



SHORT NOTE

Social Wasps as Biological Control Agents Against *Diaphania hyalinata* (Linnaeus, 1767) (Lepidoptera, Crambidae), a Cucumber Pest in Amazonas, Brazil

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Abstract

Diaphania hyalinata (Lepidoptera: Crambidae), popularly known as “melonworm moth”, is considered a main pest of the cucumber, and depending on the intensity of infestation, the damage can reach 100%. Herein, we report the predation of *D. hyalinata* larvae by seven social wasp species: *Brachygastra lecheguana*, *Polybia dimidiata*, *Polybia ignobilis*, *Polybia liliacea*, *Protopolybia minutissima*, *Synoeca surinama* and *Synoeca virginea*, and predation of *D. hyalinata* pupae by *Polybia liliacea*. We suggest that *Polybia liliacea*, should be considered as a potential biological control for cucumbers, due to its high index of captured prey and intense foraging activity.

Diaphania hyalinata (Linnaeus, 1767) (Lepidoptera: Crambidae), popularly known as “melonworm moth”, is considered one of the main pests of the cucumber (*Cucumis sativus* L.) (Gonring et al., 2002; 2003), and attacks other Curcubitaceae species, such as: melon (*Cucumis melo* L.), watermelon (*Citrullus lanatus* (Thunberg) Matsumura & Nakai), pumpkin (*Curcubita moschata* Duchesne) and zucchini (*Curcubita pepo* L.) (Fernandes, 1998; Costa et al., 2008; Santana Júnior et al., 2012; Panthi et al., 2017). Adults deposit egg masses on leaf surfaces, where eggs hatch and larvae begin to feed on leaves, flowers, and fruits (Santana Júnior et al., 2012; Panthi et al., 2017).

In fruits, larvae feed on the surface or form galleries, damaging the cucumber pulp (Fernandes, 1998) (Figure 1). Such attacks on fruit accelerate their decomposition due to penetration by saprophyte organisms, which completely rot the fruits and prevent their consumption (Gonring et al., 2003; Costa et al., 2008). Depending on the intensity of infestation, the damage can reach 100% (Melo et al., 2011). Controlling

D. hyalinata is difficult because they are multivolt insects with high reproductive capacity and adapt to food resources that fluctuate in terms of quality and availability (Guedes et al., 2010). Pupae can form on cucumber leaves, soil, or adjacent plants, where the larvae form cocoons by winding a leaf section (Capinera, 2004).

Although *D. hyalinata* is a widely studied species, due to its agricultural and economic importance, information about its predators is scarce. Regarding predation by social wasps, there are only records of *D. hyalinata* larvae predation by *Polybia ignobilis* (Haliday, 1836), which is the most common, and *Polybia scutellaris* (White, 1841), which seems to be restricted to the Atlantic Forest (Gonring et al., 2002; Santana Júnior et al., 2012; Gonring et al., 2003; Jacques et al., 2015).

Predatory wasps play an important role in the natural control of insect pests (Picanço et al., 2012), as they search for and consume prey, adapt to environments, and compete for food, which make them highly efficient (Santana Júnior et al., 2012). According to Prezoto et al. (2008), social wasps



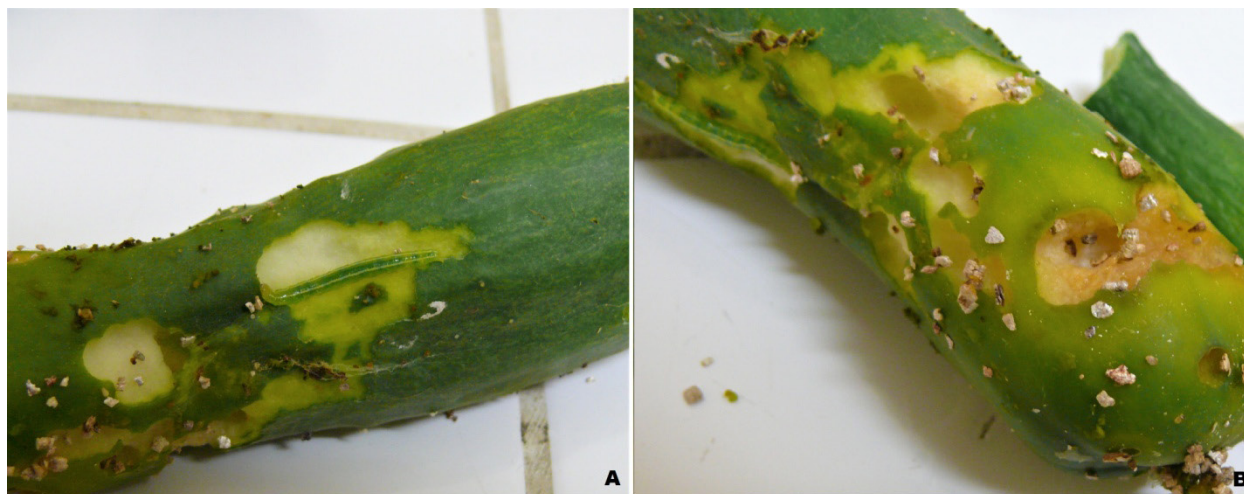


Fig 1. *Diaphania hyalinata* larvae forming galleries inside the cucumber fruits.

capture adult and/or immature insects to feed their larvae. The preference for preying upon Lepidoptera is a good indicator that wasps could act as biological control agents for economically destructive caterpillar populations such as *Spodoptera frugiperda* (Smith, 1797), *Chlosyne lacinia saundersi* (Doubleday, 1847), *Alabama argillacea* (Hübner, 1823), *Anticarsia gemmatalis* Hübner, 1818 and *Heliothis virescens* (Fabricius, 1777), which make up the most common pests abundantly found in small farms in Neotropical environments such as Brazil (Prezoto et al., 2019). Recently, in Amazonas State, predatory activity of *Polistes canadensis* (Linnaeus, 1758) on *Plutella xylostella* (Linnaeus, 1758) has been observed at a small organic kale plantation (*Brassica oleracea* L.) (Montefusco et al., 2017).

The importance of social wasps is recognized, however, little is known about their activity as agents of biological control for *Diaphania* species (Santana Júnior et al., 2012). Thus, we report predation of larvae, and, for the first time, pupae of *D. hyalinata* by social wasps.

The present work is the result of collections, observations, and visual records (photos and films) made in January 2015, from a rural cucumber (*Cucumis sativus* L.) plantation located approximately 45 km distant from Rio Preto da Eva, Amazonas, Brazil, accessed by km 125 of AM-010 highway, and coordinates -2.842388°S, -59.438138°W. The area consists of a plantation with 2,000 cucumber plants, largely surrounded by primary dense ombrophilous forest, and entirely infested by *D. hyalinata* larvae and pupae.

D. hyalinata and social wasps' specimens were captured with entomological nets, and the vouchers deposited in the Invertebrate Collection of the National Institute of Amazonian Research (INPA). The lepidopterans were raised in the laboratory and adults were identified based on Arias and Clavijo (2001). Wasps were identified using Richards (1978) and through comparisons with deposited and identified material from INPA's collection.

We observed *Brachygastra lecheguana* (Latreille, 1804), *Polybia dimidiata* (Olivier, 1792), *Polybia ignobilis* (Haliday,

1836), *Protopolybia minutissima* (Spinosa, 1851), *Synoeca surinama* (Linnaeus, 1767) and *Synoeca virginea* (Fabricius, 1804) in larvae only. The wasps were observed preying on fifth instar larvae during the capture, using their posterior legs to catch the larvae, and their mandibles during flight to stabilize the prey (Figura 2A).

Featured, we observed *Polybia liliacea* (Fabricius, 1804) preying on larvae and pupae of *D. hyalinata* (Figure 2A, B, C, D) (film supplementary), representing the first record of *D. hyalinata* pupa predation by social wasps. These pupae were found in large clusters on dried cucumber leaves, sharing the location (Figure 2C). Since we found no information about behavior of *D. hyalinata* pupae in the literature, we considered leaves as the pupation site. During foraging, wasps approached the pupation site and groped the leaves to locate the pupae (Figure 2C), opened the cocoon, and captured the insect, using their posterior legs and mandibles, similar to larvae capture.

Apparently, *D. hyalinata* predation, as well as other agricultural pests of social wasps, do not present highly specialized relationships, and may in fact be more related to the original distribution of the social wasp species (Carpenter & Marques, 2001). Herein, most species are typically from the Amazon Rainforest, except for *Brachygastra lecheguana* and *Polybia ignobilis*, which are widely distributed in the Neotropics.

This information is relevant since identifying and studying these predatory insects, especially in agricultural environments, are the first steps to identifying the best species to use in biological pest control (Jacques et al., 2015). In this way, such information can support control strategies for *D. hyalinata*, associated with integrated pest management.

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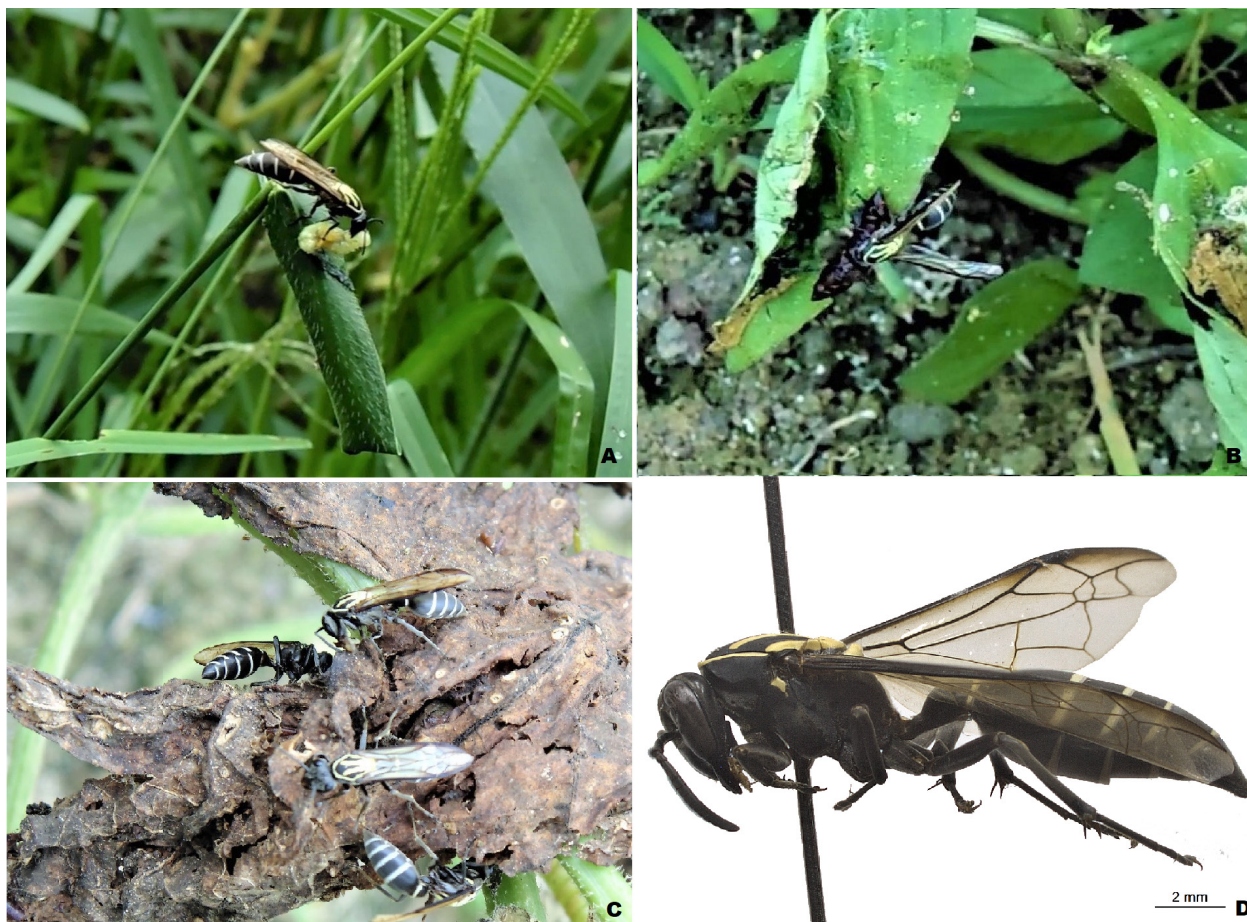


Fig 2. *Polybia liliacea* preying on *Diaphania hyalinata*: (A) fifth instar larvae; (B) pupae; (C) *Polybia liliacea* in pupation site; (D) *P. liliacea* in lateral view.

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Supplementary file (film)

<http://periodicos.uefs.br/ojs/index.php/sociobiology/rt/suppFiles/3576/0>

1: *Polybia liliacea* preying on *Diaphania hyalinata* larvae. DOI: 10.13102/sociobiology.v66i4.3576.s2103

2: *Polybia liliacea* preying on *Diaphania hyalinata* larvae. DOI: 10.13102/sociobiology.v66i4.3576.s2658

