

Occurrence of beetles (Insecta: Coleoptera) in mosquito ovitraps (Diptera: Culicidae, Culicinae) in an Atlantic Forest fragment

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Abstract. Ovitrap are generally used to collect immatures of Culicinae (Diptera: Culicidae). This study reports eight species of beetles found in ovitraps placed in an Atlantic Forest fragment in the state of Rio Grande do Sul, Southern Brazil. Seven species were classified in the family Scarabaeidae (subfamily Scarabaeinae), and one species in the family Hybosoridae (subfamily Hybosorinae). The first record of *Canthon angularis* Harold, 1868 in Rio Grande do Sul state is also documented.

Keywords: Detritivorous beetles, Hybosorinae, Scarabaeinae, Trap.

Resumo. Ocorrência de besouros (Insecta: Coleoptera) em ovitrampas de mosquitos (Diptera: Culicidae, Culicinae) em um fragmento da Mata Atlântica. Ovitrapas são geralmente usadas para coletar imaturos de Culicidae (Diptera). No entanto, este estudo reporta oito espécies de besouros encontrados em ovitrampas dispostas em um fragmento floresta de Mata Atlântica no estado do Rio Grande do Sul, sul do Brasil. Sete espécies foram classificadas na família Scarabaeidae (subfamília Scarabaeinae) e uma espécie na família Hybosoridae (subfamília Hybosorinae). O primeiro registro de *Canthon angularis* Harold, 1868 no estado do Rio Grande do Sul é também documentado.

Palavras-chave: Besouros detritívoros, Hybosorinae, Scarabaeinae, Armadilha.

Scarabaeinae and Hybosorinae are taxa (OCAMPO, 2006; SIMMONS & RIDSDILL-SMITH, 2011). of detritivorous beetles that feed on decomposing These insects play important ecological roles organic matter, such as mammal excrements, (DAVIS, 2004; NICHOLS *et al.*, 2008), and have been animal carcasses, and rotten plant material used as bioindicators of environmental quality in

multiple ecosystems (DAVIS, 2004; AUDINO *et al.*, 2014; VIEGAS *et al.*, 2014). There are several kinds of traps used to collect these insects, such as light, (e.g. RONQUI & LOPES, 2006), pitfall (e.g. SILVA *et al.*, 2007), and flight intercept traps (e.g. COSTA *et al.*, 2009). Pitfalls are buried in the soil and may be used with attractive baits, like flesh, decomposing fruits, or vertebrate excrement (SCHIFFLER *et al.*, 2003; SPECTOR, 2006; AUDINO *et al.*, 2011; SILVA *et al.*, 2011).

Some species of mosquitoes play an important role in the transmission of infectious agents to humans. A few specialized traps are used to capture adult mosquitoes and measure the density of the female population that is potentially infected. Ovitrap are an example of device used to capture mosquito eggs, which enable the measurement of bite rate of these dipterans (MARQUES *et al.*, 1993). Ovitrap can be installed in urban or rural areas to monitor populations of *Aedes aegypti* (Linnaeus, 1762) and *Haemagogus* species, respectively. Gravid females are attracted to oviposit in those traps by chemicals released from the decomposition of grass in the water (TIKASINGH & LAURENT, 1981; FANTINATTI *et al.*, 2007). In this context, this study aimed to report the occurrence of adult beetles in ovi-traps installed in an Atlantic Forest fragment in Southern Brazil and also discuss some aspects of the occurrence of this fact.

The study was developed in a forest fragment located in a rural area in the municipality of São José do Ouro (27°46'10"S, 51°35'40"W), located in the northern region of Rio Grande do Sul State, 318 km from the capital Porto Alegre, Brazil. The area is composed by Araucaria forest (SONEGO *et al.*, 2007) with a size of about 80 ha, altitude of

823 m, and subtropical climate.

A total of eight ovi-traps were installed with the aim to capture mosquitoes eggs and larvae. They consisted of a brown plastic container, with a capacity of one liter (20 x 15 cm), and were modified from TIKASINGH & LAURENT (1981). Four traps were installed at ground level on the soil (not buried) and the other four were installed 15 m above the ground, arranged on tree branches, to check the mosquitoes site preference of oviposition. Two traps were installed at the edge of the forest fragment, four traps in the forest interior and two traps in a glade located near a puddle in the forest interior, and were verified every 15 days from October 6th 2013 to December 13th 2013.

In the traps, decomposing plant material was added to dechlorinate water, the former composed of dead leaves from leaf litter in a proportion of 4:1 (water: leaves), this water was changed every 15 days. Later on, insects captured were put in ethanol 70% and carried to the laboratory for identification. The beetle specimens were identified using dichotomous keys provided by OCAMPO (2006) and VAZ-DE-MELLO *et al.* (2011), and by comparison with specimens from the Entomological Collection of the Centro de Ciências Biológicas from Universidade Federal de Santa Catarina, where they were deposited.

Seven species of Scarabaeinae were found in the ovi-traps of mosquitoes: *Canthon angularis* Harold, 1868: two males; *Coprophanaeus saphirinus* (Sturm, 1826): one female; *Deltochilum brasiliense* (Castelnau, 1840): one female; *Deltochilum rubripenne* (Gory, 1831) one male; *Dichotomius assifer* (Eschscholtz, 1822): one

female and one male; *Eurysternus francinae* Génier, 2009: one female and one male; and *Onthophagus tristis* Harold, 1873: one female. One species of Hybosoridae, *Coilodes* aff. *gibbus* (Perty, 1930), two males, was also collected. Despite the considerable number of beetles that fall in the traps, only two exemplars were collected per species. All specimens were collected in the traps installed on the soil in the forest interior, because of ecological requirements of these Coleoptera species and because the forest edge was near a crop area, it is possible that the use of pesticides difficult the surviving of these beetles out of the forest. This was the first time that these beetles' taxa were recorded in ovitraps of mosquitoes.

Deltochilum brasiliense and *D. rubripenne* are roller species that builds spheres of food that are rolled and buried in the ground far away from the resource (HALFFTER & EDMONDS, 1982); they has generalist feeding habit (ALMEIDA & LOUZADA, 2009; SILVA *et al.*, 2012). *Canthon angularis* is also a roller species, and is attracted to human excrement (MARTÍNEZ, 1959; CULOT *et al.*, 2013). These species are associated with preserved Atlantic Forest areas from South-Central region of Neotropical region (ALMEIDA & LOUZADA, 2009; SILVA *et al.*, 2012; 2013).

Dichotomius assifer and *Onthophagus tristis* are tunneler species that buries food resources below or next to the feeding source (HANSKI & CAMBEFORT, 1991). They have coprophagous feeding habit (SILVA *et al.*, 2012; CAMPOS & HERNÁNDEZ, 2013). *Dichotomius assifer* is also attracted to rotten flesh and decomposing fruits (SILVA *et al.*, 2012). They are very common in Atlantic Forest areas in the Southern and Southeast Brazil (SILVA *et al.*, 2011; SILVA *et al.*,

2013). *Coprophanaeus saphirinus* is also a tunneler species with necrophagous feeding habit (ALMEIDA & LOUZADA, 2009; SILVA *et al.*, 2012), also attracted by mammals excrements and decomposing fruits (SILVA *et al.*, 2012). It occurs in Atlantic Forest from the Southern and Southeast regions of Brazil and also in Bahia (Brazil), Argentina and Paraguay (SILVA *et al.*, 2011).

Eurysternus francinae is a dweller and coprophagous species that feeds and nests inside the resource (HALFFTER & EDMONDS, 1982; CAMPOS & HERNÁNDEZ, 2013). It occurs in the Atlantic Forest of Southeast Brazil (GÉNIER, 2009). The hybosorid *C. aff. gibbus* feeds mainly on excrement and rotten flesh in its adult stage. A lot of Hybosoridae species are attracted to light, and larvae have been collected from decomposing plant material, associated with roots (OCAMPO, 2006).

Most of the collected species were likely attracted to the ovitraps due to their detritivorous feeding habit. Twenty-one days after placing the traps, the water content showed a strong fetid odor (E. B. Santos, personal observation), which probably attracted the insects as they searched for food by smell (SIMMONS & RIDSDILL-SMITH, 2011). Dung beetles have two foraging strategies in search for food: some species do cruising flights and others just perching on leaves waiting for the odor plume (GILL, 1991). There is a wide range of volatile compounds present in different rotting resources that can attract dung beetles (PFROMMER & KRELL, 2004). When they found an odor plume dung beetles usually fly on or land near it. The fetid odor of rotting plant material and the landing on the food resources may explain the occurrence of different species of detritivorous beetles in the

ovitraps. The biology of hybosorid beetles is not well known, but based on the results reported here there is a great chance that the species follow the same pattern described by dung beetles: flying on the resource attracted by the strong smell of rotting plant material.

One remarkable finding was the collection of *C. angularis*, a species reported for the first time in the state of Rio Grande do Sul, previously known to occur in the Brazilian states of Minas Gerais, Paraná, Rio de Janeiro, Santa Catarina and São Paulo, as well as Argentina and Paraguay. Moreover, it was possible to observe that beetles were attracted to decomposing plant material (leaf litter), a fact that, although reported in the literature, is less often observed, because most of the studies use excrement, carrion and fruits to attract this fauna. Therefore, the use of a high-stage decomposed leaf litter, together with other collecting baits can contribute to a better sampling of these insects and also to the knowledge of their trophic preference. This is an important question to be elucidated about the biology of these insects.

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