SHORT COMMUNICATION

ELYTRAL PATTERN OBSERVATIONS AND ECOLOGICAL NOTES OF THE FLOWER CHAFER, *Protaetia acuminata* (FABRICIUS) (COLEOPTERA: SCARABAEIDAE: CETONIINAE) FROM SINGAPORE

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ABSTRACT

Protaetia acuminata (Fabricius, 1775) is one of two species of cetonid beetle of the genus *Protaetia* found in Singapore. Ecological data concerning this diminutive but charismatic cetonid is scarce. Five separate observations of individual specimens were documented flying into household residences within the Mount Emily Road and River Valley Road area from 2018 to 2021. On 20 March 2021, a healthy population of *P. acuminata* was discovered living in a covered composter within a private residential property along Saraca Road. Elytral pattern observations of eight specimens (4 males, 4 females) were performed using macro photography. Mean specimen length was 14.1 mm (SD±0.9 mm), and mean width was 7.1 mm (SD±0.5 mm). The highly contrasting colours and seemingly haphazard dots and dashes which make up the elytral pattern of *P. acuminata* resembled a "QR code". This is likely a form a disruptive camouflage, breaking up its outline and reducing the risk of detection by predators. Four specimens appeared "light", i.e., having more light-coloured elytral patches, and four specimens appeared "dark", i.e., having less light-coloured elytral patches. The degree of light-colouration was not bimodally distributed, with a spectrum of intermediate forms between the lightest and darkest insects. No two specimens were exactly alike; each beetle had a unique elytral pattern compared to the others, demonstrating substantial intraspecific variation within the study population. Furthermore, the pattern of each individual showed fluctuating asymmetry, a type of bilateral asymmetry caused by random deviations. Further studies with larger sample sizes may be necessary to yield greater insights into this fascinating "QR code" beetle.

Key words. Cetonid beetle, elytral pattern, disruptive camouflage, Singapore

ABSTRAK

Protaetia acuminata (Fabricius, 1775) ialah satu dari dua spesies kumbang cetonid dari genus *Protaetia* di Singapura. Data ekologi terhadap kunbang ini adalah kurang. Lima pemerhatian berbeza terhadap spesimen kumbang ini telah didokumentasikan terbang di sekitar perumahan

di Jalan Mount Emily dan Jalan River Valley dari 2018 hingga 2021. Pada 20 Mac 2021, populasi *P. acuminata* telah diperhatikan hidup pada sekitaran di rumah persendirian di Jalan Saraca. Pemerhatian terhadap corak elitra untuk lapan spesimen (4 jantan, 4 betina) telah dijalankan menggunakan makrofotografi. Julat panjang spesimen ialah 14.1 mm (SD±0.9 mm), dan julat lebar ialah 7.1 mm (SD±0.5 mm). Warna yang berbeza, titik dan sengkang yang diperhatikan pada elitra *P. acuminata* berbentuk seperti imbasan QR kod. Ini adalah bentuk kamouflaj untuk mengelakkan risiko dikenalpasti oleh pemangsa. Empat spesimen adalah lebih terang iaitu mempunyai warna tampalan yang lebih terang dan empat spesimen lebih gelap, iaitu tampalan yang kurang terang. Darjah terang pewarnaan adalah tidak bertabur secara bimodal dengan spektrum pada pertengahan antara terang dan gelap. Tidak ada dua spesimen yang kelihatan sama, setiap kumbang mempunyai corak elitra yang unik berbanding antara satu sama lain, menunjukkan variasi intraspesifik dalam populasi yang dikaji. Tambahan lagi, corak pada setiap individu menunjukkan asimetri turun naik, jenis asimetri bilateral disebabkan pencapahan rawak. Kajian lanjutan dengan jumlah sampel saiz yang lebih besar adalah diperlukan untuk gambar yang lebih jelas tentang kumbang ini.

Kata kunci: Kumbang Cetonid, corak elitra, kamoflaj gangguan, Singapura

INTRODUCTION

Protaetia acuminata (Fabricius 1775) is a diminutive but striking cetonid beetle distributed throughout Southeast Asia, including Peninsular Malaysia, Borneo, Sumatra, Burma, Thailand, as well as the Andaman and Nicobar Islands (Biswas et al. 1999), and is one of two species of the genus *Protaetia* Burmeister 1842 known to occur in Singapore. The first recorded specimen in Singapore was collected by Ridley in 1904. Previously known as *Urbania acuminata*, Özdikmen and Turgut 2009 found the genus *Urbania* already occupied by a single species of moth, as described by Hampson 1901. They proposed the replacement genus *Miksicus*, after René Mikšic, who had originally named the beetle genus *Urbania* Mikšic 1963. Thereafter, *Miksicus* was demoted back to the subgenus of *Protaetia* by Krajčík 2011. The a*cuminata* means sharp or tapering in Latin, possibly referencing the spine at the elytral apex of the species.

Protaetia acuminata males are slenderer and more elongate in appearance, usually with a longer elytral spine relative to females. The elytral pattern consists of cream-coloured patches on a dark brown background, with an iridescent copper lustre. There is high inter-individual elytral pattern variability, leading to new descriptions of the same species or confusion with other similar species.

The other Singapore *Protaetia* species, *P. fusca* (Herbst 1790) bears a resemblance to *P. acuminata* in size and colouration, with both bearing the common name of mango flower beetle. However, *P. fusca* is less glossy with the concentration of cream patches along the lateral edges of the elytra instead of running across the mid-elytra as in *P. acuminata*. Five separate instances were recorded of *P. acuminata* specimens flying into well-lit household residences within the Mount Emily Road and River Valley Road area from 2018 to 2021, in the evenings from 2000 to 2200 hrs. Two older recordings, in 2001 and 2009, were made of *P. fusca* amongst suburban roadside vegetation along Neo Tiew Lane. Based on these observations, *P. acuminata* appears to be the more common species in urban Singapore environments.

A population of adult and larval *P. acuminata* was discovered on 20 March 2021 within an enclosed refuse bin on private residential property. This report aims to describe the elytral pattern variations and provide short ecological notes of the current sample of *P. acuminata* from an urban residential area in Singapore.

MATERIALS & METHODS

A total of 37 specimens were found on 20 March 2021 from a landed residential property along Saraca Road, Singapore (1°23'06.2"N 103°51'58.0"E). The beetles were discovered inside a refuse bin, which was used as a composter for garden waste and was approximately half filled with soil, grass, mango leaves and branches, decomposed to a relatively flake-like consistency (Figure 1). As the refuse bin lid was rain-proof and had not been opened for at least 12 months, the substrate was found to be in a desiccated state. Fifteen complete imago *P. acuminata* specimens were found, with eight dead and seven of these alive and active despite the lack of an obvious food source. The species was identified based on Biswas (1999) and Jakl (2018). Several characteristic cetonid larvae (five L3, nine L2 and eight L1 instars) were also unearthed upon superficial excavation of the substrate (Figure 2). The absence of other coleopteran species within this enclosed environment following careful inspection implied that these were *P. acuminata* larvae as well. It was uncertain if free entry into and exit from the composter was possible, even for this small beetle, as the heavy lid was designed to keep out pests such as cockroaches and rats. The eight dead *P. acuminata* specimens were collected and close-up photography performed using a DSLR camera with 100 mm macro lens.

Figure 1. Refuse bin composter where a healthy population of *P. acuminata* were found

Figure 2. *P. acuminata* adults and larvae

RESULTS

Systematic Account

Protaetia acuminata (Fabricius 1775)
Cetonia acuminata Fabricius 1775
Urbania acuminata (Fabricius 1775)
Miksicus acuminata (Fabricius 1775)
Cetonia marmorata Fabricius 1801
Cetonia marmorea Weber 1801
Cetonia corrosa Gory & Percheron 1833
Cetonia daldorffi Schonherr 1817

Materials Examined

8 specimens examined. Saraca Road, Singapore, 20.iii.2021, I Seow-En (coll. Seow-En).

Description

Of the eight specimens, four were male and four were female. Mean specimen length was 14.1 mm (SD±0.9 mm), and mean width was 7.1 mm (SD±0.5 mm). Males tended to be larger, with

an elongate appearance and more pronounced elytral spine compared to females. However, these differences were subtle. There was no observable pattern differentiation between genders.

Distribution
This species is known from Southeast Asia (Peninsular Malaysia, Borneo, Sumatra, Burma, Thailand, as well as the Andaman and Nicobar Islands).

Ecological Notes
Protaetia larvae have been reported to thrive in a range of environments with abundant organic matter, including animal faeces and ripe fruit substrate; oviposition has even been observed in cricket holes (Pausas et al. 2018). Moreover, *Protaetia* adults are known generalists, feeding on the nectar, pollen, fruit, flowers and leaves of numerous plant species, even invading the nests of stingless bees for their honey (Woodruff 2016). These attributes have likely contributed to the success of *Protaetia* as an invasive species, including *P. fusca* in the Pacific Islands (Krell & Breidenbaugh 2016). To my knowledge, however, *P. acuminata* has not been documented as invasive.

From my observation of the healthy larval and adult population in the spartan and desiccated refuse bin conditions, *P. acuminata* similarly not appear to require any special substrate or conditions to develop. I have observed wild specimens of *P. acuminata* adults congregating and feeding on gilled mushrooms of the genus *Coprinus*, as well as captive bred larvae feeding on ripe fruit and burrowing into beetle jelly pots.

DISCUSSION

The characteristic light- or cream-coloured elytral patches of this species were largely distributed across the mid-elytra, on a dark background. These striking collections of seemingly haphazard lighter dots and dashes were reminiscent of QR codes, now prevalent in daily COVID-era Singapore life. This pattern of colouration is probably a form of disruptive camouflage, a known method of disguise in the animal kingdom (Adams et al. 2019). This involves the use of highly contrasting colours and patterns, similar that of pixelated military combat uniforms, to break up an animal's outline, decreasing the chance of detection and predation.

Four specimens appeared "light", i.e., having more light-coloured elytral patches (Figure 3), and four specimens appeared "dark", i.e., having less light-coloured elytral patches (Figure 4). The overall differences in appearance between the specimens in Figure 3 and 4 demonstrates the distinction between "lighter" and "darker" forms. The degree of light-colouration was not bimodally distributed, with a spectrum of intermediate forms between the lightest and darkest insects. No two specimens were exactly alike within this limited sample, with each beetle displaying a unique elytral pattern distinct from one another. Intraspecific phenotypic variation has been studied in other beetles including the Asian ladybird beetle, *Harmonia axyridis*, which exhibits >200 distinct elytral colour forms (Ando et al. 2018). Phenotypic diversity of individuals of a population may have significant ecological implications (Bolnick et al. 2011), including effects on predation, reproduction, and survival.

Moreover, each *P. acuminata* specimen did not show bilateral elytral pattern symmetry, although the differences were noticeable only on macro photographic examination due to small overall specimen size. The asymmetrical patterns were not due to elytral disruptions or scales being rubbed off. Bilateral asymmetry is an unusual feature amongst insects (Lamb 1922) but

has been reported in the head morphology of beetles (Toki & Togashi 2011). Few studies have demonstrated the function or significance of bilateral asymmetry. The asymmetry shown in amongst our study samples is fluctuating asymmetry (FA), one of three kinds of biological asymmetry (Van Valen 1962). Unlike the other kinds of bilateral asymmetry, FA is not developmentally controlled and occurs as a result of random deviation by genetic and environmental accidents (Van Valen 1962). The significance of this finding in the studied species remains unknown.

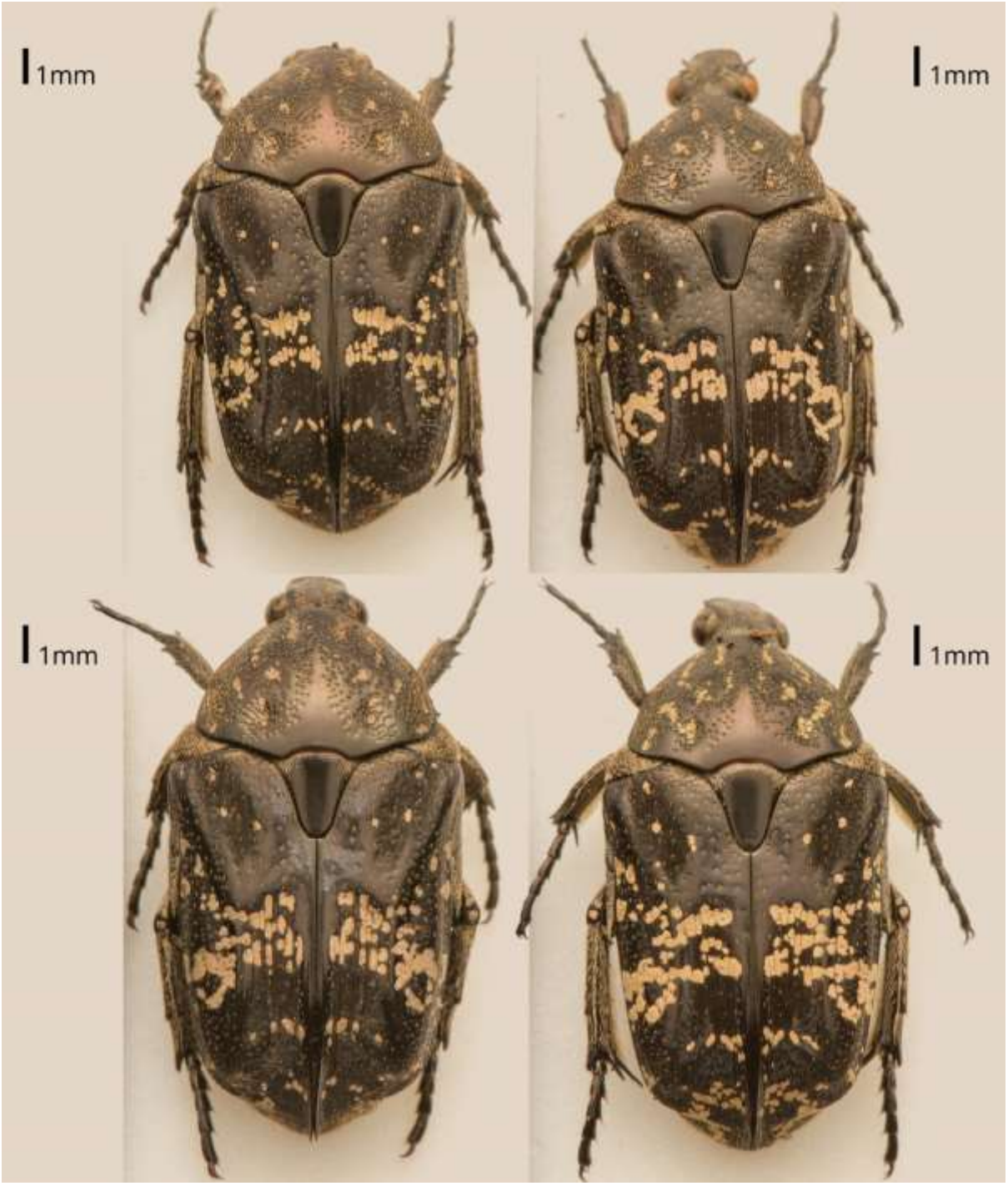

Figure 3. "Lighter"-coloured specimens, with a greater concentration of light-coloured elytral patches

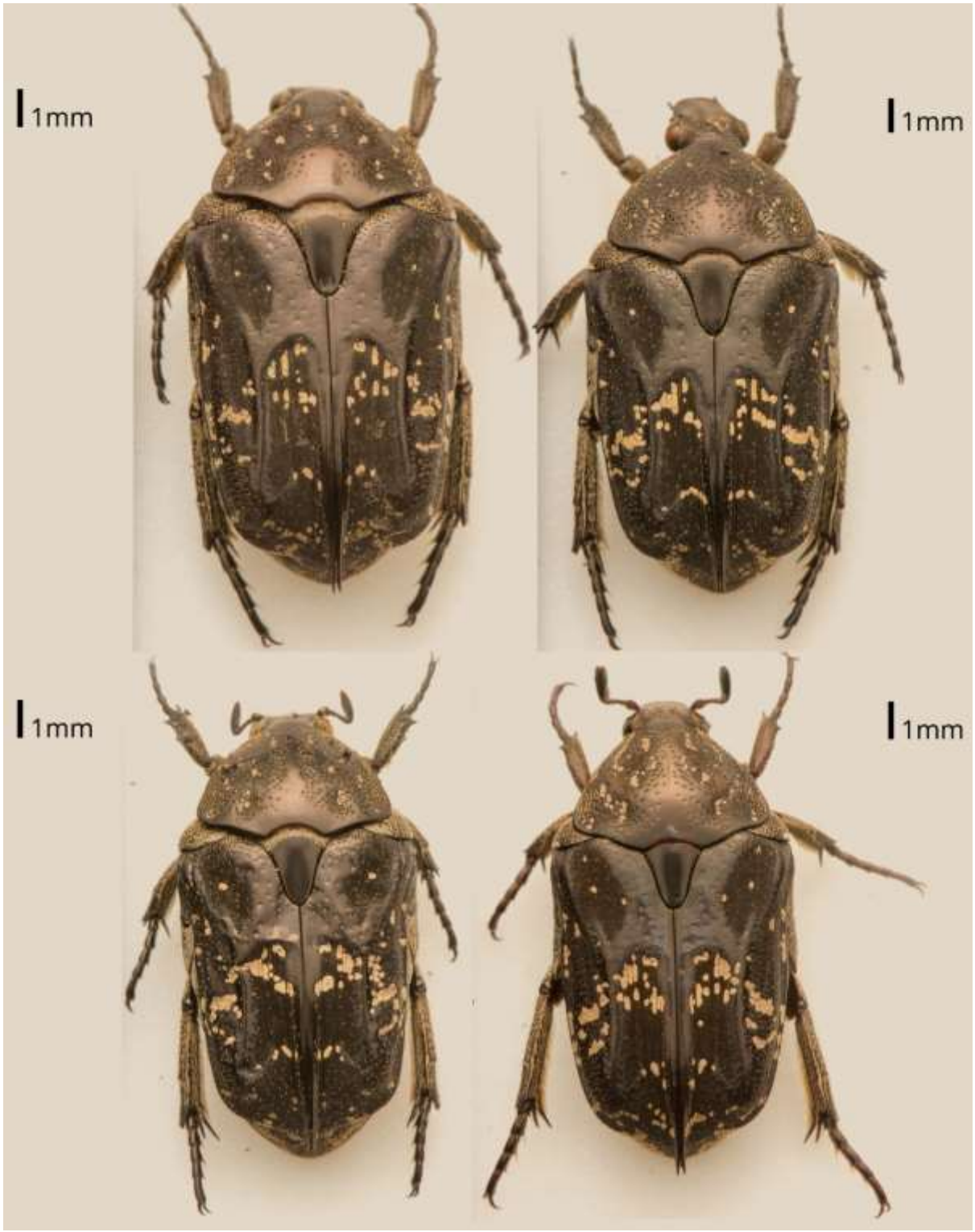

Figure 4. "Darker"-coloured specimens, with a lesser concentration of light-coloured elytral patches

CONCLUSION

Protaetia acuminata exhibits unique elytral patterns with disruptive coloration, fluctuating asymmetry, and high intraspecific variability. Further study with larger sample sizes may be necessary to yield greater insights of the ecologic relevance of these observations for this "QR code" beetle.

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