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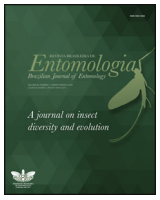

Dancing close together in the woods: mate-guarding behavior might explain sexual dimorphism in *Chrysoprasis auriventris auriventris* Redtenbacher, 1868 (Coleoptera: Cerambycinae)

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ABSTRACT

A fortuitous observation of mate-guarding behavior of male *Chrysoprasis a. auriventris* is presented here. In our observation, a male hold onto the female's body using his forelegs and walks along with her while she lays the eggs into the trunk slits. While guarding the female, the male adopted aggressive postures and attacked rival males that approached her. We suggest that the mate-guarding behavior may explain the male's elongated mid and hindlegs in this species, under a functional perspective. Additionally, a new host plant association was recorded.

There is no question of the vast ignorance we have about biodiversity. The organization of such lack of knowledge as shortfalls (Brown and Lomolino, 1998; Lomolino, 2004; Cardoso et al., 2011; Diniz-Filho et al., 2013; Hortal et al., 2015; Faria et al., 2021) was a very important advancement, both in terms of the systematization of the knowledge gaps, and also for enabling the emergence of more focused and well-constructed mitigation proposals (e.g., Assis, 2018). When one assesses the very nature of these shortfalls, the importance of natural history becomes even greater (see e.g., Cotterill and Foissner, 2010). Hence, such advancements in our knowledge of natural history, mainly by a process of observation and interpretation (see Gilligan, 2009), often rely on notable fortuitous observations and documentation (Burns and Low, 2022).

In this context, there is a strengthening of citizen science initiatives to address biodiversity (e.g., Lees and Martin, 2015; Barahona-Segovia et al., 2017; Di Cecco et al., 2021), which stimulates the participation of local communities in monitoring and reporting threats to biodiversity. There are many interesting reports where photographs taken in an unpretentious manner have led to important findings and the decrease of the Wallacean shortfall (e.g., Freitas et al., 2021).

Biodiversity shortfalls are also massive for Coleoptera, which is particularly true for long-horned beetles (Cerambycidae) (e.g., Hanks and Wang, 2017). Cerambycidae (Coleoptera), encompassing about 35,000 described species, is one of families with the greatest number of species within the Phytophaga (Haddad et al., 2018; Tavakilian and Chevillotte, 2022). Despite the vast taxonomic literature, very little is known about their behavior, as most observations refer to species of economic interest (Hanks and Wang, 2017). Moreover, it is not surprising that a single and fortuitous observation could provide several pieces of information regarding the bionomics of a single species.

According to Napp and Martins (1997, 18p) *Chrysoprasis a. auriventris* may be identified by the following: "...metatibiae strongly flattened, middle and hind legs very elongated, metafemora subequal in length to elytra, surpassing the elytral apex by half of their length, prothorax elongated, subparallel-sided, antennae (male) surpass the elytral apex by V–VI antennomeres..." (freely translated). The elongated middle and hindlegs are usually found in males only, and the authors did not address the females or comment on the sexual dimorphism. It is noteworthy that differences in length of appendages, where males typically have longer mid- and hindlegs are common in Cerambycidae, especially in Lamiinae (see Nascimento and Santos-Silva, 2019). However, some

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functional context for traits as the sexually dimorphic elongation of appendages are yet to be explored.

In this contribution, we describe aspects of the mating behavior of *Chrysoprasis a. auriventris* and suggest the function of its elongated legs as a secondary sexual trait and provide morphological notes on females. Additionally, *Parapiptadenia rigida* (Benth.) Brenan (Fabaceae) is recorded as a host plant for the species.

The observation was carried out in the Iguaçu National Park (-25.6548° -54.4357°, 210 m a.s.l.), Foz do Iguaçu, Paraná, Brazil.

Behavioral observations were made using a DSLR camera (Nikon D7500) with a macro lens (Nikon Micro-Nikkor 55mm f/2.8) and a diffused flashlight, and videos were taken using a smartphone (LG G7 ThinQ). Specimens were not collected, so the subsequent identification relied on the recorded photographs and videos. The specimens were identified using the key proposed by Napp and Martins (1997), and by comparing them with type material photographs provided by Bezark (2023). Additional material housed at the Danúncia Urban Entomological Collection (CEDU-UNILA) was also studied.

On October 27th, 2022, around noon, during a nature walk along the Bananeiras Trail (Iguaçu National Park) in an ecotourism activity, one of us (BMT) observed a small aggregation of longhorn beetles (*C. a. auriventris* Redtenbacher, 1868) on a fallen trunk of *Parapiptadenia rigida* (Benth.) Brenan. The beetles seemed to prefer the cross-sectional location of the wood, where the innermost wood parts were exposed. A female was observed probing the trunk with her exposed ovipositor, clearly looking for cracks in the wood where eggs could be laid. The male held onto the female's thorax with his forelegs, just behind the pronotum, and between first and second pair of legs, keeping himself on top parallelling the female's body, and following her movements walking on his long mid- and hindlegs (Figure 1, Video 1).

Meanwhile, some other single males were also observed trying to harass the ovipositing female. Hence, the guarding male turned his body perpendicular to the female and kicked the opponent away with his long middle and hind legs, without losing physical contact with the female (Video 2), and then quickly returned to the straddled position parallel to the female's body.

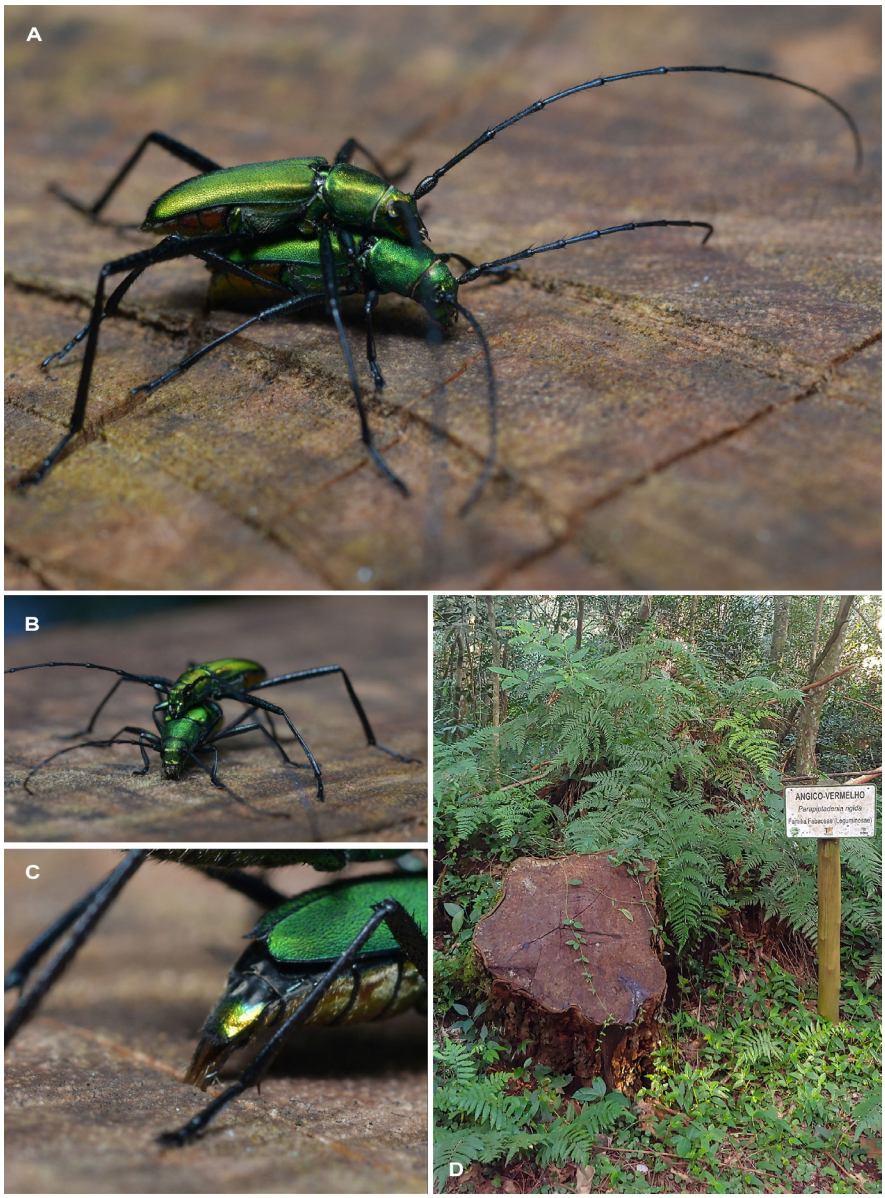

Figure 1 A. and B. pair of *Chrysoprasis auriventris auriventris* Redtenbacher, 1868 engaged in the mateguarding behavior; C. female with the ovipositor inserted into a slit in the trunk; D. trunk of Parapiptadenia rigida (Benth.) Brenan. and the surroundings.

In the original description by Redtenbacher (1868, 195p), only antennal length was mentioned as dimorphic in this species: "The antennae are hairy on the underside, in males they are much longer than the body, in females only as long as this" (freely translated). Subsequent authors (i.e. Napp and Martins, 1997) also only emphasized the length of antennae and neglected the sexual dimorphism of mid- and hindlegs, much shorter in females. While in males the metafemora exceed the elytral apex by about half of their length, in females the metafemora exceed the elytral apex by about 1/10 (0.1) of their length.

The main goals of mating strategies utilized by male insects can be understood under two main contexts: (i) insemination of a larger number of females (partners of other rivals), or (ii) prevention of sexual partner from being inseminated by other males (Alcock, 1994). This latter could rely on mate-guarding behaviors in which males prevent females from leaving their sites and/or that conspecific males approach their mates (see Parker, 1974; Alcock, 1994; Simmons, 2001).

Cerambycids basically adopt two mating strategies, the "resource defense polygyny", in which males are extremely territorial and defend the scarce resource (host plant), or the most common "female defense polygyny" strategy, in which females (not the host plants) are the limiting resource, and are thus guarded by the males preventing rival males from mating with guarded females (see Hanks and Wang, 2017).

As mentioned, a main feature of the observed species is the length/ratio of the mid and hindlegs in relation to the body of males. Cerambycids typically exhibit sexually dimorphic traits such as antennal length, that is longer in males (Hanks et al., 1996a, 1996b). The functional context of some hyperallometric traits was observed, as the elongated forelegs of male harlequin beetle [*Acrocinus longimanus* (Linnaeus, 1758)], used as weapons against other males, and for guarding females and host plants (Zeh et al., 1992). Here we provide new data on the mating behavior and host plant of *C. a. auriventris*, a species of longhorn beetle with barely known natural history. We also present our interpretation of the elongated mid- and hindlegs of males under a functional context, as an evolutionary consequence of the mate-guarding behavior.

Finally, we emphasize the importance that a single – and at first unpretentious – natural history observation has in addressing biodiversity shortfalls. Based on this observation, this communication provides data that could be contextualized under at least four biodiversity shortfalls: (i) a species trait, the long legs, was treated under its ecological function (Raunkiaeran shortfall, Hortal et al., 2015), (ii) information on its host plant was presented (Eltonian shortfall, Hortal et al., 2015), (iii) the known distribution of the species was extended to western Paraná State (Wallacean shortfall, Lomolino, 2004).

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Conflicts of interest

The authors declare no conflicts of interest.

Author contribution statement

BMT made the original observations; FELN identified the species and provided the taxonomic context; BMT, FELN and LRRF interpreted the observations and wrote the manuscript, regarding both previous drafts and the final version. All the authors approved the final article

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Supplementary material

The following online material is available for this article:

Video 1 **-** Couple of Chrysoprasis auriventris auriventris Redtenbacher, 1868 engaged in the mate-guarding behavior.

Video 2 **-** Aggregation of Chrysoprasis auriventris auriventris Redtenbacher, 1868 in the trunk of Parapiptadenia rigida (Benth.) Brenan., with a quick dispute between males.