

Scent-robbing and fighting among male orchid bees, *Eulaema (Apeulaema) nigrita* Lapeletier, 1841 (Hymenoptera: Apidae: Euglossini)

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Abstract: Male Neotropical orchid bees (Euglossini) collect volatile chemicals from floral and non-floral sources and store them in specialized hind tibial structures. The ultimate causes of euglossine fragrance collection remain a mystery. Recent evidence suggests that odoriferous substances play a role in euglossine courtship and serve as indicator of male genetic quality. Males of *Eulaema nigrita* were observed robbing scents from the detached hind legs of a conspecific male *E. nigrita* in Belém, Brazil. The hind leg seemed to have been detached during fights between males, since one male was missing a hind leg where the observation was made. This behavior appears to be common among males of *E. nigrita* since more than one case was observed on the same day. The observation reported here shows that males of *E. nigrita* with tibiae filled with fragrances are attacked by conspecific males that attempt to steal it.

Keywords: Apoidea, *Eulaema*, male fight, orchid bees, Neotropical Region, Brazil.

CARVALHO FILHO, F.S. **Roubo de essências e lutas entre os machos da abelha da orquídea *Eulaema (Apeulaema) nigrita* Lapeletier, 1841 (Hymenoptera: Apidae: Euglossini)**. Biota Neotrop. 10(2): <http://www.biotaneotropica.org.br/v10n2/pt/abstract?short-communication+bn01710022010>.

Resumo: Machos das abelhas das orquídeas (Euglossini) coletam substâncias voláteis de fontes florais e não florais e armazenam estas em estruturas especializadas nas tíbias posteriores. O motivo pelo qual estas substâncias são coletadas permanece um mistério. Evidências recentes sugerem que estas substâncias são utilizadas durante a corte e são indicadoras da qualidade genética dos machos. Neste estudo, machos de *Eulaema nigrita* foram registrados roubando substâncias de uma perna posterior arrancada de outro macho de *E. nigrita* em um parque de Belém (Brasil). A perna posterior parece ter sido arrancada durante lutas entre machos, já que no local de observação havia um macho sem uma perna posterior. Esse comportamento parece ser comum entre machos de *E. nigrita*, um vez que no mesmo dia de observação foram registrados dois grupos distintos de machos voando e lutando ao redor de uma perna posterior arrancada. A observação registrada neste estudo mostra que machos de *E. nigrita*, que apresentam pernas cheias de essências, são atacados por machos da mesma espécie que procuram roubar as fragrâncias armazenadas.

Palavras-chave: Apoidea, *Eulaema*, conflito entre machos, abelhas das orquídeas, Região Neotropical, Brasil.

Introduction

The tribe Euglossini is restricted to the Neotropical Region and comprises five genera with almost 200 species known as “orchid bees” or “gold bees” (Dressler 1982, Cameron 2004, Oliveira 2006). Some orchid bee species are solitary while others are communal or even quasisocial (O’Toole & Raw 1991).

Male orchid bees are attracted to scents (fragrances) emitted by flowers and non-floral sources, such as fungi, wet leaf litter, old logs, resins, saps, rotten fruits or feces (Dressler 1982, Ackerman 1983). This behavior is exploited by many Neotropical orchids that attract euglossine bees as their exclusive pollinators (Williams 1982). About 650 species of orchids are pollinated solely by orchid bees (Dressler 1981). Females are rarely seen at orchids but visit a variety of flowers for nectar and pollen (Dressler 1982).

The odoriferous substances collected by males with their tarsal hair brushes are stored in specialized pouches located in their hind tibia (Cruz-Landim et al. 1965, Eltz et al. 1999, 2003). The exact use to which the bees put these collected fragrances is still unclear and has puzzled the scientist for over 50 years.

While researchers suggested that they are used as repellents, antimicrobial compounds, sexual gift or aid longevity or vigor of bees (Dressler 1982, Williams & Whitten 1983, Ackerman & Montalvo 1985, Roubik 1989, Stern 1991), other authors believe that males use the fragrances in order to form “leks” (Dodson 1975, Kimsey 1980). Recent findings, however, suggest that the stored fragrances play a role during courtship behavior. One view is that males accumulate species-specific compounds (male fragrance bouquet) that serve as an indicator of male genetic quality (Whitten et al. 1989, Eltz et al. 1999, Roubik & Hanson 2004). Bembé (2004), based on morphological studies, suggested that the males of orchid bees possess the ability to spray off the stored fragrances at courtship sites. Eltz et al. (2005) showed that males of *Euglossa cognata* Moure, 1970 relocate and expose fragrances from their hind legs when displaying at small mating territories (Eltz et al. 2005).

The genus *Eulaema* Lepeletier, 1841 comprises 26 species of robust, hairy, non-metallic bees that slightly resemble large bumble bee queens (Cameron 2004, Oliveira 2006). *Eulaema (Apeulaema) nigrita* Lepeletier, 1841, is a common and widespread species ranging from Central America to South Brazil (Moure 1950, Nemésio 2002) that has been regarded as a “typical” species of open or disturbed areas (Morato et al. 1992).

In this paper, I report for the first time aggressive interactions within an aggregation of *Eulaema nigrita* males. Observations about aggregations between males of euglossine bees in nature are scarce since males of *Eulaema* and *Euglossa* Latreille, 1802 usually keep small territories that are defended against intruding conspecific males (Dressler 1982 and references therein). The observation reported here, even being an isolated event, suggests that males with hind tibiae filled with fragrances are occasionally attractive to conspecific rival males which want to rob fragrances.

Methods

At 10:30 AM on 1 December 2007, in the “Bosque Rodrigues Alves” (BRA) Botanical Garden (1° 25’ 49.52” S and 48° 27’ 19.08” W) I found, in two distinct occasions and in two different sand trails, males of *E. nigrita* flying around a detached hind leg on the ground (Figure 1). Close examination revealed that it was a hind leg of another *E. nigrita* male. The Bosque Rodrigues Alves is a forested urban park of about 150,000 m² (38 acre) located in Belém city, State of Pará, Northern Brazil. BRA shelters a natural reserve with hundreds of plant species from the Amazon River delta.

The first bee group observed was composed of four males, including one that was without one hind leg. Observational sessions of the first group summed about 20 minutes. During the observational process I remained about 60 cm from the detached leg, taking photos or filming the bees with a DSC-H9 camera. The second group found was composed of three males, all with both hind legs. Observational sessions of the second group summed only 3 minutes, since this group was in a sand trail with continuous flux of people, which drove off the bees. The observations treated here were based only on first group.

Results and Discussion

In the moment of the first group observation, a male (with no hind leg missing) landed on the detached hind leg moving its mandibles frantically (opening and closing repeatedly) (Figures 2a, b). While the male was on the ground some rival males were flying around it (Figure 1). From time to time rival males approached and tried to drive off the male that was on the hind leg and brief fights took place on the ground. During the fights, the males embraced for some seconds (2-3 seconds) and flew away. Fighting occurred during brief intervals, making observations and adequate description of this behavior difficult. After the fights, another male landed near the hind leg and scraped it with the foretarsi. Among the males there was one with one hind leg missing (Figure 3), presumably the owner of the detached leg. During the observation, the male with one hind leg missing was not able to get access to the leg. I was not able to determine if all males collected the fragrances.

When the detached leg was manually placed three meters away from the original place, the bees, after 5 seconds, quickly localized it and continued to fight and fly around it.

The *E. nigrita* hind tibia seems to be detached by a rival male during fights, since in the observation place there was one male with one hind leg missing (Figure 3). This is indirect evidence that the leg was not detached by a predator or that it was gnawed off by males from a dead specimen. In addition, on the same day of observation, 15 minutes later and in another sand trail in BRA, a group of three males was flying and fighting close to another detached hind leg on the ground.

Eltz et al. (1999), monitored males of two species of *Euglossa* in Barro Colorado Island, Panamá and suggested that the males forage for fragrances continuously over considerable periods of time, maybe throughout their lifetime. Eltz et al. (1999) also assumed that



Figure 1. Males of *Eulaema (Apeulaema) nigrita* flying around a male’s detached hind leg of *E. nigrita*.



Figure 2. a and b. Male of *Eulaema (Apeulaema) nigrita* removing the scents stored in detached hind leg from another male.



Figure 3. Male of *Eulaema (Apeulaema) nigrita*, which possibly lost one of its hind legs during fights with other males. The arrow indicates the male with one hind leg missing.

the fragrances are generally scarce, expensive to collect, or costly to retain. Thus, the individual fragrance bouquet may serve as an indicator of male genetic quality (e.g., reflecting foraging skills and/or survival abilities) to females (Whitten et al. 1989, Eltz et al. 1999, Roubik & Hanson 2004).

Since fragrances are scarce resources and play a key role during courtship, the males that accumulated complex bouquets may represent a rewarding fragrance source. Eberhard (1997) and Roubik (1998) recorded males of *E. sebrai* Moure, 1960 and *E. meriana* (Oliver, 1789) collecting odoriferous substances from hind tibiae of conspecific dead males. In the present work, I suggest that males of *E. nigrita* that have their tibiae filled with fragrances are attacked by conspecific males that attempt to rob the fragrances, and that during fights the hind legs are detached from the attacked males.

Dodson (1966, 1975) observed that males, which had previously collected scent, were found to attract other conspecific males. According to the same author (Dodson 1975), the congregated males then form leks, when they display together in order to attract females. The observation reported here and that in other papers (e.g. Dressler 1982, Nemésio & Morato 2005), however, show that euglossine males show strong aggressive behavior toward conspecific males.

Every male observed visiting a detached hind leg belonged to *E. nigrita* species, suggesting that males of *E. nigrita* collect and store species-specific scents blend as recorded for many species of *Euglossa* and *Eulaema* (Eltz et al. 1999, 2005).

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References

- ACKERMAN, J.D. & MONTALVO, A.M. 1985. Longevity of euglossine bees. *Biotropica* 17:79-81.
- ACKERMAN, J.D. 1983. Specificity and mutual dependency of the orchid-euglossine bee interaction. *Biol. J. Linn. Soc.* 20:301-314.
- BEMBÉ, B. 2004. Functional morphology in male euglossine bees and their ability to spray fragrances (Hymenoptera, Apidae, Euglossini). *Apidologie* 35:283-291.
- CAMERON, S.A. 2004. Phylogeny and Biology of Neotropical Orchid Bees (Euglossini). *Ann. Rev. Entomol.* 49:377-404.
- CRUZ-LANDIM, C.D, STORT, A.C, COSTA-CRUZ, M.A.D. & KITAJIMA, E.W. 1965. Órgão tibial dos machos de Euglossini, estudo ao microscópio óptico e eletrônica. *Rev. Bras. Biol.* 25:323-342.
- DODSON, C.H. 1966. Ethology of some bees of the tribe Euglossini (Hymenoptera: Apidae). *J. Kans. Entomol. Soc.* 39:607-629.
- DODSON, C.H. 1975. Coevolution of orchids and bees. in *coevolution of animals and plants*. (L.E. Gilbert & P.H. Raven, eds). University of Texas Press, p. 91-99.
- DRESSLER, R.L. 1981. *The Orchids: natural history and classification*. Harvard University Press, Cambridge.
- DRESSLER, R.L. 1982. Biology of the orchid bees (Euglossini). *Ann. Rev. Ecol. Syst.* 13:373-394.
- EBERHARD, W. 1997. Graverobbing by Male *Eulaema sebrai* Bees (Hymenoptera: Apidae). *J. Kans. Entomol. Soc.* 70:66.

- ELTZ, T., ROUBIK, D.W. & WHITTEN, M.W. 2003. Fragrances, male display and mating behavior of *Euglossa hemichlora*: a flight cage experiment. *Physiol. Entomol.* 28:251-260.
- ELTZ, T., SAGER, A. & LUNAU, K. 2005. Juggling with volatiles: exposures of perfumes by displaying male orchid bees. *J. Comp. Physiol. A* 191:575-581.
- ELTZ, T., WHITTEN, M.W., ROUBIK D.W. & LINSEMMAIR, K.E. 1999. Fragrance collection, storage, and accumulation by individual male orchid bee. *J. Chem. Ecol.* 25:157-175.
- KIMSEY, L.S. 1980. The behavior of male orchid bees (Apidae, Hymenoptera, Insecta) and the question of leks. *Anim. Behav.* 28:996-1004.
- MORATO, E.F., CAMPOS, L.A. & MOURE, J.S. 1992. Abelhas Euglossini (Hymenoptera, Apidae) coletadas na Amazônia central. *Rev. Bras. Entomol.* 36:767-771.
- MOURE, J.S. 1950. Contribuição para o conhecimento do gênero *Eulaema* *Lepeletier* (Hymen.-Apoidea). *Duesenia* 1:181-200.
- NEMÉSIO, A. & MORATO, E.F. 2006. The orchid-bee fauna (Hymenoptera: Apidae) of Acre state (northwestern Brazil) and a re-evaluation of euglossine bait-trapping. *Lundiana* 7:59-64.
- NEMÉSIO, A. 2002. Notes on the occurrence of an aberrant coloration in *Eulaema nigrita* (Hymenoptera: Apidae: Euglossina) in forest fragments in Southeastern Brazil. *Lundiana* 3:75-77.
- O'TOOLE, C. & RAW, A. 1991. *Bees of the World*. Facts on File, New York.
- OLIVEIRA, M.L. 2006. Três novas espécies de abelhas da Amazônia pertencentes ao gênero *Eulaema* (Hymenoptera: Apidae: Euglossini). *Acta Amazonica* 36:121-128.
- ROUBIK, D.V. 1998. Grave-robbing by Male *Eulaema* (Hymenoptera, Apidae): Implications for Euglossine Biology. *J. Kans. Entomol. Soc.* 71:191-199.
- ROUBIK, D.W. & HANSON, P.E. 2004. *Orchid bees of tropical America: biology and field guide*. Instituto Nacional de Biodiversidad Press, Heredia.
- ROUBIK, D.W. 1989. *Ecology and Natural History of Tropical Bees*. Cambridge University Press, New York.
- STERN, D.L. 1991. Male territoriality and alternative male behaviors in the euglossine bee, *Eulaema meriana*. *J. Kans. Entomol. Soc.* 64:421-437.
- WHITTEN, W.M., YOUNG, A.M. & WILLIAMS, N.H. 1989. Function of glandular secretions in fragrance collection by male euglossine bees. *J. Chem. Ecol.* 15:1285-1295.
- WILLIAMS, N.H. & WHITTEN, W.M. 1983. Orchid floral fragrances and male euglossine bees: methods and advances in the last sesquidecade. *Biol. Bull.* 164:355-395.
- WILLIAMS, N.H. 1982. The biology of orchids and euglossine bees. In *Orchid biology: reviews and perspectives* (J. Arditti, ed.). Cornell University Press, New York, p. 119-171.

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