



## Natural history of *Protaetia (Vietnamoprotactia) sericophora* (Seillière) (Coleoptera: Scarabaeidae: Cetoniinae) with notes on collecting flower beetles in karst areas

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### Abstract

The natural history of the little-known *Protaetia (Vietnamoprotactia) sericophora* (Seillière, 1910) (Coleoptera, Scarabaeidae, Cetoniinae) in China is documented. Records from Guangdong, Guangxi, and Yunnan have significantly extended the distribution range of this species. The female is illustrated for the first time and sexual dimorphism is presented. Photographs of the habitus, parameres, and type materials of this beetle are also provided. The observations on the natural habitat of its larvae provided new insights for capturing the flower beetles occurring in limestone areas and similar habitats.

**Key words:** Lamellicornia, flower chafer, Cetoniini, *Vietnamoprotactia*, Oriental Region, distribution, Limestone area, larva

### Introduction

*Protaetia* Burmeister, 1842 is the most speciose genus of the subfamily Cetoniinae Leach, 1815 and comprises 53 subgenera and 484 species-level taxa (Allsopp & Schoolmeesters 2024). Species of this genus are mainly distributed in Eurasia, and currently about 20 subgenera are known from China (Krajčák 2011; Bezděk 2016). Some *Protaetia* species are rather widespread and easily collected, but there are also many rare species for which knowledge is still very limited.

The subgenus *Vietnamoprotactia* Mikšić, 1971 was introduced to accommodate two Indo-Chinese species that were misplaced in the genus *Glycyphana* Burmeister, 1842 for more than half a century (Mikšić 1970, 1971). These hitherto known two *Vietnamoprotactia* species were rarely mentioned in the literature, and both have been recorded from southern China in recent years. The first record of this subgenus in China was represented by the discovery of *Protaetia (V.) sericophora* (Seillière, 1910) in the Maolan Natural Reserve of Guizhou (Jákl in Ziani *et al.* 2015). The Cetoniinae fauna of this reserve is very similar to that of northern Vietnam where is the previously known distribution of this beetle (Seillière 1910; Bourgoin 1917; Paulian 1960). The type species *P. (V.) aeneipes* (Bourgoin, 1920) was originally described from Vian-Poukha in northern Laos, and was later reported from northern Vietnam and northern Thailand by Mikšić (1970) and Jákl (2020), respectively. Moreover, *P. (Netocia) absidata* Ma, 1993, which was named based on three individuals from Mengla of Yunnan, southern China, was synonymized with this species by Jákl (2020). It is suggested that *P. (V.) aeneipes* ranges from northern Vietnam and southern Yunnan, China in the north, to northern Thailand in the south. *Protaetia (V.) sericophora* and *P. (V.) aeneipes* have

been redescribed by Paulian (1960) and Mikšić (1987), respectively; the female of the latter with wider spurs in metatibia was mentioned by Ma (1993). The parameres and habitus of these two species were recently illustrated with color plates by Jákl (2020) in his valuable work on Indo-Chinese *Protaetia*. However, the female of *P. (V.) sericophora* has not been figured, and the sexual dimorphism is still unknown. In addition, no biological information was reported on these two species.

In the past decade, *Protaetia (V.) sericophora* was found several times in Limestone areas in southern China. Herein we mapped the geographic distribution of this beetle based on the records in the literature and examined specimens. Observation on the habitat in the field and the artificial rearing of larvae allow us to document the natural history of this rare species. The adults are quite difficult to catch in field because of insufficient knowledge on the habit, while the habitats of larvae under cliffs are easy to find in karst areas. By excavating the larvae or cocoons, more specimens and species of the flower beetles inhabiting in karst forest were obtained.

## Material and methods

A Canon 90D camera in conjunction with Laowa macro 2X lens EF 100 mm f/2.8 and Canon macro photo lens MP-E 65mm f/2.8 1-5X were used for taking images of the habitus and male genitalia, respectively. The camera was fixed on the Laowa E01 rail and controlled by the app WeMacro 4.0 for macro photography focus stacking. The final deep-focus images were created in Helicon Focus 7.0.2 Pro, and all images were modified in Adobe Photoshop CS5.

The distributional map (Fig. 21) of the subgenus *Vietnamoprotaetia* was modified with data taken from the labels and published records (Seillière 1910; Bourgoin 1917, 1920; Paulian 1960; Mikšić 1971; Ma 1993; Jákl 2020). Label data for type specimens are cited verbatim and our remarks are enclosed in a square bracket “[ ]”. The abbreviation “hw.” in square brackets is used for handwriting on a label; otherwise, the letters on the label were printed. A double slash (//) is used to separate different labels, and a single slash indicates data on the reverse side. The following abbreviations are used for public and private collections (curators in parenthesis), and the asterisk (\*) given in the citation are whose voucher specimens were examined by authors.

**BMNH** The Natural History Museum, London, United Kingdom (Maxwell V.K. Barclay);

**CCCC** Collection of Chang-Chin Chen, Tianjin, China;

**MNHN** Muséum national d’Histoire naturelle, Paris, France (Olivier Montreuil);

**MYNU** Invertebrate Collection of Mianyang Normal University, Mianyang, Sichuan, China (Hao Xu);

## Taxonomy

### *Protaetia (Vietnamoprotaetia) sericophora* (Seillière, 1910)

Chinese common name: 黑腹越星花金龟

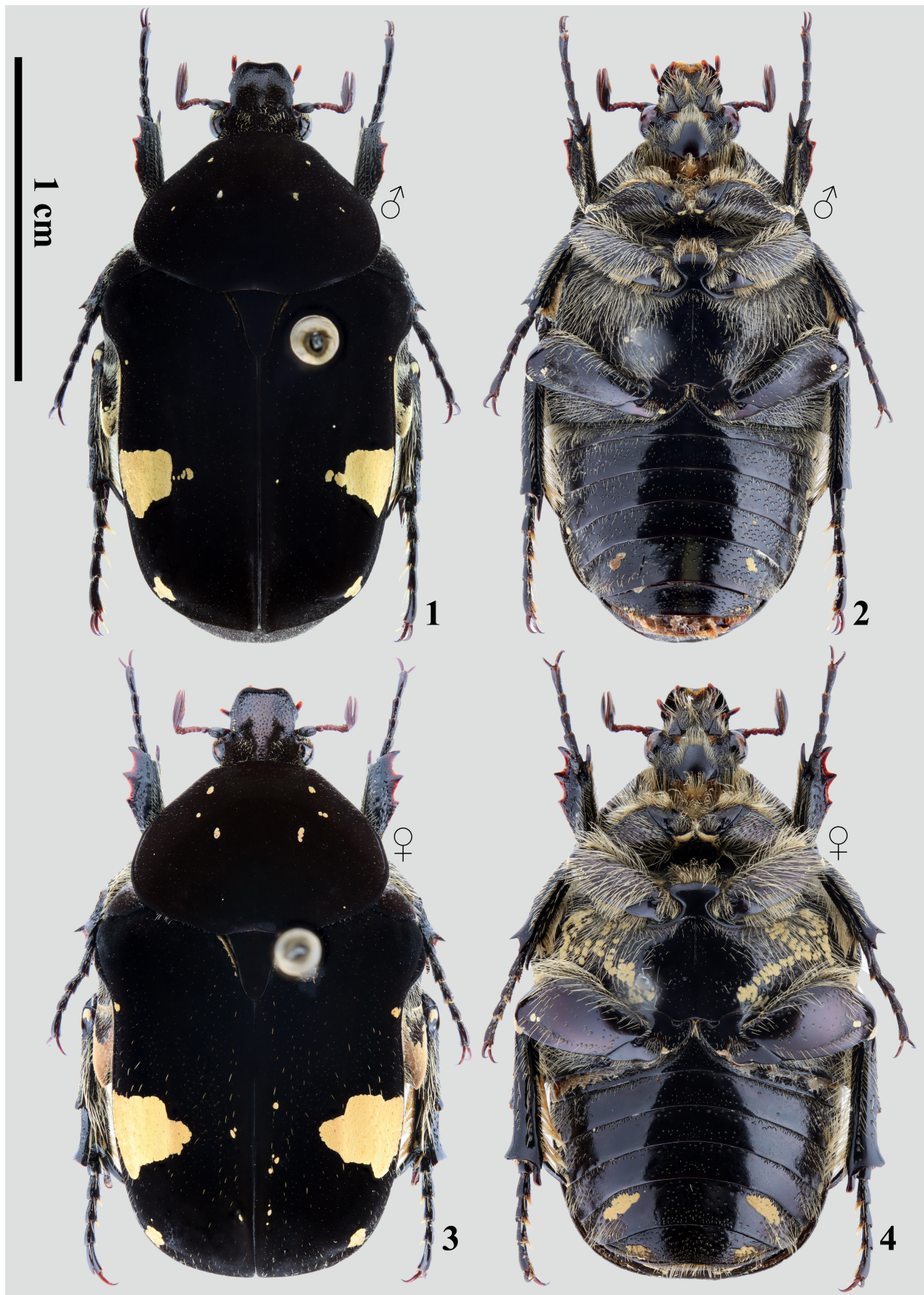
(Figs 1–15, 21–23, 27–33, 36–41)

*Glycyphana sericophora* Seillière, 1910: 327 (Type locality: Tonkin [=N. Vietnam])\*; Bourgoin 1917: 49 (Dong-Dang, Tonkin)\*; Schenkling 1921: 278 (catalogued); Paulian 1960: 61 (Ha Giang & Hoa Binh, Tonkin)\*.

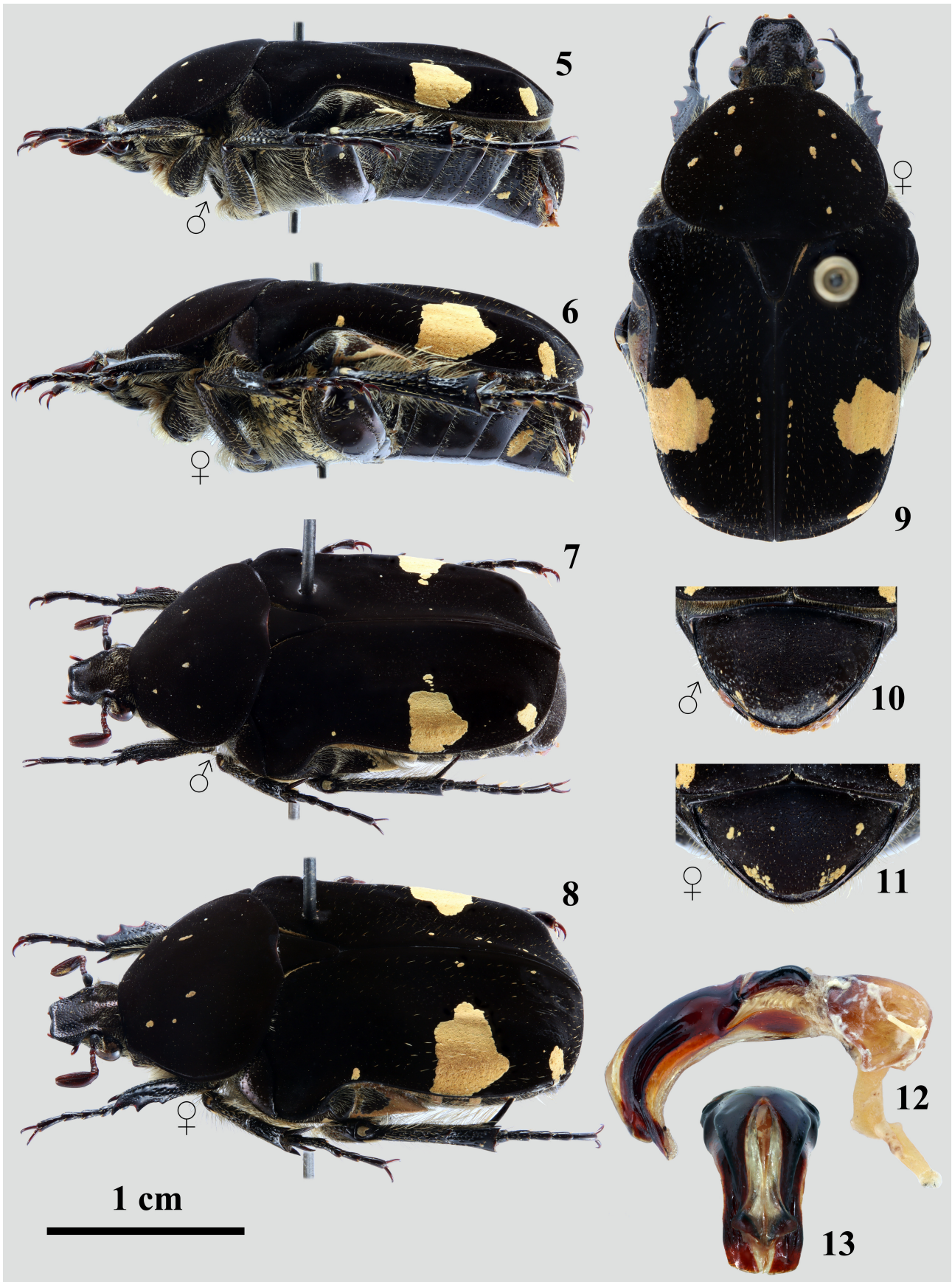
*Protaetia sericophora* (Seillière): Mikšić 1970: 4.

*Protaetia (Vietnamoprotaetia) sericophora* (Seillière): Mikšić 1971: 209; Mikšić 1987: 443; Krajčák 1998: 48 (catalogued); Krajčák 2012: 226 (catalogued); Jákl in Ziani *et al.* 2015: 27 (Maolan, Guizhou, S. China); Bezdek 2016: 387 (catalogued); Jákl 2020: 44 (Dong Van, Ha Giang, N. Vietnam), figs 28a–e ♂.

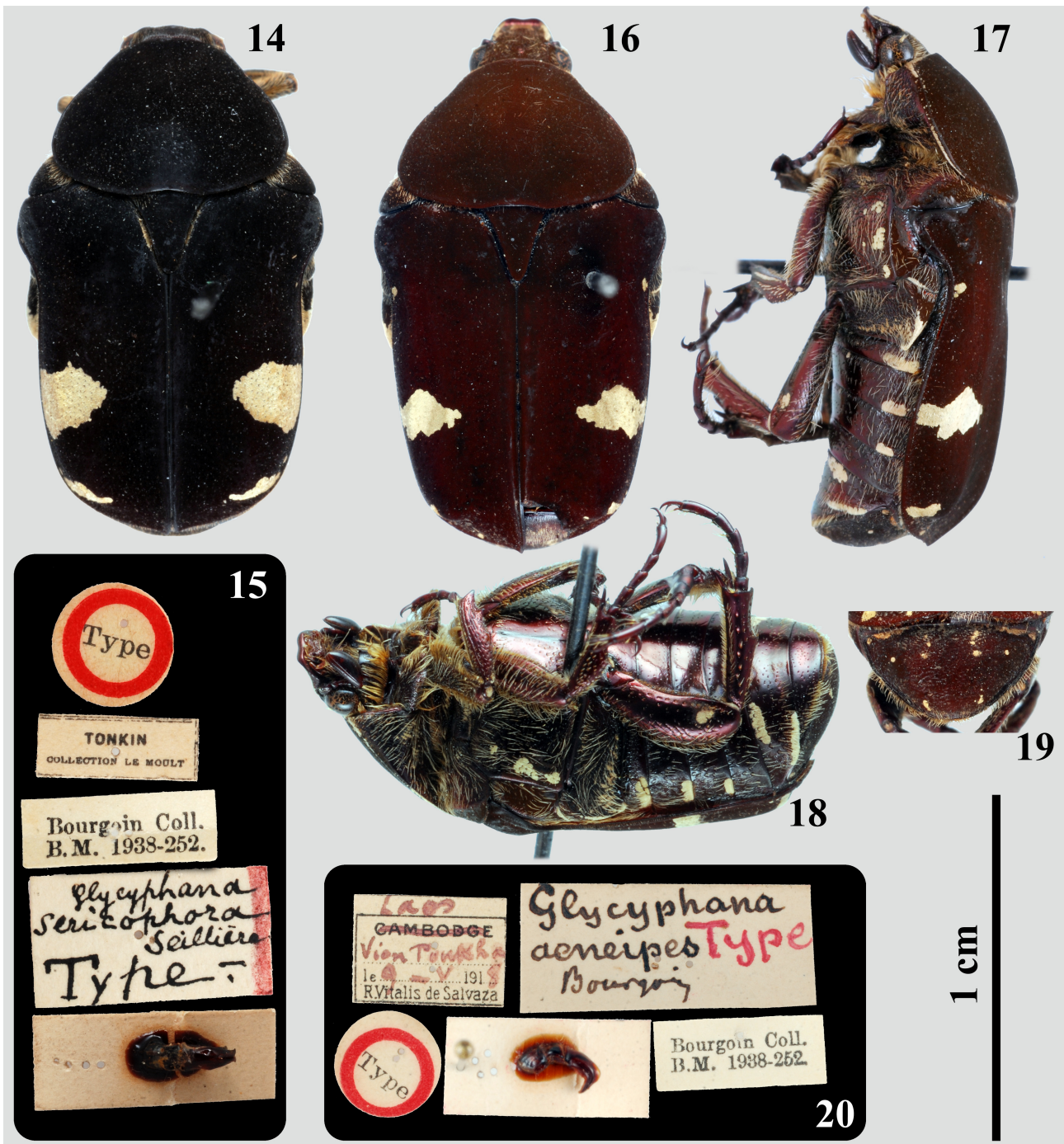
**Type material.** Seillière (1910) stated that this species was originally described based on a sole female from Tonkin provided by E. Le Moul. Label data of the holotype (by monotypy) in BMNH matches the original publication, but it is a male. **Holotype** of *Protaetia (Vietnamoprotaetia) sericophora* (Seillière, 1910) (♂, BMNH, Figs 14–15): TONKIN, COLLECTION LE MOULT// Bourgoin Coll., B.M. 1938-252// glycyphana sericophora Seillière, Type [hw.]// Type [round label].



FIGURES 1–4. Habitus of *Protactia* (*Vietnamoprotactia*) *sericophora*. 1, 3. Dorsal view. 2, 4. Ventral view.



**FIGURES 5–13.** *Prottaetia (Vietnamoprottaetia) sericophora*. 5–6. Habitus in lateral view. 7–8. Habitus in lateral oblique view. 9. Female with many light-yellow tomentose maculae on the pronotum. 9–10. Pygidium. 12–13. Parameres in dorsal and lateral view.



FIGURES 14–20. Type specimens of *Protactia* (*Vietnamoprotactia*) spp. 14–15. Male holotype of *P. (V.) sericophora* in dorsal view and labels (BMNH). 16–20. Male holotype of *P. (V.) aeneipes*. 16–18. Holotype in dorsal, lateral, and ventral view. 19. Pygidium. 20. Labels (BMNH).

**Additional material examined** (25 exs). **CHINA: Guizhou:** 1♂, 1♀ (MYNU), 2017.II.8, adult in cocoon, Lashou Village, Jialiang, Libo Co., alt. 800 m, Hao XU & Jian-Yue QIU lgt.; 1♂, 2♀♀ (MYNU), 2017.II.8, adult in cocoon, Yaoai Village, Maolan, Libo Co., alt. 560 m, Hao XU & Jian-Yue QIU lgt.; 4♂♂, 1♀ (MYNU), 2018. III.1, adult in cocoon, Yaoai Village, Maolan, Libo Co., alt. 560 m, Hao XU & Jian-Yue QIU lgt.; **Guangxi:** 1♀ (MYNU), 2021.V.14, Nonggang Village, Zhubo, Longzhou Co., Chongzuo, Lu LU lgt.; 1♂, 1♀ (MYNU), 2023. V.6, Longhengtun, Nonggang Village, Zhubo, Longzhou Co., Chongzuo, Guo-Xi XUE lgt.; **Guangdong:** 1♂, 3♀♀ (MYNU), 2022.II.21 larva, 2022.X.10 adult, Mt. Yanyanshan, Lingbei, Yangshan Co., alt. 230 m, Hao XU, Jiang

ZHU, Zhi-Zhao YE lgt.; **Yunnan**: 1♀(CCCC), 2016.IV.25, Huayudong, Nanxi, Hekou Co., alt. 334 m, Xiao-Dong YANG lgt.; **VITENAM**: 1♀(BMNH), Thuon[g?]-Lam (Tonkin)// Bourgoin Coll., B.M. 1938-252//♀; 1♂ (BMNH), Tonkin, Dong Dang [hw.], le mai 1915, R.Vitalis de Salvaza// Bourgoin Coll., B.M. 1938-252//♀; 1 ex (MNHN), Tonkin [hw.]/ *Vietnamoprotactia*, Mikš. *sericophora* Seill. [hw.], G. RUTER det. 19; 1 ex (MNHN), Tonkin [hw.]/ *P. (Vietnamoprotactia) sericophora* Seillière [hw.], St. Jakl det., 2011; 1♂ (MNHN), Tonkin [hw.]/ *glycyphana sericophora* Seill. [hw.]/ *P. (Vietnamoprotactia) sericophora* Seillière [hw.], St. Jakl det., 2011; 1♀ (MNHN), Reg. d'Ha-Giang, nassae, thanh hung, Ha Giang Luan-La [hw.]/ MUSEUM PARIS, Tonkin N., (H te Riv. Claire [=River Sông Lô]), S. Olivier 1916 [hw.]; 1 ex (MNHN), H. Tonkin, Dong Van, Cap<sup>nc</sup> Gadel, 1898// *P. (Vietnamoprotactia) aeneipes* BOURGOIN [hw.], J. Ph. Legrand det., VIII.2008.

**Differential diagnosis.** This species and *P. (V.) aeneipes* both possess tomentum on the dorsal surface and pygidium with scattered yellow patches or spots, but they can be easily distinguished by the color of the ventral surface and legs, that is black in this species, and wine-red in *P. aeneipes* (Figs 16–19). The shape of parameres is distinctly different, see figures displayed in Jákł (2020).

**Sexual dimorphism.** Female highly resemble males, but body, protibia, and metatibia slightly wider; outer tooth of protibia and metatibia slightly larger; the two spurs of metatibia distinctly wider and blunt (Figs 3–4).

**Measurements.** Body length 18.5–23.0 mm, width 9.5–11.3 mm.

**Variability.** The color of the body usually is black, but sometimes the dorsal surface of the pronotum becomes dark brown (Figs 27, 41). The number and size of the yellow spots on the body surface are variable. Pronotum usually with two to six tiny light-yellow tomentose maculae (Figs 1, 3, 27), occasionally eight or ten (Fig. 9), or totally absent (Fig. 14). Elytron usually with three light-yellow tomentose maculae: a tiny one on the posthumeral area, but sometimes absent (Fig. 41); a large one on the median portion of the lateral declivity, few individuals with an additional small one towards suture (Fig. 1); a small one on the lateral margin near anteapical umbone, sometimes almost connected to the large one. Few tiny tomentose maculae may be present along the sutural costa (Figs 3, 9, 27). Pygidium is usually clad with two or four small tomentose maculae (Fig. 10), sometimes six or absent (Fig. 11). Metasternum usually with few tiny maculae, but numerous in a few specimens (Fig. 4).

**Distribution.** China: Guizhou, Guangxi (**new record**), Guangdong (**new record**), Yunnan (**new record**); Vietnam.



**FIGURE 21.** Known collecting locations of *Protactia (Vietnamoprotactia) sericophora* (black dots) and *P. (V.) aeneipes* (black triangles). Type localities are underlined, and the open dot in North Vietnam is the type locality “Tonkin” without a precise location.

**Natural history.** The natural history of the adults was unknown before our study. The specimen data of our examined materials and Jákl (2020) suggested that the adults occur in forests from late April to July. Several newly emerged adults in pupal cocoons have been excavated from the leaf litter under cliffs in Maolan Natural Reserve in Libo of southern Guizhou in February and March (Figs 22–36). While, in the same season of the year 2022, only mature larvae were found under the cliff in Yangshan of northern Guangdong. These wild-collected larvae were provided with decayed leaves in a small plastic container at room temperature in Mianyang, Sichuan, and four adults were found in October (Figs 37–41). It is uncertain whether the adults had emerged in October, or emerged earlier (perhaps in March) but they were dormant in their cocoons until October.

**Remarks.** Prior to the present study, *Protaetia* (*Vietnamoprotetia*) *sericophora* in China was only known from southern Guizhou and no information was available on the larva. Our findings not only extended the distribution range of this species, but also indicated that the larvae inhabit leaf litter in limestone areas at low elevations of 200–800 m. All the sites where the Indo-Chinese specimens of this subgenus were found, are located in areas that are well-known karst landscapes. Furthermore, there is a scenic spot of karst landscape in Mengla which is the type locality of *P. absidata* Ma, 1993. This implies that *P. (V.) aeneipes* can be found in the karst areas in southern Yunnan and Guangxi (Fig. 21). One reason why these two species have been rarely collected is probably because mid- to high-altitude forests are frequently surveyed, but the environment of lower altitude areas which they inhabit are often neglected in surveys due to severe damage.

Using the knowledge of the larval habitat of *P. (V.) sericophora* obtained from the karst area at Libo in Guizhou at the beginning of 2017, many larvae of different species were found by searching for similar cliff habitats in Yunnan, Sichuan, Guangdong, and Guizhou in the following years (see the table 1). Based on the observation of the leaf litter at the foot of cliffs and surrounding areas, the habitat (Figs 23, 29, 33, 37, 42, 47) where these larvae were found can be characterized as follows: 1) the larvae prefer to stay in relatively dry conditions, and no any streams flowing through; 2) the habitat is usually humid by receiving little rain, and not drenched by rainfall or totally dry like surrounding flat areas; 3) with broadleaf trees or bush on the top of cliffs, and decayed leaves forming a layer of humid leaf litter; while almost no humid litter in surrounding flat areas. The layer of leaf litter on the shady side is usually thicker, providing moist conditions for leaf litter decomposition and providing sufficient food for the larvae. The larvae usually feed on a large amount of humus, and surrounded by large amounts of fecal pellets which are elongated oval in shape and easily recognized (Figs 24–26, 30–31, 34–35, 40, 44, 51). Therefore, it is necessary to check for the presence of fecal pellets before excavating. Stages of the wild-collected individuals depends on species and season. There are no seasons limited in the use of this method, but from late fall to early spring the grass and shrubs are not yet lush and the habitats easily accessible.

**TABLE 1.** Species of Cetoniinae collected in karst areas in southern China by excavating litter

Date	Location	Species	Stage
27 <sup>th</sup> Jan. 2017	Menglai, Cangyuan Co., Yunnan	<i>Protaetia</i> ( <i>Pachyprotaetia</i> ) sp.	larva, cocoon
7 <sup>th</sup> Feb. 2017	Yaoai, Maolan, Libo Co., Guizhou	<i>Protaetia</i> ( <i>Dicranobia</i> ) <i>rochei</i> <i>Protaetia</i> ( <i>Vietnamoprotetia</i> ) <i>sericophora</i>	larva, cocoon
8 <sup>th</sup> Feb. 2017	Jialiang, Libo Co., Guizhou	<i>Cosmiomorpha</i> ( <i>Microcosmiomorpha</i> ) sp. <i>Protaetia</i> ( <i>Vietnamoprotetia</i> ) <i>sericophora</i>	larva
26 <sup>th</sup> Feb. 2018	Gulingqing, Maguan Co., Yunnan	<i>Trigonophorus riaultii</i> (Fairmaire, 1897)	remains
27 <sup>th</sup> Feb. 2018	Qiaotou, Hekou Co., Yunnan	<i>Protaetia</i> ( <i>Dicranobia</i> ) sp.	adult
1 <sup>st</sup> Mar. 2018	Maolan NR, Libo Co., Guizhou	<i>Protaetia</i> ( <i>Potosia</i> ) <i>nitididorsis</i> (Fairmaire, 1889) <i>Protaetia</i> ( <i>Dicranobia</i> ) <i>rochei</i> Bourgoin, 1916 <i>Protaetia</i> ( <i>Vietnamoprotetia</i> ) <i>sericophora</i>	larva, cocoon
3 <sup>rd</sup> Mar. 2018	Maolan NR, Libo Co., Guizhou	<i>Moseriana</i> sp.	larva
21 <sup>st</sup> Jun. 2020	Maolan NR, Libo Co., Guizhou	<i>Protaetia</i> sp.	larva, cocoon
16 <sup>th</sup> Jan. 2022	Jingguangdong, Jiangyou, Sichuan	<i>Protaetia</i> ( <i>Dicranobia</i> ) <i>potanini</i> (Kraatz, 1889) <i>Petrovitzia guillotii</i> (Fairmaire, 1891)	larva, remains
21 <sup>st</sup> Feb. 2022	Mount Yanyanshan, Yangshan Co., Guangdong	<i>Protaetia</i> ( <i>Vietnamoprotetia</i> ) <i>sericophora</i>	larva



**FIGURES 22–27.** Habitat of the larva of *Protaetia* (*Vietnamoprotia*) *sericophora*. **22.** Karst landscape in Yaoai, Libo, Guizhou, China. **23.** Habitat under the cliff. **24.** Closer view of the habitat in leaf litter. **25–26.** Mature larva and dead adult of *P. (Dicranobia) rochei* found in the litter with fecal pellets on 7<sup>th</sup>, February 2017. **27.** Newly emerged adult of *P. (V.) sericophora* in pupal cocoon. (Blue arrows indicate habitats, blue circle indicates larva).

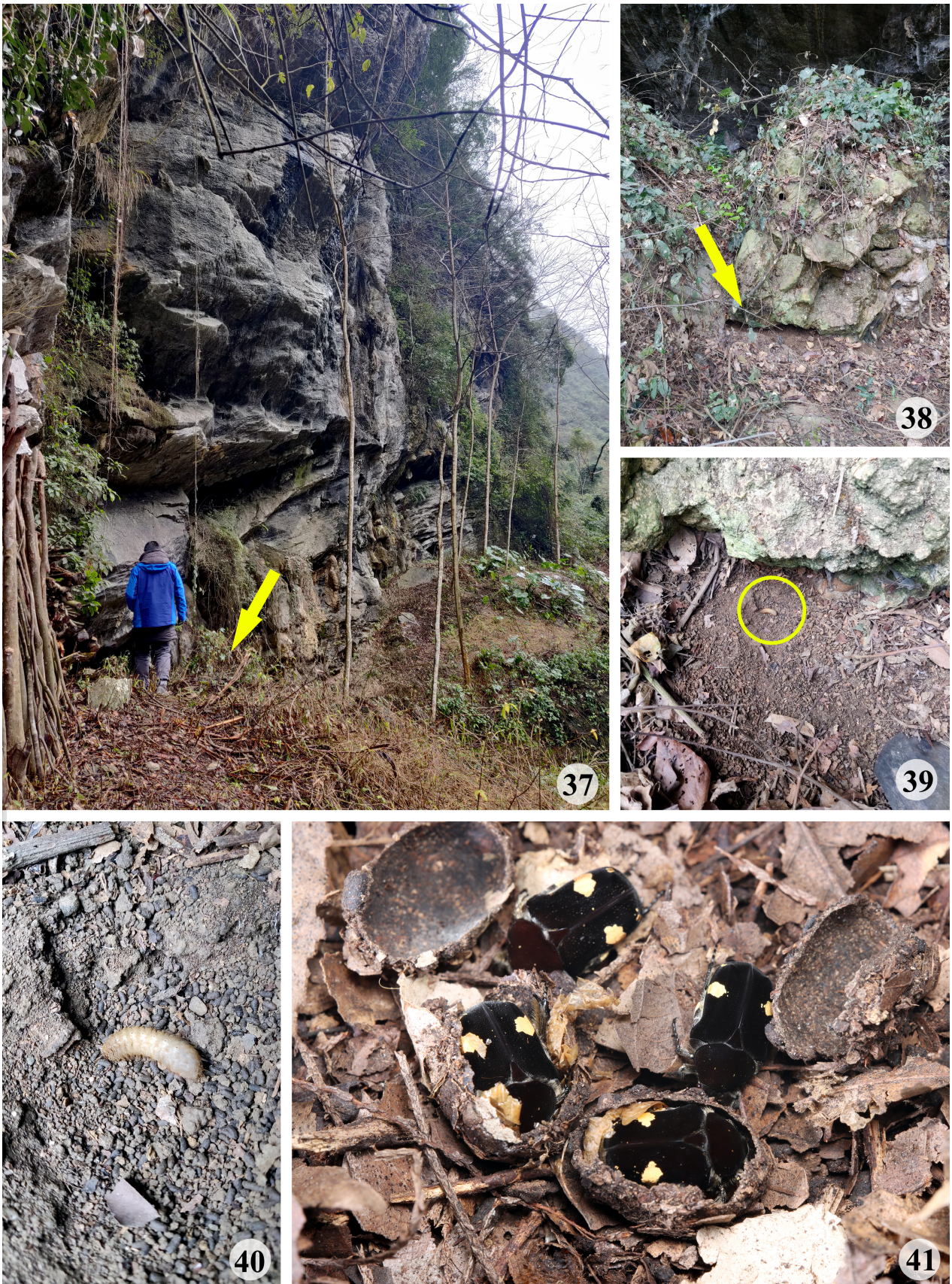




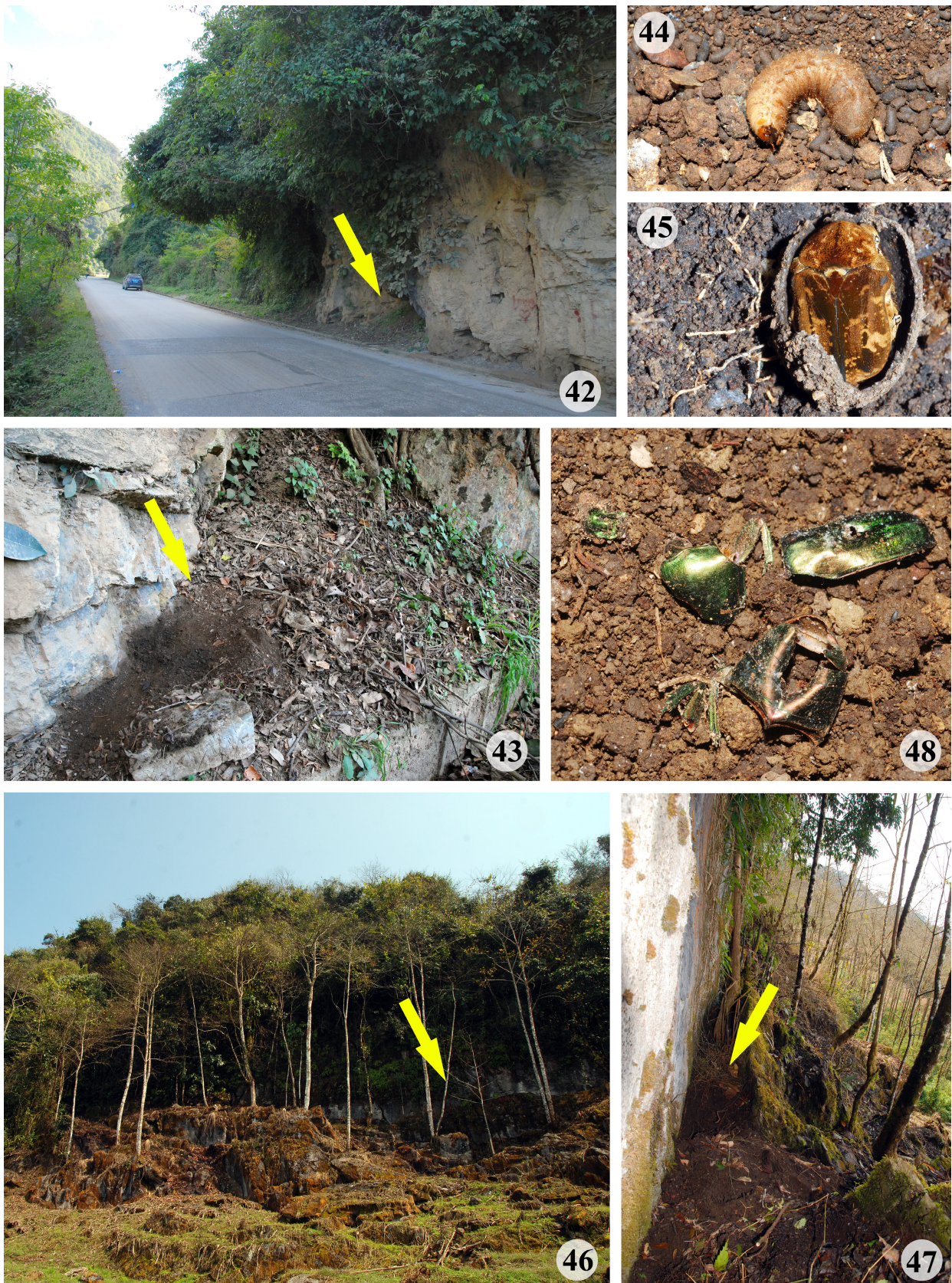
**FIGURES 28–31.** Habitat of the larva of *Protaetia* (*Vietnamoprotetia*) *sericophora*. **28.** Overall view of the karst landscape in Jialiang, Libo, Guizhou, China. **29.** Habitat under the cliff. **30.** Closer view of the habitat in leaf litter. **31.** Newly emerged adult of *P. (V.) sericophora* in pupal cocoon found in litter on 8<sup>th</sup>, February 2017. (Blue arrow indicates habitat, blue circle indicates pupal cocoon).



**FIGURES 32–36.** Habitat of the larva of *Prottaetia* (*Vietnamoprotaetia*) *sericophora*. **32.** Karst landscape in Maolan Natural Reserve, Libo, Guizhou, China. **33.** Habitat at cave entrance. **34.** Closer view of the habitat in leaf litter. **35–36.** Mature larva of *P. (Dicranobia) rochei* and newly emerged adult of *P. (V.) sericophora* in pupal cocoon found in litter on 1<sup>st</sup>, March 2018. (Blue arrows indicate habitats, blue circle indicates larva).



**FIGURES 37–41.** Habitat of the larva of *Prottaetia* (*Vietnamoprottaetia*) *sericophora*. **37.** Habitat under a cliff in Yangshan of Guangdong, China. **38.** Closer view of the habitat. **39–40.** Mature larva of *P. (V.) sericophora* found in leaf litter on 21<sup>st</sup>, February 2022. **41.** Adults of *P. (V.) sericophora* found in pupal cocoons under artificial conditions on 10<sup>th</sup>, October 2022. (Yellow arrows indicate habitats, yellow circle indicates larva).



**FIGURES 42–48.** Habitats of other Cetoniinae larvae in karst areas. **42–45.** *Protaetia* (*Pachyprotaetia*) sp.: **42.** Habitat under a cliff along a road in Cangyuan, Yunnan, China. **43.** Closer view of the habitat. **44.** Mature larva found in leaf litter on 27<sup>th</sup>, January 2017. **45.** Newly emerged adult found in pupal cocoon in litter on 27<sup>th</sup>, January 2017. **46–48.** *Trigonophorinus riaultii* (Fairmaire, 1897): **46.** Habitat under a cliff in Maguan, Yunnan, China. **47.** Closer view of the habitat. **48.** Remains of an adult found in the leaf litter on 26<sup>th</sup>, February 2018. (Yellow arrows indicate habitats).



**FIGURES 49–52.** Habitats of larvae of another *Protaetia* sp. in karst area. **49.** Habitat under a cliff in Maolan Natural Reserve in Libo, Guizhou, China. **50.** Closer view of the habitat in leaf litter. **51.** Larva found in leaf litter with fecal pellets on 21<sup>st</sup>, June 2020. **52.** Adult found together. (Yellow arrow indicates habitat, yellow circle indicates larva).

This method can also be used in similar habitats. For example, many larvae of different species were found in the leaf litter along road slopes, wall footings, and even abandoned steps during our surveys conducted in dry valleys of western Sichuan in recent years. Although the Cetoniinae species (listed in table 1) can be collected in karst forests by this method, it is not an indication that these species are endemic to limestone areas. This may be due to more cliff-like habitats in karst areas, in which larvae can be easily found. Species of the subgenera *Cosmiomorpha* (*Microcosmiomorpha*) Mikšić, 1974 and *Protaetia* (*Dicranobia*) Reitter, 1900 have been frequently collected in non-karst regions in southern China. Therefore, this method can be applied extensively in other environments to determine the distribution of these species.

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## 黑腹越星花金龟 *Protaetia (Vietnamoprotia) sericophora* 自然史及采集喀斯特地区花金龟的方法 (鞘翅目: 金龟科: 花金龟亚科)


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**摘要:** 记录了罕见种黑腹越星花金龟 *Protaetia (Vietnamoprotia) sericophora* 在中国的自然史。广东、广西和云南的产地记录显著地拓展了其分布范围。首次图示了该种雌性, 并提供了性二型特征。还展示了其整体图、雄性外生殖器侧叶图及模式标本图。通过观察其幼虫的自然生境, 获得了对采集栖息于石灰岩地区或类似生境的花金龟的新见解。

**关键词:** 鳃角类; 花金龟; 花金龟族; 越星花金龟亚属; 东洋界; 分布; 石灰岩; 幼虫