Figs. 1-6)

Type material. Holotype (♂): Hulukou, Xima, Yingjiang County, Dehong Dai and Jingpo Autonomous Prefecture, Yunnan, China, Vii-Viii.2019, Wei-Zong Yang leg., (MYNU). Paratypes: (11 ♂♂, 8 ♀♀): same data as the holotype, (CFLW).

Description of holotype. Body length 14.8 mm, greatest width 8.0 mm; body elongate ovoid, moderately convex in profile. Dorsal surface except sides of pronotum deep metallic green, ventral surface dark brown with coppery and green lustre; clypeus slightly with golden reflections, antenna reddish brown, sides of pronotum yellow, apex of scutellum blackish brown, epipleuron brown with golden reflections; pygidium generally green with metallic lustre; legs reddish brown with thinly green reflections.

Head. Clypeus subtrapezoidal, 0.33 times as long as wide, rounded apically, anterior margin weakly reflexed, with reticulately punctate; fronto-clypeal suture weak; frons with dense and deep punctures, somewhat sparser posteriad; interocular distance equals 0.61 times the maximum transverse head width; vertex with sparse punctures; antennal club 0.85 times as long as footstalk.

Pronotum.1.79 times as wide as long, sides convergent in the middle; anterior marginal line weak in the middle, posterior margin with marginal line between hind angle and scutellum, lateral margins with rather narrow fringe in posterior 1/2 of sides; anterior angles acute, posterior angles sub-rightangular, broad rounded apex; disc densely punctate, gradually becoming denser to the sides.

Scutellum. 1.47 times as wide as long; with sparse, deep punctures, different in size.

Elytra. 0.89 times as wide as long, widest in anterior 2/5; elytra densely punctate, punctures smaller to the sides, with distinct strial punctures; sutural interval both with both small, shallow punctures and deep, large punctures; other intervals with small, shallow punctures; epipleuron disappearing in posterior 2/5.

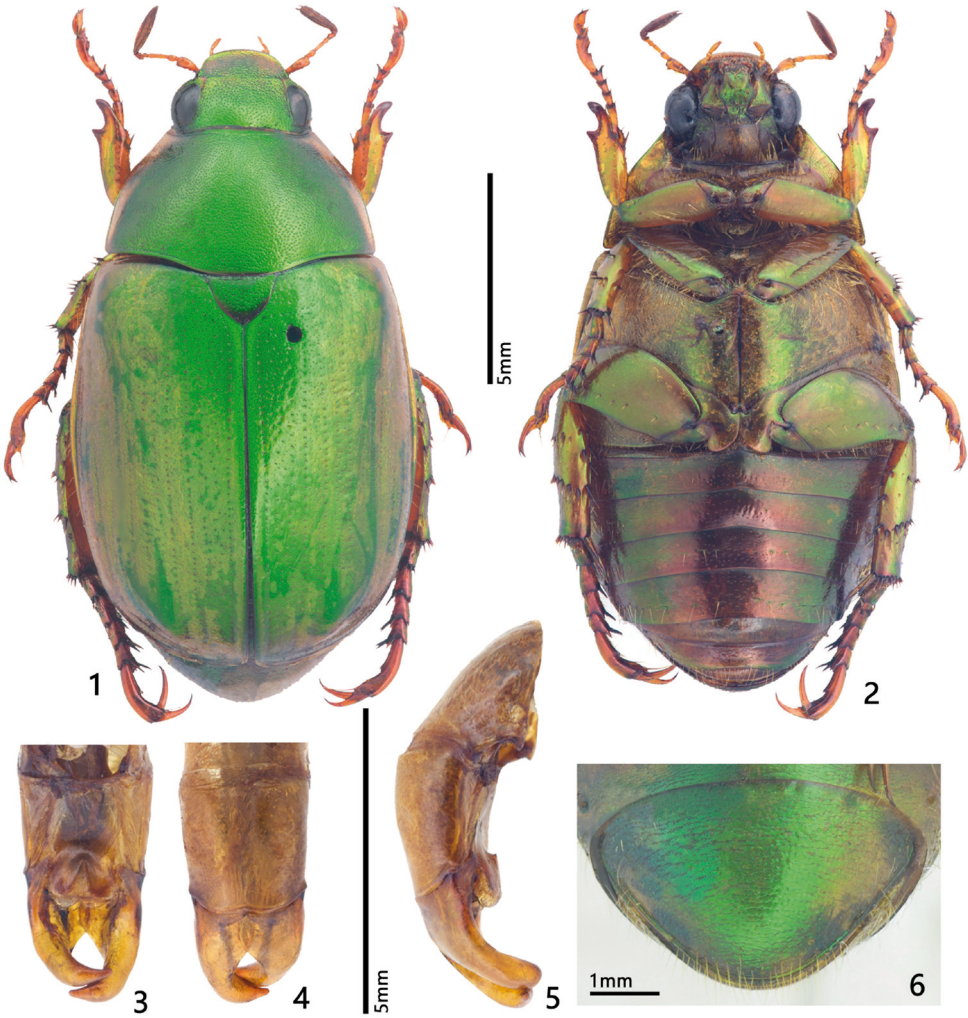
Pygidium. Weakly convex in profile, surface densely transversely punctate; corners with several short brown setae.

Abdominal ventrites. Abdominal ventrites with sparse transverse punctures in the middle, gradually becoming denser to the sides, with a transverse row of yellow setae in the middle, denser at sides, sides of ventrites 1-2 carinate.

Legs. Tarsi becoming stronger from protarsus to metatarsus successively, protarsal inner claw and mesotarsal outer claw cleft; protibia bidentate, terminal tooth curved and prolonged, another tooth acute; mesotibia and metatibia fusiform, surface slightly smooth.

Genitalia. As in Figs. 3-5.

Sexual dimorphism. Length 15.2-15.3 mm, width 8.1-8.2 mm. Body slightly larger; apical tooth of protibia rather longer, protarsal inner claw narrower, punctures on elytra surface sparser.



Figs. 1-6. *Anomala chenyilini* sp. nov.: 1- male habitus, dorsal view; 2- male habitus, ventral view; 3- male genitalia, dorsal view; 4- male genitalia, ventral view; 5- male genitalia, lateral view from right; 6- pygidium.

Differential diagnosis. The new species and *A. lateripila* Lin, 2002 (Fujian), *A. obliquisulcata* Lin, 2002 (Fujian, Guangdong, Guizhou, Guangxi, Hainan, Hunan, Hubei, Jiangxi, Shannxi, Zhejiang), *A. sauteri sauteri* Ohaus, 1915 (Taiwan) are smaller in general appearance and body size than the other members of the genus. *Anomala chenyilini* sp. nov. can be distinguished from *A. lateripila* (described only with female) by antennal club shorter than antennomeres 2-6 ('Antennal club a little longer than the 2nd to 6th segments combined' in *A. lateripila*), sides of pronotum with yellow border ('the pronotum neither pale colour sides and oblique sulci' in *A. lateripila*), sides of the abdominal ventrites less setaceous ('sides of

abdomen covered with dense and long hairs' in *A. lateripila*), from *A. obliquisulcata* by hind angles of pronotum without deeply obliquely sulci (Lin 2002b), and from *A. s. sauteri* by surface of pygidium without dense and short setae (Ohaus 1915b). The new species is also related to *Anomala exoletoides* Lin, 2000 (Henan, Shannxi) of which I examined two males collected from Sichuan (a new record), but differs from it by anterior margin of clypeus reflexed weaker, surface of elytra smoother, parameres of male genitalia plump cylindrical, stronger, gradually shrinking to apex.

Etymology. The new species is dedicated to Yi-Lin Chen from Guangdong (China), who provided Rutelinae materials for the author's study.

Distribution. South China, Yunnan, Yingjiang County.

Anomala chouwenyii sp. nov.
(Figs. 7-12)

Type material. Holotype (♂): Yinggeling Natural Reserve, Qiongzhong Li and Miao Autonomous County, 109°54'19.31" E, 19°03'95.64" N, alt. 640 m, V.2019, Wen-Yi Chou leg., (MYNU). Paratypes: (1 ♂): same data as the holotype, (CFLW); (1 ♂): Jianfengling National Forest Park, Ledong Li Autonomous County, Hainan, alt. 800 m, 15.V.2019, Hai-Tian Song leg., (CFLW); (1 ♂): Hainan, Jianfengling, Mingfenggu, at light, 9.Viii.2019, Pin-Chao Lin leg., (ZMPC); (1 ♀): Tianchi, Jianfengling, Hainan, (ZMPC).

Description of holotype. Body length 25.8 mm, greatest width 13.7 mm; body elongate ovoid, rather convex in profile. Dorsal surface green, partly with fire-red colour, ventral surface dark red with thinly green metallic reflections; clypeus with fire-red colour, fading from anterior margin fronto-clypeal suture, orbital cavity and anterior corners of frons with red colour, basal antennal club and footstalk dark red, antennal club blackish brown; lateral margin and middle of posterior margin of pronotum, apex and posterior 2/3 of sides of scutellum, lateral margin and epipleuron of elytron, sides of pygidium with red colour; all the legs deep red with green metallic reflections thinly.

Head. Clypeus subtrapezoidal, 0.35 times longer than wide, rounded apically, anterior margin distinctly reflexed, with densely and shallowly transverse punctures; fronto-clypeal suture completely, slightly incurved in the middle; frons densely punctate, sparser posteriad; interocular distance 0.66 times the maximum transverse head width; with erect yellow setae along eyes; vertex with sparse and shallow punctures; antennal club nearly equal length with footstalk.

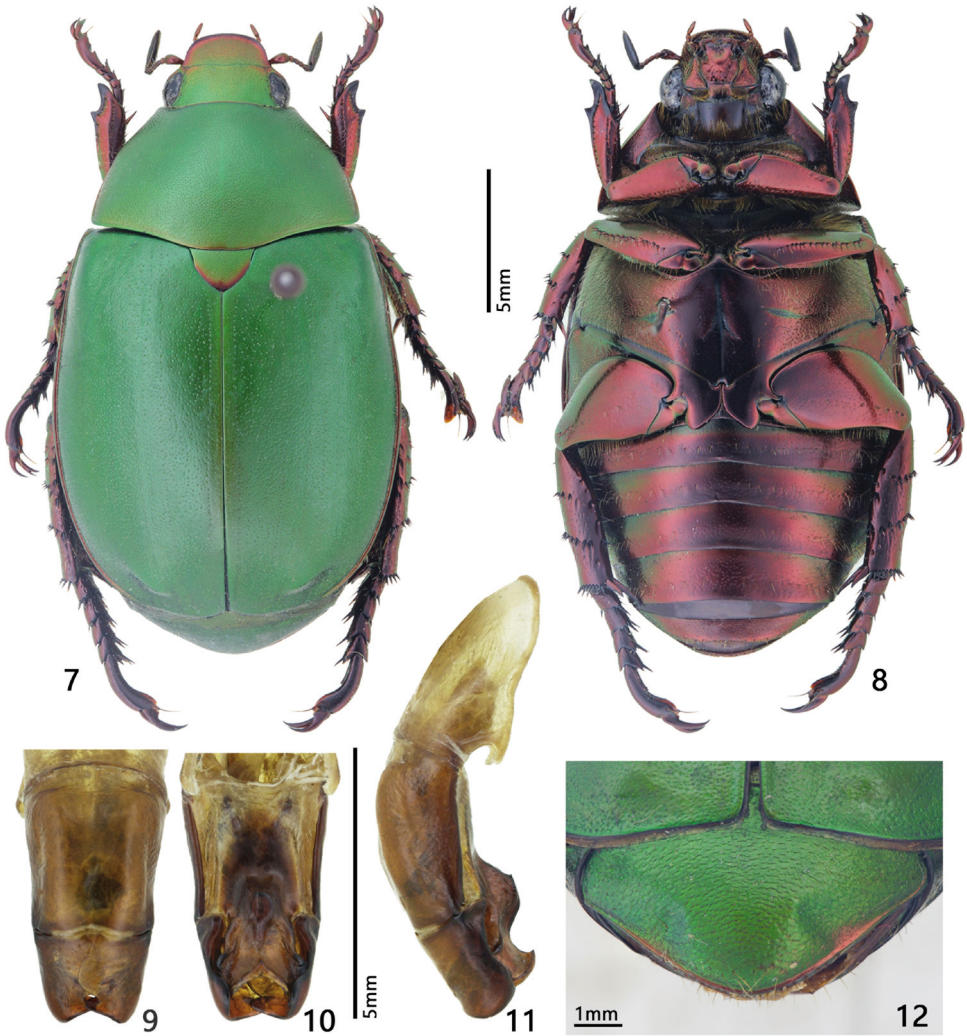
Pronotum. 1.82 times as wide as long, sides convergent in the middle, straight in anterior 1/2; anterior marginal line disappearing in lateral 1/3, posterior marginal line between hind angle and scutellum, posterior 2/5 of sides with marginal line; anterior and posterior angles nearly right-angle, apex rounded; disc densely covered with punctures becoming denser and smaller to the sides and anterior angles, with a discontinuous longitudinal smooth area in the middle of disc.

Scutellum. 1.51 times as wide as long; with sparse and shallow punctures, sides and apex smooth, sides incurved at anterior 1/3.

Elytra. Approximately 1.07 times as long as wide, widest in the middle; humeri with weak protuberances; elytra densely punctate, smaller to the sides, punctures different in size, large ones deep, small ones shallow; lateral margin slightly straight before hind angles, epipleuron disappearing approximately in the posterior 1/5.

Pygidium. Sub-triangular, weakly convex in profile, surface densely transversely punctate; both three angles with several long brown setae irregularly.

Abdominal ventrites. Abdominal ventrites 1-3 with sparse, shallow punctures in the middle, gradually becoming denser and transverse to the sides, with a transverse row of



Figs. 7-12. *Anomala chouwenyii* sp. nov.: 7- male habitus, dorsal view; 8- male habitus, ventral view; 9- male genitalia, dorsal view; 10- male genitalia, ventral view; 11- male genitalia, lateral view from right; 12- pygidium.

yellow setae, rather sparse in middle; abdominal ventrite 4 with deeply transverse punctures in the middle, densest on the sides, with a transverse row of yellow setae.

Legs. All tarsi rather strong, especially metatarsus; protarsal inner claw and mesotarsal outer claw cleft; protibia bidentate, terminal tooth slightly curved, another tooth short and acute; mesotibia and metatibia slightly fusiform, surface of metatibia coarse.

Genitalia. As in Figs. 9-11.

Sexual dimorphism. Length: 26.2 mm, greatest width 13.9 mm; similar to male in general, but body larger, terminal tooth of protibia longer.

Differential diagnosis. Thirteen (9 species and 4 subspecies) homologous *Anomala* species (body size 22-30 mm) were recorded from China (Lin 1996b, Nomura 1977, Zorn & Bezděk 2016): *A. cupripes* (Hope, 1839); *A. dimidiata* (Hope, 1831); *A. expansa* (Bates, 1866); *A. expansa lanhsuensis* Nomura, 1977 and *A. expansa lutaoensis* Nomura, 1977; *A. ignipes* Lin, 1996; *A. granuliformis* Lin, 1996; *A. planicorna* Lin, 1996 (described with female); *A. rubripes* Lin, 1996; *A. rubripes virescens* Lin, 1996; *A. truncate* Bates, 1890; *A. truncata chlorochelys* Arrow, 1912; *A. virens* Lin, 1996. The new species differs from *A. dimidiate*, *A. ignipes*, *A. e. expansa*, *A. e. lanhsuensis*, *A. planicorna*, *A. t. truncate*, *A. t. chlorochelys*, and *A. virens* by hind angles of elytra rounded, without expansion, and from *A. r. virescens* and *A. e. lutaoensis* it differs by ventral surface and legs dark red (Lin 1996b, Nomura 1977, Yu et al. 1998). *Anomala chouwenyii* sp. nov. is most similar to *A. cupripes*, *A. granuliformis*, *A. r. rubripes* in appearance. It is easy to distinguish *A. chouwenyii* sp. nov. from the latter three species since the new species has pygidium (Fig. 13) with slightly coarse, denser transverse punctures,. In addition, parameres of male genitalia (Figs. 9-11) of these four species are different (Arrow 1917, Lin 1996b, Paulian 1959).

Etymology. The new species is dedicated to Wen-Yi Chou from Taiwan (China), who collected the holotype and one paratype.

Distribution. South China, Hainan, Mount Jianfengling and Mount Yinggeling.

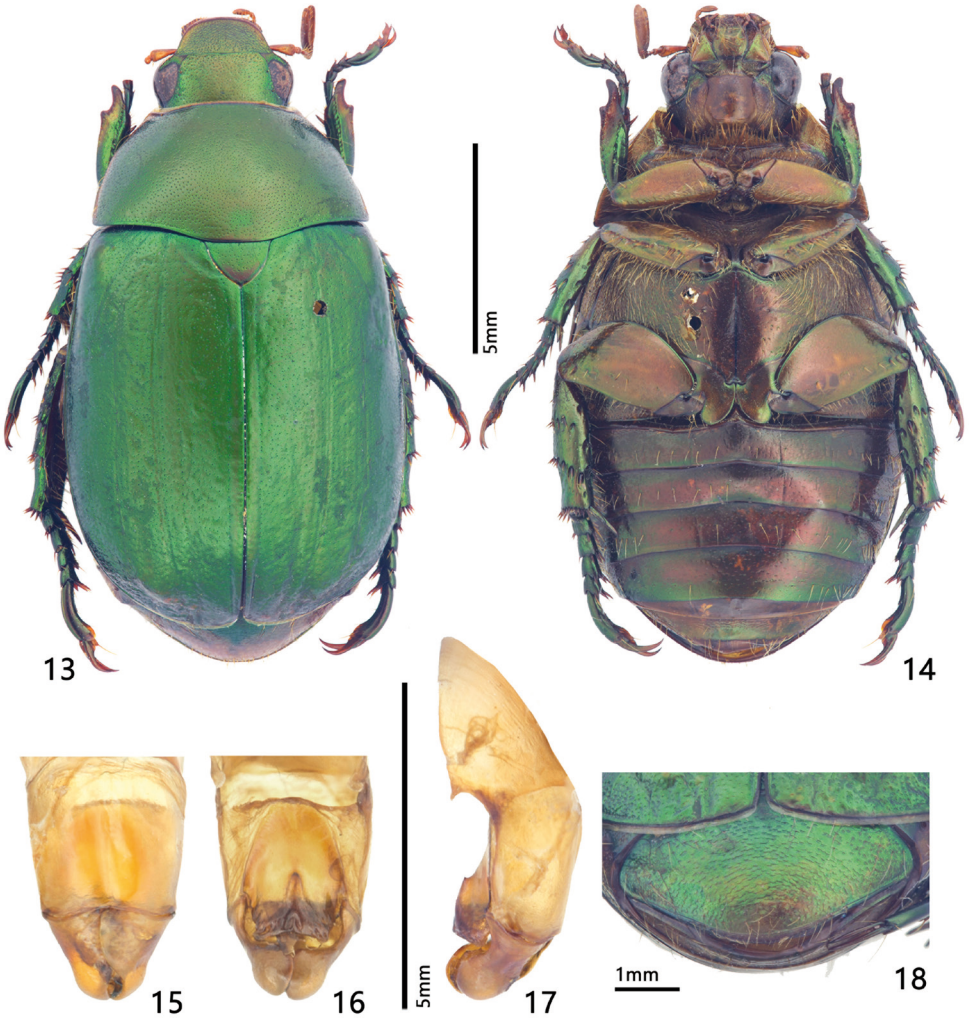
Anomala huangguiqiangi sp. nov.

(Figs. 13-18)

Type material. Holotype (♂): Mountains Ailaoshan, Xinping Yi and Dai Autonomous County, Yuxi City, Yunnan, China, alt. 1600m, Vii.2014, local leg., (MYNU). Paratypes: (3 ♂♂): same data as the holotype, (CFLW).

Description of holotype. Body length 15.9 mm, greatest width 8.3 mm; body elongate ovoid, rather convex in profile. Dorsal surface deep green generally, ventral surface dark brown with coppery and green lustre; anterior margin of clypeus with weakly golden reflections, antenna brown, sides of pronotum with rather narrow yellow fringe, apex of scutellum reddish brown, tooth of protibia and all claws reddish brown.

Head. Clypeus subtrapezoidal, 0.35 times longer than wide, rounded apically, anterior margin distinctly reflexed, with rugosely transverse punctures, sparsely punctate beside



Figs. 13-18. *Anomala huangguiqiangi* sp. nov.: 13- male habitus, dorsal view; 14- male habitus, ventral view; 15- male genitalia, dorsal view; 16- male genitalia, ventral view; 17- male genitalia, lateral view from right; 18- pygidium.

middle of fronto-clypeal suture; fronto-clypeal suture completely straight; frons with sparse punctures; interocular distance equals 0.64 times the maximum transverse head width; vertex with rather sparse punctures; antennal club longer than footstalk.

Pronotum.1.97 times as wide as long, sides convergent before middle, lateral margins with several long setae; anterior marginal line very weak in middle 1/3, posterior margin with marginal line between hind angle and scutellum; anterior angles and posterior angles sub-rightangular, posterior angles rounded apex; disc densely punctate, gradually becoming smaller to the anterior margin.

Scutellum. 1.46 times as wide as long; with rather sparse punctures.

Elytra. 1.14 times as long as wide, widest in the middle; elytra sparsely punctate, smaller to the sides, with two kinds of punctures, large ones deep, small ones shallow; epipleuron weakly, disappearing in posterior 2/5.

Pygidium. Weakly convex in profile, surface densely transverse punctate; basal corners and apex with several long, brown setae.

Abdominal ventrites. Abdominal ventrites 1-3 with shallow and sparse transverse punctures in the middle, denser and smaller on the sides, with a transverse row of yellow setae, denser at sides; abdominal ventrites 4 with deep and sparse transverse punctures in the middle, denser and smaller on the sides, with several yellow setae in posterior 1/2; sides of ventrites rounded.

Legs. Metatarsus strong, protarsal inner claw and mesotarsal outer claw deep cleft; protibia bidentate, terminal tooth slightly prolonged, another tooth obtuse; mesotibia and metatibia fusiform.

Genitalia. As in Figs. 21-23.

Sexual dimorphism. Unknown.

Differential diagnosis. This new species is similar to *A. pyxofera* Zhang & Lin 2008 (from Jiangxi) in body size and parameres of male genitalia, from which it can be distinguished due to the fact that *A. huangguiqiangi* sp. nov. shows frons with sparse punctures; basal tooth of protibia obtuse; apex of parameres rounded with an indistinct hump, apex of ventral plate acutely emarginate in ventral view, prominently in lateral view.

Etymology. The new species is dedicated to Gui-Qiang Huang from Liupanshui Normal University (Guizhou), who provided Rutelinae materials for the author's study.

Distribution. South China, Yunnan, Xinping County.

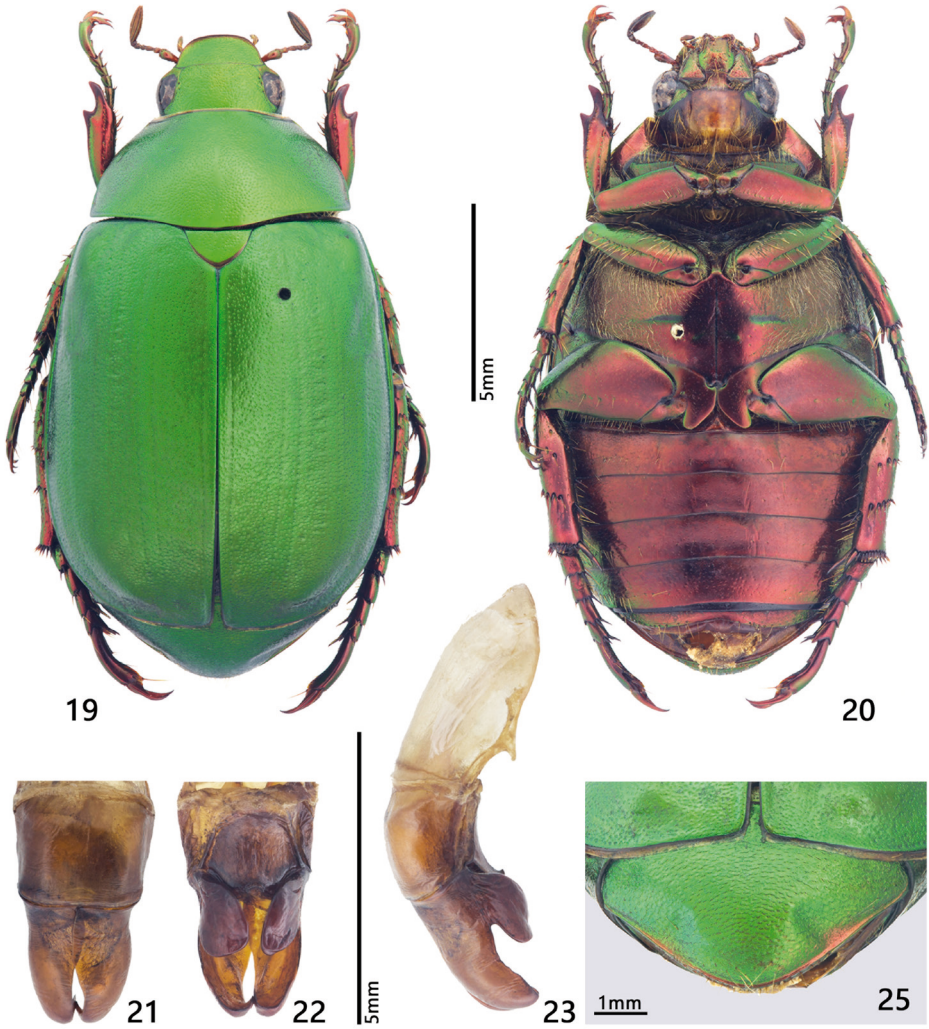
Anomala songhaitiani sp. nov.

(Figs. 19-24)

Type material. Holotype (♂): Hulukou, Xima, Yingjiang County, Dehong Dai and Jingpo Autonomous Prefecture, Yunnan, China, Vii-Viii.2019, Wei-Zong Yang leg., (MYNU); Paratypes: (35 ♂♂, 27 ♀♀): same data as the holotype, (CFLW); (67 ♂♂, 86 ♀♀): Mangyun, Taiping Town, Yingjiang County, Dehong Autonomous Prefecture, Yunnan, China, 12-30.Vii.2019, Shao-Fu Chen leg., (CFLW).

Description of holotype. Body length 17.1 mm, greatest width 13.0 mm; body elongate ovoid, highly convex in profile. Dorsal surface green, ventral surface and legs dark red with metallic reflections, with slightly green reflections; anterior margin of clypeus, antennomere, middle of posterior margin of pronotum, apex and sides of scutellum, sides of pygidium with red colour; antennal club dark brown.

Head. Clypeus subtrapezoidal, rounded apically, 0.31 times longer than wide, anterior margin slightly reflexed, shallowly and rugosely transversely punctate; fronto-clypeal suture



Figs. 19-24. *Anomala songhaitiani* sp. nov.: 19- male habitus, dorsal view; 20- male habitus, ventral view; 21- male genitalia, dorsal view; 22- male genitalia, ventral view; 23- male genitalia, lateral view from right; 24- pygidium.

straight; interocular distance 0.66 times the maximum transverse head width; frons densely punctate, denser and smaller around eyes; vertex with sparse punctures; antennal club shorter than footstalk.

Pronotum. 1.96 times as wide as long, sides convergent behind middle; posterior marginal line broadly interrupted in the middle; anterior marginal line interrupted in the middle, posterior margin line interrupted before scutellum; anterior and posterior corners both obtuse; disc densely punctate, denser and smaller besides anterior angles, with a distinct longitudinal medial smooth area on posterior 2/3; middle third of posterior margin smooth.

Scutellum. 1.91 times as wide as long; with small, sparse punctures, sides smooth.

Elytra. Approximately 0.88 times as long as wide, widest in the middle; elytra largely, densely punctate, punctures smaller at sides; epipleuron disappearing before abdominal ventrites 2.

Pygidium. Rather convex in profile; surface densely transverse punctate, sparser besides corners; apex with several brown setae.

Abdominal ventrites. Ventrites 1-3 sparsely punctate in the middle, becoming denser transversely punctures to the sides, sides with yellow setae; ventrites 4 with deep transverse punctures in the middle, denser on the sides, lateral 1/3 with yellow setae; sides of all ventrites not carinate. Legs. Metatarsus strong, protarsal inner claw and mesotarsal outer claw cleft; protibia bidentate, terminal tooth slightly curved, another tooth acute; mesotibia and metatibia nearly cylindrical, surface with sparse punctate.

Genitalia. As in Figs. 15-17.

Sexual dimorphism. Length 17.4-21.2 mm, width 13.4-15.2 mm, body generally larger, terminal tooth of protibia longer, pygidium with smaller transverse punctures.

Differential diagnosis. The male of this new species resembles those of other similar Chinese species (except species described with females) by basal parameres of male genitalia rounded and apex parameres hook-shaped (Lin 1989, 2002b, 2002a, 2002b, Zhang & Lin 2008, Zorn & Bezděk 2016). Except male genitalia, this new species well resembles *Anomala perplexa diana* Zhang & Lin, 2008 in general appearance but is easily distinguishable from it by the combination of the following characters: in *Anomala songhaitiani* sp. nov., body plumper; fronto-clypeal suture complete; the longitudinal medial area (middle 1/3) on disc of pronotum distinctly smooth.

Etymology. The new species is dedicated to Hai-Tian Song from Fujian Academy of Forestry (Fujian), who provided Rutelinae materials for the author's study.

Distribution. South China, Yunnan, Yingjiang County.

ACKNOWLEDGEMENT. I thank to Shao-Fu Chen (Yunnan, China), Wen-Yi Chou (Taiwan, China), Hai-Tian Song (Fujian Academy of Forestry, Fujian, China), Wei-Zong Yang (Yunnan, China) for collecting type materials, to Ming-Zhi Zhao (ZMPC) for adding female paratypes of *A. chouwenyii* sp. nov., to Ai-Min Shi, Yun-Chun Li, and Yuan-Yuan Ma (CWNU) for helping examine Rutelinae specimens of China West Normal University. I also thank to Xin Chen (Guangdong, China), Yi-Lin Chen (Guangdong, China), Gui-Qiang Huang (LPSNU), Zhi-Hao Qi (Fujian, China), Jian-Yue Qiu (MYNU), Lu Qiu (Southwest University, Chongqing, China), and Hao Xu (MYNU) for providing Rutelinae materials for my study generously. I also sincerely express my appreciation to Carsten Zorn (Gnoien, Germany) for discussing two new species in personal communication.

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Received: 12.7.2020
Accepted: 20.9.2020
Printed: 31.3.2021