

SHORT COMMUNICATION

Parasitizing behavior of *Cervellus piranga* Pentead-Dias (Hymenoptera, Braconidae, Braconinae) on papaya borer weevil *Pseudopiazurus obesus* Marshall (Coleoptera, Curculionidae)

Marcos A. B. Moreira¹, Paulo H. G. Zarbin², Angélica M. Pentead-Dias³ & Adenir V. Teodoro¹

¹Embrapa Tabuleiros Costeiros, Av. Beira Mar 3250, Caixa Postal 44, 49025-040 Aracaju-SE, Brasil. mmoreira@cpatc.embrapa.br; ad.teodoro@cpatc.embrapa.br

²Universidade Federal do Paraná, Departamento de Química, Caixa Postal 19020, 81531-980 Curitiba-PR, Brasil. pzarbin@quimica.ufpr.br

³Universidade Federal de São Carlos, Departamento de Ecologia e Biologia Evolutiva, Caixa Postal 676, 13565-905 São Carlos-SP, Brasil. angelica@ufscar.br

ABSTRACT. Parasitizing behavior of *Cervellus piranga* Pentead-Dias (Hymenoptera, Braconidae, Braconinae) on papaya borer weevil *Pseudopiazurus obesus* Marshall (Coleoptera, Curculionidae). The papaya borer weevil *Pseudopiazurus obesus* is a pest associated with papaya crops in Brazil and *Cervellus piranga* is a naturally-occurring parasitoid which may contribute to regulate populations of this pest. We aimed at describing the parasitizing behavior of the parasitoid *C. piranga* on papaya borer weevil *P. obesus* larvae under field conditions. The sequence of events related to the parasitizing behavior of *C. piranga* is similar to other braconid species and includes the location and recognition of the attacked host plant followed by walks on the host plant and touching it with the tip of the antennae and the ovipositor. In the following event, the parasitoid assesses the suitability of the host by speeding up antennae and ovipositor movements. After locating and accepting the host, the parasitoid remains inactive on oviposition aperture sites and starts moving the antennae. Afterwards, the parasitoid inserts its ovipositor and starts cleaning it repeatedly. The female of *C. piranga* inserts the ovipositor through the hole and lay one egg into the papaya weevil borer. After oviposition, the female cleans continuously both ovipositor and antennae before leaving to forage for a new host.

KEYWORDS. Kairomones; parasitoid; papaya pest; plant volatiles; sinomones.

RESUMO. Comportamento de parasitismo de *Cervellus piranga* Pentead-Dias (Hymenoptera, Braconidae, Braconinae) sobre a broca-do-mamoeiro *Pseudopiazurus obesus* Marshall (Coleoptera, Curculionidae). A broca-do-mamoeiro *Pseudopiazurus obesus* é uma praga de cultivos de mamão no Brasil e *Cervellus piranga* é um parasitóide que ocorre naturalmente no campo e pode contribuir para a regulação da população desta praga. O objetivo do presente trabalho foi a descrição do comportamento de parasitismo do parasitóide *C. piranga* sobre larvas da broca-do-mamoeiro *P. obesus* em condições de campo. A sequência de eventos relacionados ao parasitismo de *C. piranga* é similar a outras espécies de braconídeos e inclui a localização e o reconhecimento da planta hospedeira atacada, caminhamento na planta e toque desta com as antenas e o ovipositor. No próximo evento, o parasitóide acessa a adequabilidade do hospedeiro através do aumento dos movimentos da antena e do ovipositor. Após localizar e aceitar o hospedeiro, o parasitóide fica imóvel no sítio de oviposição e inicia a movimentar a antena. Em seguida, o parasitóide insere o ovipositor e o limpa repetidamente. A fêmea de *C. piranga* insere o ovipositor através da abertura e deposita um ovo na broca-do-mamoeiro. Após a oviposição, a fêmea limpa continuamente o ovipositor e a antena e abandona a planta para um novo forrageamento.

PALAVRAS-CHAVE. Cairomônios; parasitóide; praga do mamão; sinomônios; voláteis de plantas.

The papaya borer weevil *Pseudopiazurus obesus* Marshall, 1922 (Coleoptera, Curculionidae) is a pest associated with papaya crops in the north and northeast regions of Brazil (Moreira *et al.* 2003). Females of the papaya borer weevil lay their eggs on the papaya trunk into which larvae penetrate after egg hatching causing destruction of meristematic tissues, affecting sap translocation and eventually killing the plant (Farias & Almeida 1995). The larval cycle of the papaya borer weevil takes approximately three months, however we are not aware of any study on the biological aspects of this pest. Since the larvae dwell inside the trunk the

use of pesticides is largely inefficient. The use of natural enemies such as parasitoids to control insect pests is an important strategy in integrated pest management programs (Viggiani 2000; Gallo *et al.* 2002; Moreira *et al.* 2003).

The braconid *Cervellus piranga* Pentead-Dias, 2007 (Hymenoptera, Braconidae, Braconinae) is a naturally-occurring parasitoid which may contribute to regulate populations of the papaya borer weevil (Moreira *et al.* 2003; Pentead-Dias *et al.* 2007). Parasitism of the papaya borer weevil larvae by *C. piranga* ranges from 5 to 8% (Moreira *et al.* 2003). The advantage of parasitoids in comparison with other natural en-

emies is the ability of reaching the larvae hidden inside the trunk, which is the damaging developmental stage of the papaya weevil borer. However, a diversified community of natural enemies contributes to regulate all developmental stages of the papaya borer weevil (Moreira *et al.* 2005). Understanding the parasitizing behavior of parasitoids is vital for the establishment of successful biological control programs (Kant *et al.* 2008) as such knowledge helps to comprehend the multitrophic relationships between these natural enemies, their hosts and the host plant (Santos *et al.* 2004). Therefore, this work aimed to describe the parasitism behavior of *C. piranga* on larvae of the papaya borer weevil under field conditions.

We observed the parasitizing behavior of *C. piranga* on larvae of the papaya borer weevil in two commercial plantations of papaya (2.5 years old plants), located in the Brazilian Northeastern cities of Vera Cruz, in the state of Rio Grande do Norte (6°02'38"S, 35°25'40"W, 92 m above sea level) and Laje, in the state of Bahia (13°09'51"S, 39°25'59"W, 233 m above sea level), in October 2004.

We used a digital camera (Canon A300) to record all steps related to the parasitizing behavior of *C. piranga*. We chose plants severely attacked by the papaya borer weevil and with activity of the parasitoid *C. piranga*. Afterwards, we conducted daily observations during four days, between 6:30 and 10:30 am, which was defined based on previous field observations as the main activity period of the parasitoids. The number of observed parasitoids varied and pictures were taken and used to describe and draw the sequence of events related to the parasitizing behavior of *C. piranga* on larvae of the papaya weevil borer.

The sequence of events related to the parasitizing behavior of *C. piranga* is similar to other braconid species (Santos *et al.* 2004; Roux *et al.* 2005). The location and recognition of the host plant attacked by the papaya borer weevil by the parasitoid *C. piranga* may be mediated by visual stimuli and chemical signals, mainly sinomones and kairomones (Metcalf & Metcalf 1992). Plant volatiles play a key role in orientating both pest insects and their natural enemies (Vet & Dicke 1992). Parasitoids select habitat and host by means of volatiles recognized by their olfactory apparatus. Volatiles are released in the environment from herbivorous-attacked host plants and from the hosts themselves (Vuorinen *et al.* 2004; Dannon *et al.* 2010). Such allelochemicals are used by parasitoids to locate host plants and hosts (Dicke *et al.* 1990; Metcalf & Metcalf 1992). Therefore, *C. piranga* may use papaya weevil borer-induced plant volatiles as well as kairomones from feces and regurgitation of the borer to locate the host plant and the host, respectively.

For the recognition of the host plant potentially attacked by the papaya borer weevil, the parasitoid *C. piranga* walks on the host plant touching it alternatively with the tip of the antennae and the ovipositor. The perception of semiochemicals in interspecific communication is possibly mediated by a synergistic effect of sinomones and kairomones released in the environment (Dicke *et al.* 1990). Additionally, braconid parasitoids may detect host visually and the size of the host

indicate its suitability for parasitoid fitness (Kant *et al.* 2008). Sound emitted by larvae and pupae as a result of feeding and movement inside the trunk may also be exploited by the parasitoid in host location through vibrotaxis (Lawrence 1981).

In the following event, the parasitoid assesses the suitability of the host by speeding up antennae and ovipositor movements. Such movements are important for the decision-making process of staying on the host plant or move to another host plant (Richerson & DeLoach 1972). After locating and accepting the host, the parasitoid remains inactive on oviposition aperture sites or on holes bored by larvae of the papaya borer weevil slowly moving the antennae and matching its position to that of the host. Afterwards, the parasitoid inserts its ovipositor and starts cleaning it repeatedly with help of the posterior legs.

The female of *C. piranga* inserts the ovipositor through the hole and lay one egg into the papaya borer weevil. The parasitoid contracts its abdomen several times during oviposition probably in order to increase egg laying frequency as pointed out by Legaspi *et al.* (1987). The oviposition process takes 15 to 20 seconds from penetration to retraction of the ovipositor. The parasitoid oviposited only once in each oviposition aperture or hole of bored sites; however, one female was observed laying eggs in other sites of the same plant avoiding, thus, superparasitism. Braconids use oviposition-detering pheromones or oviposition marker pheromones to avoid intraspecific competition. After oviposition, the female stays inactive by approximately 10 seconds cleaning continuously both ovipositor and antennae before leaving to forage for a new host.

Pupal chambers of the papaya borer weevil parasitized by *C. piranga* had only one host larvae from which only one parasitoid emerged. We noticed that *C. piranga* parasitizes only the first instars of the papaya borer weevil suggesting that this parasitoid is a solitary koinobiont laying only one egg per host; however, additional studies are necessary to clarify this behavior.

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