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SHORT COMMUNICATION

Feeding and mating behavior of *Dorcacerus barbatus* (Olivier, 1790) (Coleoptera: Cerambycidae) on *Lantana camara* L. (Verbenaceae)

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Abstract

In this study we describe the mating behavior of *Dorcacerus barbatus* (Olivier, 1790) and its predation on the reproductive parts of *Lantana camara* L. (Verbenaceae) in a restored area of Atlantic forest, in southeastern Brazil. *Lantana camara* is regarded as one of the world's ten worst weeds. We found three species of longhorn beetles on this plant: *Trachyderes succintus duponti* Aurivillius, 1912, *Andraegodius rufipes zonatus* (Dalman, 1823), and *D. barbatus*; this last species represented more than 95% of all individuals found. This is the first record of these three cerambycid species on *L. camara*. We observed a sequence of mating-behavior stages: jousting, antennation, holding, mounting, fighting, licking, abdomen bending, and copulation. *D. barbatus* destroyed 60% of the reproductive parts during the mating process. These primary observations indicate that *D. barbatus* may be considered as a potential biocontrol agent for this invasive species.

Keywords: Biological control, invasive species, insect behavior, herbivory, Atlantic Rain Forest.

Beetles of the family Cerambycidae have assumed increasing prominence as pests of forest and shade trees, shrubs, raw wood products, and as vectors of tree diseases (e.g., Berti-Filho, 1997; Dall'Oglio & Peres-Filho, 1997; Hanks et al., 1998). Moreover, cerambycids are also considered important herbivores of several plant species (e.g., Monné 2001abc, 2002ab, 2004). Thus, detailed knowledge is needed on the natural history, behavior and ecology of most Neotropical species of this important insect group. In this study, we describe the mating behavior of *Dorcacerus barbatus* (Olivier, 1790) and its predation on the reproductive parts of *Lantana camara* L. (Verbenaceae) in a restored area of Atlantic rain forest, in southeastern Brazil.

Lantana camara is a native plant in tropical and subtropical America and is now widely distributed throughout the tropics, subtropics and warm temperate regions of the world (Broughton, 2000; Ghisalberti, 2000). Dutch explorers introduced it into the Netherlands from Brazil in the late 1600s and later explorers from other countries took seeds to continental Europe, Great Britain and North America. Following its introduction into Hawaii as a garden flower, it soon spread to the islands of the Pacific, Australia and southern Asia (Ghisalberti, 2000). It rapidly escaped cultivation to become one of the most noxious weeds of the world (Broughton, 2000). It infests millions of hectares of grazing and cropping land in 47 countries (Ghisalberti, 2000), and is regarded as one of the world's 10 worst weeds (Ghisalberti, 2000; Thomas & Ellison, 2000). *Lantana* thrives in a wide variety of environmental conditions and invades riverbanks, mountain slopes and valleys, pastures, and commercial forests where it forms impenetrable stands that obstruct access and utilization. Through allelopathic suppression of indigenous plant species, *Lantana* invasions also interrupt the succession processes (Gentle & Duggin, 1997) and reduce the biodiversity of natural ecosystems. Many parts of *L. camara* are toxic (Morton, 1994) and if consumed can cause cattle poisoning, with estimated annual stock loss to the farming community in South Africa of about 1800 heads (Kellerman et al., 1996). As an example, *L. camara* was introduced in India

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from Australia as an ornamental plant and later on invaded the majority of Indian pasture lands (13.2 million ha), besides other areas. The cost of its control is US$ 70 per hectare. As 4% of India's land area is pasture, the damage from *Lantana* is estimated to be US$ 924 million per year (see Pimentel et al., 2001).

The difficulties and expenses incurred by chemical and mechanical control measures and the rapid rate of the weed's spread fueled the initiation of a strong biological control program in the early 1960s. However, *L. camara* biological control attempts started in 1902, followed by others at intervals throughout the century (Broughton, 2000; Thomas & Ellison, 2000). These investigations resulted in 36 insect species being released in various countries (Thomas & Ellison, 2000). However, effective control has not been achieved yet because the combined impact remains insufficient to reduce the weed to acceptable levels and the biocontrol of the weed is considered negligible (Anonymous, 1999). Most of the established biocontrol agents are leaf feeders, which directed the search towards new candidate agents that feed on different parts of the plant (Winder & Harley 1983, Cilliers & Neser, 1991; Palmer & Pullen, 1995; Broughton, 1999; Broughton, 2000, Palmer et al., 2000; Thomas & Ellison, 2000; Baars et al., 2003; Williams & Madire, 2007) or pathogens (Thomas & Ellison, 2000; Pereira et al., 2003).

Casual observations on the herbivore insect and their host plants in the Fazenda Bulcão, municipality of Aimorés, Minas Gerais state, southeast Brazil, revealed three species of longhorn beetles associated with *L. camara* in November 2004: *Trachyderes succintus duponti* Aurivillius, 1912; *Andraegodius rufipes zonatus* (Dalman, 1823); and *Dorcacerus barbatus* (Olivier, 1790). *Dorcacerus barbatus* represented more than 95% of all individuals found. To our knowledge, this is the first record of these three cerambycid species on *L. camara.*

The Fazenda Bulcão has an area of approximately 676 ha in which a large land restoration program was initiated in 2001. The Aimorés mountain ridge was originally covered by Atlantic Forest vegetation of which only 5%-7% remains. *Lantana camara* occurs in small patches throughout the property and neighboring areas. We selected five individuals of this plant for the observations on the feeding and mating behavior of *D. barbatus*. Field behavioral observations were conducted unaided and with the naked eye, following *"ad libitum"* (Altmann, 1974). Beetles were observed only during three days, and then they disappeared. The highest abundance of beetles occurred in the first day. Mating behavior events were observed from 08:00 to 17:00. Voucher specimens of the cerambycids were deposited at the Museu de Zoologia da Universidade de São Paulo (MZUSP), São Paulo, Brazil.

We observed a sequence of stages, namely jousting, antennation, holding, mounting, fighting, licking, abdomen bending, and copulation. The *Dorcacerus barbatus* male approachs the female, touching her with his antennae or tarsi, and then hold and mount her while touching her elytra and pronotum with hihs palpae. Fukaya (2003) has shown that similar mating attempts by males of *Anoplophora malasiaca* (Thomson) (Coleoptera: Cerambycidae) were repeated on a glass dummy treated with the solvent extract of female elytra, indicating the presence of a female sex pheromone perceptible by direct contact. Males mounted the female usually from the

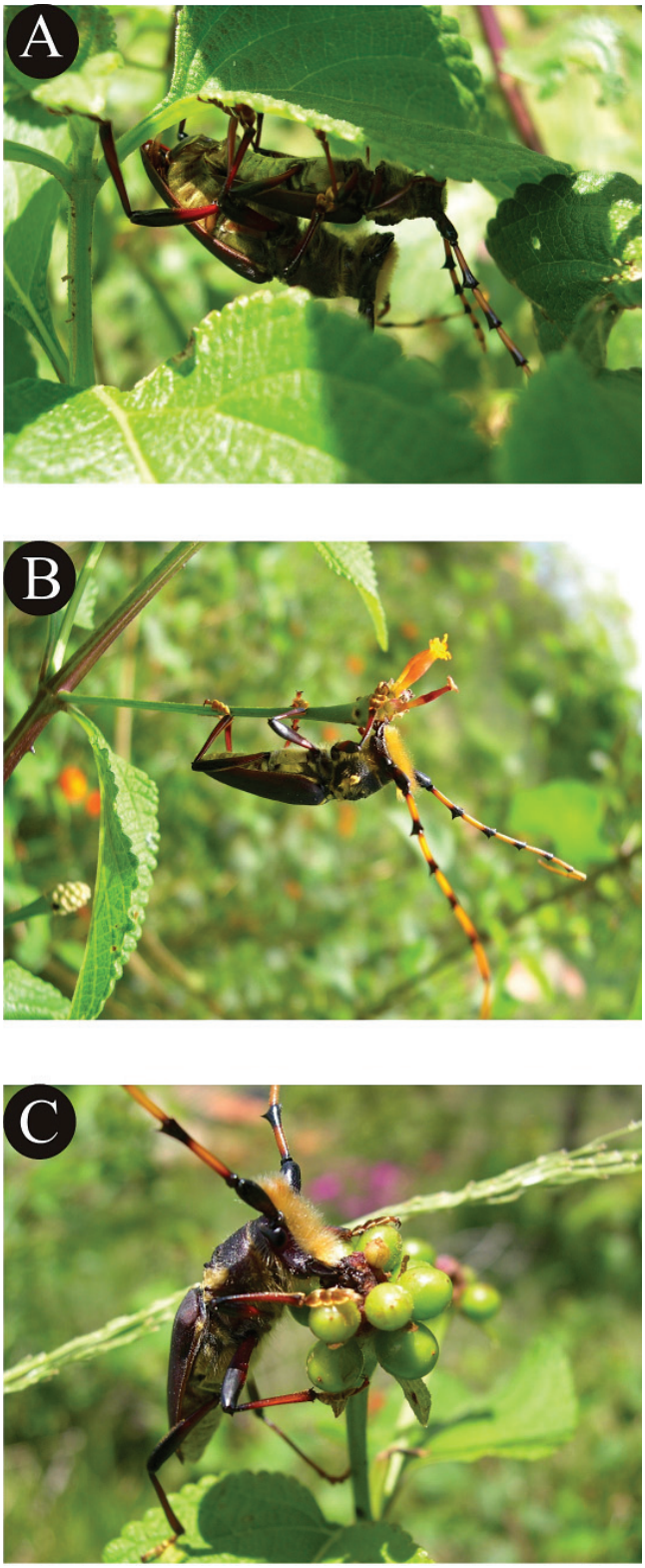

Figure 1 - *Dorcacerus barbatus* (Cerambycidae) on *Lantana camara* (Verbenaceae). (A) Abdomen bending during mating. (B) Feeding on inflorescences. (C) Feeding on fruits.

Table 1 - Number and proportion of attacked and unattacked reproductive parts (flowers and/or fruits), and the number of mating and solitary beetles of *Dorcacerus barbatus* (Cerambycidae) on *Lantana camara* (Verbenaceae).

Attacked	Unattacked	Total	Mating pairs	Solitary
9 (36.0%)	16 (64.0%)	25 (100%)	9	10
17 (58.6%)	12 (41.4%)	29 (100%)	7	11
31 (31.0%)	69 (69.0%)	100 (100%)	3	2
178 (68.7%)	81 (31.3%)	259 (100%)	4	3
134 (68.7%)	61 (31.3%)	195 (100%)	1	1
369 (60.7%)	**239 (39.3%)**	**608 (100%)**	**24**	**27**

rear, yet, at times, male and female may fight. In these situations, the male lowers his head to stroke the elytra of the female with his maxillary palpi. This behavior has been argued to have a calming effect on the female (Crook et al., 2004). Once mounted on a motionless female, the male curled the tip of his abdomen, extending his genitalia under the female's abdomen. This "abdomen bending" continued until copulation commenced (Fig. 1A). Similar mating behavior was observed by Crook et al. 2004 for the longhorn beetle *Dectes texanus texanus* LeConte. We observed 24 mating pairs and 27 solitary individuals of *D. barbatus* on the five individuals of *L. camara*. In spite of not being quantified, it is probable that the single individualsconsisted, in large part, of males waiting to approach and copulate with females.

Most males of *D. barbatus* copulated while females fed on the reproductive parts (flower and/or fruits) of *L. camara*. Plants had an average of 121.6 ± 46.17 ($\bar{x}$ ± SE) reproductive parts. *D. barbatus* totally destroyed 60% of them during the mating process (Tab. 1). However, single individuals could also attack the reproductive parts (Fig. 1B-C). Overall, most reproductive parts of *L. camara* were attacked (attacked reproductive parts: 73.8 ±. 34.45, $\bar{x}$ ± SE, n = 5 individuals; unattacked reproductive parts: 47.8 ±. 14.17, $\bar{x}$ ± SE, n = 5 individuals). Because of the high impact on reproductive parts, *D. barbatus* may be considered as a potential agent for the biological control of *L. camara*. On the other hand, detailed studies on its impact on the lifetime fitness and host specialization on *L. camara* are needed. *Dorcacerus barbatus* may have a specific relationship with *L. camara*. Despite the fact that this species was only found feeding on *L. camara*, more studies will be needed. However, other cerambycidae species (*Aerenicopsis championi* and *A. mendosa*), not listed in this study, were also reported on *L. camara* (see Monné, 2004). Among the longhorn beetles observed, only *T. succintus duponti* (previously recognized as *T. succintus*) attacks plantations of *Eucalyptus* (Berti-Filho, 1997) and rubber trees, *Hevea brasiliensis* (Willd. ex Adr. Juss) Müll. Arg., in Brazil (Dall'oglio & Peres-Filho, 1997). Among the several plant species available at the study area, *D. barbatus* appears to have selected *L. camara* as mating site, and this selection of host plant can be of fundamental importance to the behavior and biology of many cerambycid species. Hence, detailed studies on the behavior and ecology of *D. barbatus* are needed to answer this question.

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