

Taxonomical notes about *Liocola* C. G. Thomson, 1859 and *Macroliocola* Alexis & Delpont, 1998, subgenera of *Protaetia* Burmeister, 1842, with descriptions of new species (Coleoptera: Scarabaeidae: Cetoniinae)

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Abstract. *Macroliocola* Alexis & Delpont, 1998, subgenus of *Protaetia* Burmeister, 1842 is studied. Both currently known species are compared with newly described species from northern part of Sichuan (China) named *Protaetia* (*Macroliocola*) *brunneocoerulea* sp. nov. and new species from northern Vietnam and southern China named *Protaetia* (*Macroliocola*) *vietnamosinica* sp. nov. Second newly described *Macroliocola* Alexis & Delpont, 1998 is also compared with some representatives of subgenus *Liocola* C. G. Thomson, 1859. Dichotomical key to males and known females is provided. New distribution data for *Protaetia* (*Macroliocola*) *montana* Nonfried, 1892 are presented. Pictures of both taxa described and their congeners, including male aedeagi, are given.

INTRODUCTION

The subgenus *Liocola* was described as a monotypical genus by C. G. Thomson in 1859 with type species *Cetonia marmorata* Fabricius, 1792. First author, who tried to group other liocoline cetoniines, described by several authors in various genera, was Schenkling (1921) in his catalogue. That time, Schenkling listed 10 species and 2 subspecies belonging in his opinion to *Liocola* C. G. Thomson. From the Schenkling's list, three species currently belong to different subgenera of *Protaetia* Burmeister, 1842. Several other species have been described after Schenkling's catalogue (1921) by different others, some in *Liocola* C. G. Thomson, some in different subgenera of *Protaetia* Burmeister, 1842. Alexis & Delpont (1998) published paper, in which authors tried to make some order in grouping of liocoline cetoniines. Unfortunately, due to nomenclatural mistakes, this attempt was only partially successful and due to invalidly designated new genera, most of liocoline cetoniines still belong to the subgenus *Liocola* C. G. Thomson, 1859.

Fifteen species and four subspecies are currently accommodated in subgenus *Liocola* C. G. Thomson. Some species are very similar and females are difficult to separate (unless locality is used as criterion), some species are morphologically rather different, but with nearly same aedeagi of males. But some species in authors opinion surely belong to different subgenera, which was already proposed by Alexis & Delpont (1998), in case that the structure of male aedeagus is the main criterion for subgeneric identification as it is in other subgenera of *Protaetia* Burmeister. For example structure of male aedeagi of *Protaetia* (*Liocola*) *auripes* Hope, 1831 or *Protaetia* (*Liocola*) *miyakoensis* Nijjima & Kinoshita, 1923 are unique and completely different than in all the rest of species. In contrary *Protaetia*

(*Pseudocetonischema*) *pretiosa* Nonfried, 1891 and *Protaetia* (*Pseudocetonischema*) *ceylanica* Schoch, 1892 are good candidates for transfer into subgenus *Liocola* C. G. Thomson, otherwise rest of species from *Pseudocetonischema* Mikšič, 1965 must be removed to newly established subgenera. As in other groups of flower beetles, two species flying in one locality try to imitate each other, but it seems to author that in *Liocola* C. G. Thomson, this is more extreme than in other groups. In some localities not two, but even three *Liocola* C. G. Thomson species coexist together and although aedeagi of males are completely different, it is not easy to separate females. Due to this, phylogenetical analysis will be necessary in future to tell us more about this interesting group of Cetoniinae.

Macroliocola Alexis & Delpont, 1998 is currently represented only by two species, one from Taiwan, second with much larger distribution in continental Asia, across transition zone between Palaearctic and Oriental Regions. Single male of *Macroliocola* Alexis & Delpont, 1998 was collected in Sichuan Province of China. External morphology and structure of male aedeagus are closer with its Taiwanese congener and the species is described in this article. Second unknown liocoline species, which was collected in Southern China and Northern Vietnam, belongs also to *Macroliocola* Alexis & Delpont and it is close to *Protaetia* (*Macroliocola*) *montana* Nonfried, 1891. But surprisingly its male genitalia are reminding of some representatives in subgenus *Liocola* C. G. Thomson. This species is compared with *P. montana* Nonfried and also with its Japanese relative *Protaetia* (*Liocola*) *cataphracta* Arrow, 1913 and it is described in taxonomical part of this work. Record of Krajčák (2011) of *P. cataphracta* Arrow, 1913 from China might belong to this newly described species.

MATERIAL AND METHODS

The following codens of institutional and private collections are used in the text:

BMNH British Museum Natural History, London, UK;

IRSNB Institut royal des Sciences Naturelles de Belgique, Brussels, Belgium;

NSMT National Science Museum, Tokyo, Japan;

SJCP Stanislav Jákl, private collection, Praha, Czech Republic;

ZMHB Museum für Naturkunde, Leibniz-Gemeinschaft, Berlin, Germany.

Specimens of newly described species are provided with red and yellow printed labels, red for HOLOTYPUS, yellow for PARATYPUS. Each holotype or paratype label is provided with sex symbol, number of paratype (in paratype label) and words St. Jákl det. Label data are cited for the material examined, individual labels are indicated by a double slash (//), individual lines by a single slash (/).

RESULTS

Protaetia (*Macroliocola*) Alexis & Delpont, 1998

Macroliocola Alexis & Delpont, 1998: 167 (original description).

Protaetia (*Macroliocola*) Alexis & Delpont: Krajčák, 2011: 38 (Cetoniidae of China); Bezděk 2016: 378 (catalogue).

Type species: *Cetonia montana* Nonfried, 1892 (by original designation).

Protaetia (Macroliocola) montana (Nonfried, 1892)
(Figs. 1-5)

Cetonia montana Nonfried, 1892: 371 (original description).

Protaetia montana (Nonfried): Arrow, 1910: 142 (monograph).

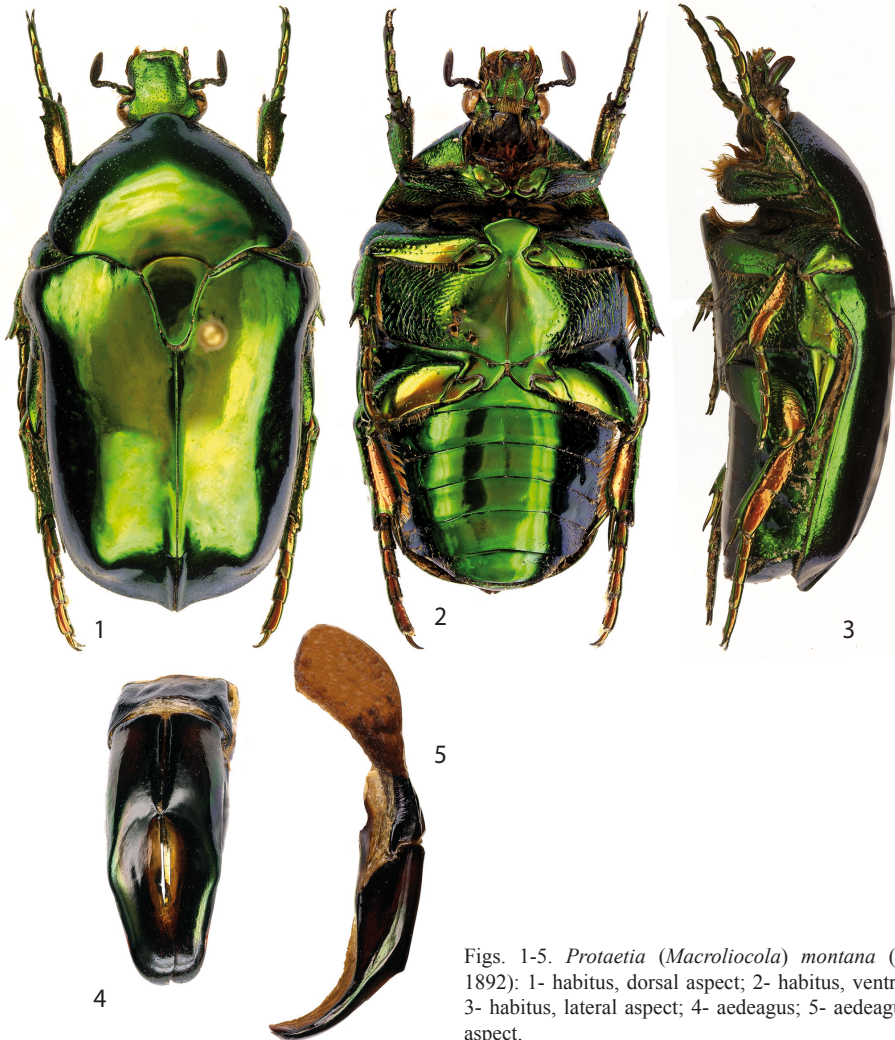
Cetonischema montana (Nonfried): Schein, 1956: 21 (Cetoniidae of Ceylon).

Liocola montana (Nonfried): Mikšič, 1963: 38 (= *L. auripes* Hope).

Protaetia (Liocola) montana (Nonfried): Sakai & Nagai, 1998: 288, pl. 93, figs. 1035-1 male, 1035-2-3 female (Thailand).

Macroliocola montana (Nonfried): Alexis & Delpont, 1998: 167 (redescription, lectotype designation), fig. 9 (parameres).

Protaetia (Macroliocola) montana (Nonfried): Bezděk in Löbl & Löbl, 2016: 378 (catalogue).



Figs. 1-5. *Protaetia (Macroliocola) montana* (Nonfried, 1892): 1- habitus, dorsal aspect; 2- habitus, ventral aspect; 3- habitus, lateral aspect; 4- aedeagus; 5- aedeagus, lateral aspect.

Type locality. “Ex Himalaya“ (= Himalaya Mts.).

Type material. Nonfried described species probably from one specimen. Mikšič (1987) and Alexis & Delpont (1998) did not find type and lectotype (specimen from Thailand) was designated by latter authors. It should be housed in Alexis’s collection in IRSNB.

Material examined: 18 ♂♂, 6 ♀♀ (SJCP) labelled: Laos-NE, Houa Phan pr./ Ban Saluei v., Mt. Phou Pane/ 920-1450 m, 10.-21.VI.2010/ St. Jakl et local collectors lgt; 1 ♂ (SJCP) labelled: FANG/ CHIANG MAI/ THAILAND/ APR 1992; 1 ♂ (SJCP) labelled: FANG/ CHIANG MAI/ THAILAND/ 22 APR 1994; 1 ♀ (SJCP) labelled: THAILANDE/ CHIANG MAI FANF/ ex coll. M. Delpont/ 28.IV.1993/R. ALEXIS Coll./ Coll. IRSNB/ ex. Exchanged with/ S. JAKL/ I. G. : 31. 970; 1 ♂ (SJCP) labelled: THAILANDE/ CHIANGMAI/ leg. Mihara/ VIII. 1996/ R. ALEXIS Coll./ Coll. IRSNB/ ex. Exchanged with/ S. JAKL/ I. G. : 31. 970; 1 ♂ (SJCP) labelled: near Fang/ Chiang Mai Prov./ THAILAND/ MAY 1996; 1 ♂, 2 ♀♀ (SJCP) labelled: VIETNAM, Kon Tum Prov./ MT. NGOC LINH/ VII. 2012/ local collector leg.

Distribution. Central and Southern Vietnam, Northeastern Laos, N. Thailand, NE India, ? Nepal.

Note. Status of this species remains unclear. Populations flying in Vietnam, Thailand and Laos are conspecific, but author did not examine any specimens west of Thailand. Original description is not completely matching with specimens from Indochina and Thailand and due to this, other study in future will be necessary.

***Protaetia (Macroliocola) nigropurpurea* Yawata, 1941**
(Figs. 6-10)

Protaetia nigropurpurea Yawata, 1941: 122, fig. L (original description).

Protaetia (subg. ?) *nigropurpurea* Yawata: Mikšič, 1987, fig. 164 (parameres) [monograph, in species incertae sedis].

Protaetia (Liocola) nigropurpurea Yawata: Sakai & Nagai, 1998: 287, pl. 93, figs. 1029-1 male, 1029-2 female (Taiwan); Krajčičik 1998 : 38 (catalogue).

Macroliocola nigropurpurea Yawata: Alexis & Delpont, 1998: 170, 173, fig. 2 (new rang).

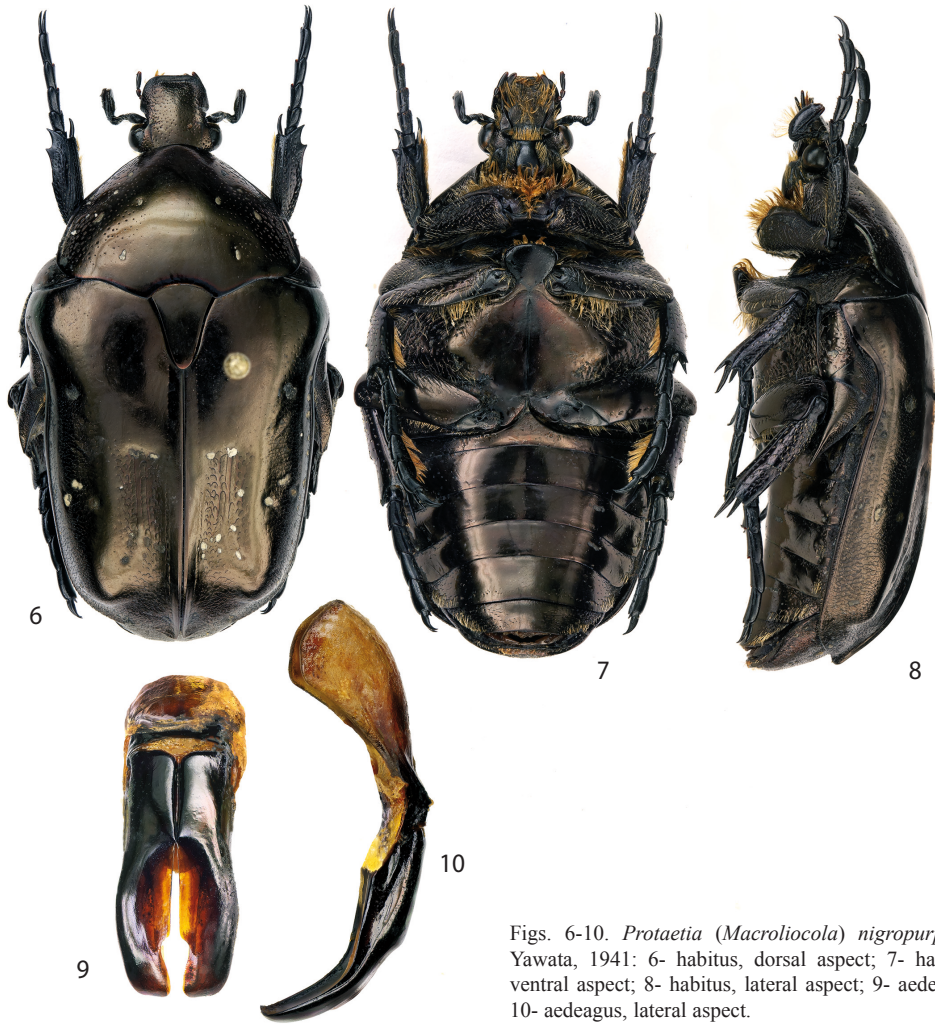
Protaetia (Macroliocola) nigropurpurea Yawata: Bezděk in Löbl & Löbl, 2016: 378 (catalogue).

Type locality. “Musha, Formosa” (= Musha, Taiwan).

Type material. Holotype (♂) (NSMT), ex coll. S. Hirayama.

Material examined: 2 ♂♂, 1 ♀ (SJCP) labelled: FORMOSA (TCHAI-WAN)/ Nantou, WUSHE/ 1.6.-6.6. 2002/ Jar. DALIHOD leg.

Distribution. Taiwan.



Figs. 6-10. *Protactia (Macroliocola) nigropurpurea* Yawata, 1941: 6- habitus, dorsal aspect; 7- habitus, ventral aspect; 8- habitus, lateral aspect; 9- aedeagus; 10- aedeagus, lateral aspect.

***Protactia (Macroliocola) brunneocoerulea* sp. nov.**

(Figs. 11-15)

Type locality. China, N. Sichuan, Micang Shan, 1300-1450 m, Daba env. (32°40' N 106°55' E).

Type material. Holotype (♂) (SJCP) labelled: China, N Sichuan, 11.-12. 6./ Micang Shan, 1300 - 1450 m/ DABA env., 32°40' N 106°55' E/ Jaroslav Turna leg, 2008.

Description of holotype. Coloration of body bronze to brown with rather strong metallic to purpureous lustre. Both sides of body glabrous and completely immaculate. Body size 23.5 mm (excluding pygidium).

Head. Bronze with purpureous lustre. Punctuation simple, rather fine, punctures circularly shaped with density same in both halves. Lateral declivities striolated, clearly visible from dorsal view. Apex of clypeus nearly vertically elevated. Antennae short, its coloration blackish to dark brown, club slightly longer than stalk.

Pronotum. Brownish to bronze, with purpureous to metallic lustre. Pronotal disc very finely punctured to nearly impunctate, sides with short striolate lines or simple punctures. Lateral border developed in two posterior thirds. Setation and white ornament absent.

Scutellum. Brownish with moderately developed lustre, impunctate, immaculate.

Elytra. Brownish to bronze with metallic to purpureous lustre. Sides and part of apex with very shallow and sparse striolation, rest of surface impunctate. White ornament and setation absent. Subhumeral emargination moderately sharp. Humeral calli obtuse, apical calli more distinct. Lateral border reaching level of calli in apex. Sutural ridge completely flat throughout total length, its apex not drawn out over elytral apex.

Pygidium. Bronze, purpureously reflected. Transversally running striolation very sparse and its lines very shallow. Pygidial apex with few white setae.

Ventrum. Coloration plum purple with moderately developed metallic lustre. Abdomen and metasternal plate completely impunctate. Abdominal impression not developed. Sides of metasternum and metacoxae with deep and rather dense striolation and cover of yellow setation. Central groove of metasternal plate deep, running throughout its total length. Apex of mesometasternal process broader than long, its apical margin rather obtusely rounded. Met- and mesepimeron finely punctured. Prosternum and mentum striolated and partially covered with yellowish setation.

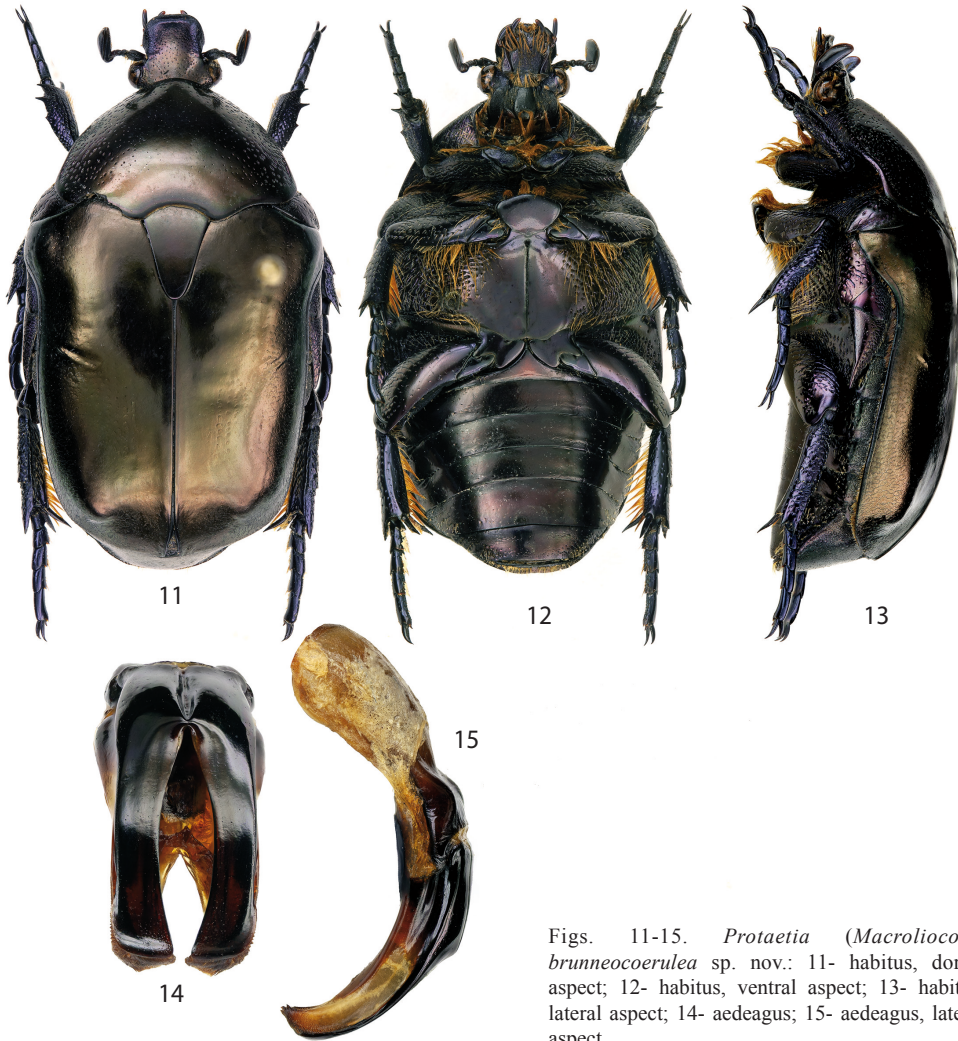
Legs. Coloration of femora, tibia and tarsi plum purple. Posterior margins of mesofemora with brush of yellowish setation. Protibia tridentate, teeth nearly equidistant, posterior tooth smaller. Meso- and metatibia granulated, in posterior half with moderately sharp carina and brush of reddish setation in inner sides. Terminal spurs short and sharp.

Genitalia. Large, but simply developed, parameres nearly parallel running with short setation in apex (Figs. 14-15).

Sexual dimorphism and variability. Hitherto only holotype male is known.

Differential diagnosis. The newly described species differs from both currently known congeners (*P. montana* Nonfried, 1892 and *P. nigropurpurea* Yawata, 1941) in several main characters: I. body size smaller, 23.5 mm, but 26-29 mm in its congeners; II. Clypeal apex in new species vertically elevated, but low, not vertically elevated in its congeners; III. Abdominal impression in male completely absent in new species, but present in its congeners; IV. Metasternal groove deep and long in new species, but very shallow and vague in its congeners; V. Protibia distinctly tridentate in new species, but usually bidentate in males of its congeners; VI. Sutural ridge flat throughout its total length in new species, but elevated at least in apex in its congeners; VII. Genitalia of male in new species differently structured than in its congeners.

Etymology. Named after the coloration of dorsal side of body.



Figs. 11-15. *Protactia* (*Macroliocola*) *brunneocoerulea* sp. nov.: 11- habitus, dorsal aspect; 12- habitus, ventral aspect; 13- habitus, lateral aspect; 14- aedeagus; 15- aedeagus, lateral aspect.

Distribution. China, North Sichuan, Micang Shan, Daba env.

Note. Newly described species is not typical representative of *Macroliocola* Alexis & Delpont, 1998. Metatibiae in new species are not widened and thickened, but according to other morphological characters (structure of mesometasternal process, glabrous appearance, structure of male parameres etc.) it seems to author that the insect is still closer to *Macroliocola* Alexis & Delpont than to the nominotypical subgenus.

***Protaetia (Macroliocola) vietnamosinica* sp. nov.**
(Figs. 16-20)

Type locality. Vietnam, Ha Giang Province, near Dong Van.

Type material. Holotype (♂) (SJCP) labelled: VIETNAM, VI. 2011/ Ha Giang prov./ nr DONG VAN/ local collector leg. Paratypes: (No. 1 ♀) (SJCP) labelled: same as holotype; (No. 2 ♀) (SJCP) labelled: Cao Bang/ N. Vietnam/ V. 2002; (No. 3 ♀) (SJCP) labelled: Mt. Piaoac/ Caobang Prov./ N. Vietnam/ VIII. 1998; (No. 4 ♀) (SJCP) labelled: N. VIETNAM, 300 m/ Yen Bai Prov., V. 2015/ N. T. Lien Son env./ local collector leg; (No. 5 ♂) (SJCP) labelled: CH-Guizhou NE 27.V. - 3.VI./ 20 km NW of Jiangkou, 1995/ FANJING SHAN- Kuaichang/ E. Jendek & O. Šauša leg.

Description of holotype. Green, very glabrous, with strong golden lustre, nearly impunctate and completely immaculate. Body size 24.5 mm (excluding pygidium).

Head. Green, with strong golden reflection. Both halves with fine, simple and sparse punctation. Punctuation of lateral declivities much denser. Apex of clypeus with nearly vertically developed, but low border. Clypeal sides merging gradually to lateral declivities. Antennae brownish, scapus dark green. Clun slightly shorter than stalk.

Pronotum. Green, very strongly reflected. Pronotal disc completely impunctate, sides with few simple punctures, anterolateral angles with few shortly developed striolae. Lateral border running throughout total length, but in its anterior third less distinct. In front of posterolateral margins with rather shallow emargination. Ornament and setation absent.

Scutellum. Green, with strong golden lustre, impunctate, immaculate.

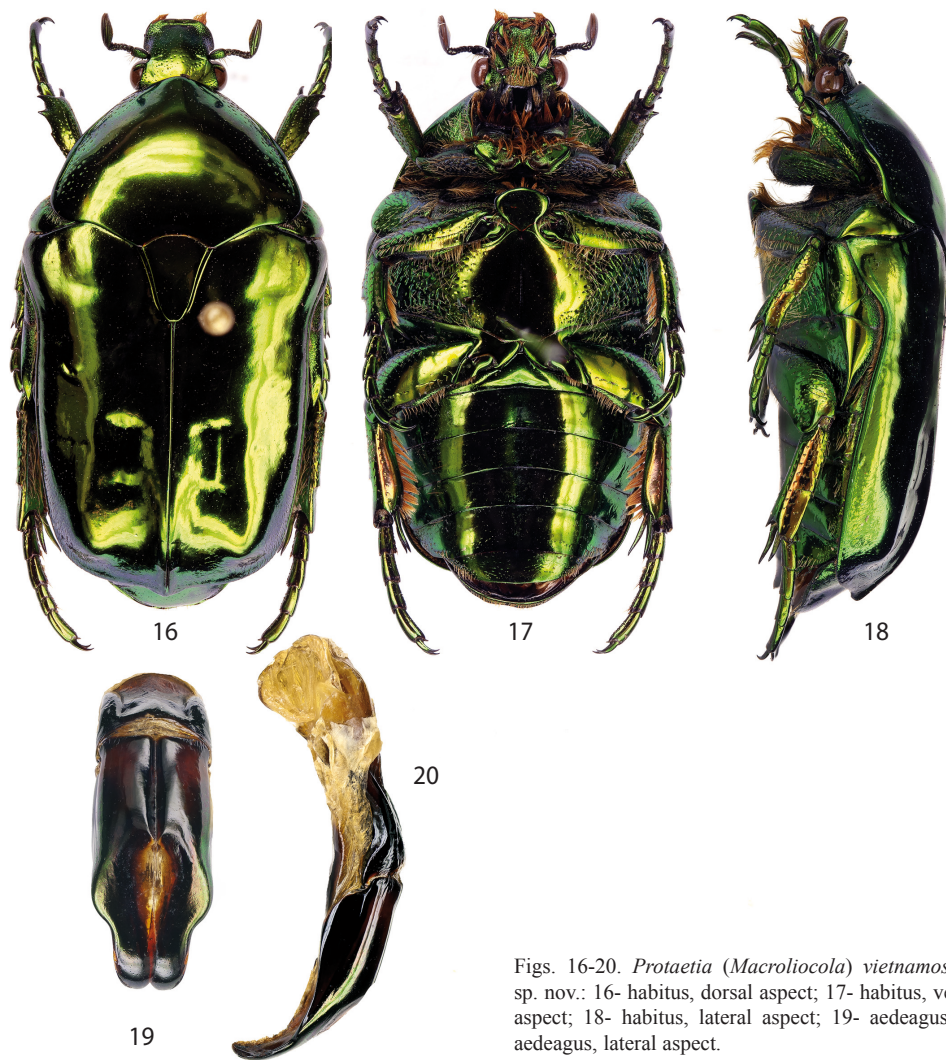
Elytra. Green, with strong golden lustre. Apical quarter of sides and part of apex with shallow and rather sparse striolation, rest of elytra completely impunctate. Apical half of disc with two transversally developed impressions in each elytron. Lateral border reaching level of apical calli. Sutural ridge completely flat nearly throughout its total length, in front of apex slightly elevated and very shortly drawn out over elytral apex.

Pygidium. Green, with strong golden reflection. Disc with few simple punctures, anterolateral angles with few wrinkles. Pygidial apex with few short, yellowish setae.

Ventrum. Green, strongly shining, especially in metasternal plate. Excepting anal ventrite, rest of abdomen impunctate and immaculate. Abdominal impression rather broad and deep. Metasternal plate strongly shining, impunctate, its longitudinal groove blackish and shallow. Metasternal sides and metacoxae with moderately dense and deep striolation and metasternal sides with cover of yellowish to reddish setation. Mesometasternal process large, nearly circularly shaped, its width only slightly longer than its length. Prosternum and mentum striolated and covered with moderately long reddish to yellowish setation.

Legs. Moderately long, completely green, with golden lustre, especially in femora and tibiae. Metafemora with striolation in anterior margins, striolation of meso- and profemora more expressed. Protibia tridentate, teeth nearly equidistant. Meso- and metatibia with carina in posterior half and brush of reddish setation on inner sides. Terminal spurs of metatibia long and sharp, slightly curving to inner side. Metatibiae gradually widening apically.

Genitalia. Reminding of genitals of *P. insperata* Lewis, 1897 and *P. cataphracta* Arrow, 1913 from subgenus *Liocola* C. G. Thomson. (Figs. 19-20).



Figs. 16-20. *Protactia (Macroliocola) vietnamosinica* sp. nov.: 16- habitus, dorsal aspect; 17- habitus, ventral aspect; 18- habitus, lateral aspect; 19- aedeagus; 20- aedeagus, lateral aspect.

Variability. Size of males 24-26 mm. Male from Guizhou (China) with several minute white patches in posterior half of elytra and small patch in each side of 2nd to 4th abdominal segments. In other aspects similar or same.

Sexual dimorphism. Size of females 24.0-25.5 mm. One female with three nearly invisible white patches in elytral impression of each elytron. Abdomen arched, without impression. Punctuation of pronotal sides and striolation of elytral sides and apex slightly more developed than in males. Protibia wider and more robust, tridentate as in males, but teeth longer and sharper. Antennae slightly shorter. In other aspects same or very similar to males.

Differential diagnosis. *Protaetia (Macroliocola) vietnamosinica* sp. nov. can be confused with *Protaetia (Macroliocola) montana* Nonfried. The newly described species differs from its congener in following characters: I. Size of the new species 24-26 mm, but in *P. montana* Nonfried 26-29 mm; II. Legs in the new species green with golden reflection, but coppery-red legs in its congener; III. Pronotal border running throughout total length in the new species, but not reaching anterior third in its congener; IV. Abdominal impression deep and broad in the new species, but shallow in its congener; V. Mesometasternal process more or less circularly shaped in the new species, but approximately triangularly shaped with obtusely rounded apex in its congener; VI. Metatibia medially widened and thickened in the new species, but extremely widened and thickened in its congener; VII. Male parameres in the new species very different than in *P. montana* Nonfried.

Aedeagus of male in the new species is not dissimilar to *P. cataphracta* Arrow, 1913 *P. insperata* Lewis, 1897 and *P. marmorata* Fabricius, 1792 belonging to the subgenus *Liocola* C. G. Thomson, 1859. The newly described species of *Macroliocola* Alexis & Delpont, 1998 can be distinguished from latter congeners in completely glabrous and immaculate dorsum with very strong golden lustre, nearly equidistant teeth of protibia and enlarged and widened metatibia with long and sharp terminal spurs slightly curved to inner side.

Etymology. Named after currently known distribution of new species, transitional zone between northern Vietnam and southern China.

Distribution. N. Vietnam; S. China (Guizhou Province).

Note. Record of *Protaetia (Liocola) cataphracta* Arrow, 1913 from China by Krajčičk (2011) might belong to this newly described species.

DICHOTOMICAL KEY TO MALES OF *PROTAETIA (MACROLIOCOLA)* ALEXIS & DELPONT SPECIES

- 1(2) Body size 23.5 mm, dorsal coloration bronze to brownish, both body sides immaculate, disc of elytra completely impunctate, abdomen without impression, metasternal groove deep and long, protibia tridentate, metatibia not widening to its apex. China: N. Sichuan*Protaetia (Macroliocola) brunneocerulea* sp. nov.
- 2(1) Body size 24-29 mm, dorsal coloration green with golden lustre or bronze with metallic lustre, body sides with white ornament or immaculate, disc of elytra with or without striolation, abdomen with impression, metasternal groove shallow and vague, protibia bidentate or tridentate, metatibia medially or strongly enlarged, widening to its apex.
- 3(6) Dorsal coloration green with golden lustre, head, pronotum and elytra immaculate or with considerably reduced ornament in elytra, elytral disc impunctate.
- 4(5) Green with strong reflection and coppery-red legs. Pronotal border not reaching anterolateral angles. Abdominal impression shallow. Mesometasternal process more or less triangularly shaped. Size 26-29 mm. Vietnam, Laos, Thailand, NE India, ? Nepal *Protaetia (Macroliocola) montana* Nonfried, 1891
- 5(4) Green with strong reflection and green-golden legs. Pronotal border running throughout total length. Abdominal impression broad and deep. Mesometasternal process nearly circularly shaped. Size 24-26 mm. North Vietnam; South China*Protaetia (Macroliocola) vietnamosinica* sp. nov.
- 6(3) Dorsal side bronze with metallic lustre and with white ornament in elytra and pronotum, elytral disc with striolation, legs bronze to coppery- brown with metallic lustre. Taiwan
..... *Protaetia (Macroliocola) nigropurpurea* Yawata, 1941

DICHOTOMICAL KEY TO FEMALES OF *PROTAETIA* (*MACROLIOCOLA*)
ALEXIS & DELPONT SPECIES

- 1(4) Coloration of body green with strong golden lustre. Legs coppery-red or green with strong golden lustre. Elytra nearly impunctate and usually immaculate, pronotum always immaculate, striolation of elytral disc always absent.
- 2(3) Legs coppery-red, shining. Mesometasternal process approximately triangularly shaped. Pronotal border incomplete. Body size 26-29 mm. Vietnam, Laos, Thailand, NE India, ? Nepal
..... *Protaetia (Macroliocola) montana* Nonfried, 1891
- 3(2) Legs green with strong golden reflection. Mesometasternal process nearly circularly shaped. Pronotal border running throughout total length. Body size 24-26 mm. North Vietnam; South China
..... *Protaetia (Macroliocola) vietnamosinica* sp. nov.
- 4(1) Coloration of body bronze to coppery-red. Legs bronze to brownish with metallic lustre. Elytra and pronotum with white ornament pattern. Elytral disc with striolation. Taiwan.....
..... *Protaetia (Macroliocola) nigropurpurea* Yawata, 1941

Note. Female of *Protaetia (Macroliocola) brunneocoerulea* sp. nov. stays unknown, therefore is not included in the key to females.

***Protaetia (Liocola) cataphracta* Arrow, 1913**
(Figs. 21-25)

Protaetia cataphracta Arrow, 1913: 405 (original description); Yawata, 1941: 82, fig. D (parameres).

Protaetia insperata cataphracta Arrow: Kurosawa, 1959: 340.

Protaetia (Liocola) cataphracta Arrow: Mikšič, 1987: 499, fig. 130 (parameres); Krajčák, 1998: 38 (catalogue); Sakai & Nagai, 1998: 287, pl. 93, figs. 1025-1 male, 1025-2 female 1025-3 male (iconography); Sakai & Fujioka, 2007: 117, figs. 1-16 (Atlas of Japanese Scarabaeoidea); Krajčák, 2011: 42 (Cetoniidae of China).

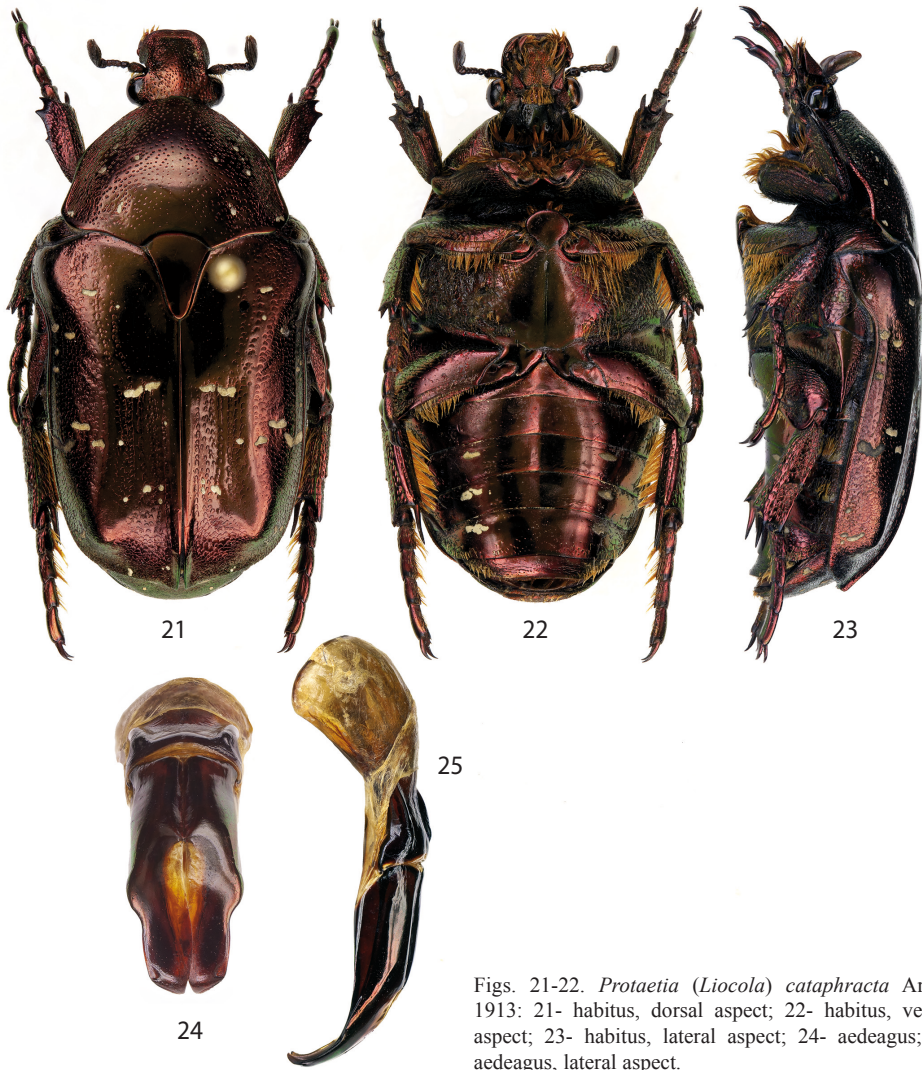
Type locality. North Japan: Nikko, L. Junsai, Fusai, Usui Pass.

Type material. Arrow described this species based on 1 male and 11 females, which are deposited in BMNH.

Material examined: 2 ♂♂, 1 ♀ (SJCP) labelled: Anayama, Nirasaki/ Yamanashi, Japan/ 28. V. 1980/ Kazuo Iwase leg// *Protaetia (Liocola) cataphracta*/ Arrow, 1913/ det. K. Sakai, 2006.

Distribution. Japan: Hokaido, Honshu and Shikoku Islands.

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Figs. 21-22. *Protaetia (Liocola) cataphracta* Arrow, 1913: 21- habitus, dorsal aspect; 22- habitus, ventral aspect; 23- habitus, lateral aspect; 24- aedeagus; 25- aedeagus, lateral aspect.

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