Belvosia sp. (Diptera: Tachinidae) Parasitizing *Halysidota* sp. (Lepidoptera: Arctiidae) Caterpillars on *Ficus benjamina* (Moraceae) in Brazil

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BELVOSIA SP. (DIPTERA: TACHINIDAE) PARASITIZING *HALYSIDOTA* SP. (LEPIDOPTERA: ARCTIIDAE) CATERPILLARS ON *FICUS BENJAMINA* (MORACEAE) IN BRAZIL

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Ficus benjamina L. (Moraceae), an ornamental plant from south and southeast Asia and Australia and specifically Malaysia, was introduced in Brazil because of traits not observed in other species of this group, including branches almost at ground level and glossy oval leaves with the acuminate tips (Fang et al. 2007; Lazzarotto et al. 2011). This plant can exceed 20 m in height in tropical regions, and be imposing in urban sites, such as parks and gardens (Miao et al. 2011).

Halysidota Hübner (Lepidoptera: Arctiidae) species include caterpillars that defoliate Moraceae and Myrtaceae plants, e.g., *Halysidota orientalis* Rothschild, which defoliated *Morus alba* L. (Moraceae) in São Paulo (Sánchez-Soto et al. 2004). In addition *H. pearsoni* Watson defoliated *Eucalyptus* spp. (Myrtaceae) in Minas Gerais, Brazil and its pupae were parasitized by the gregarious generalist endoparasitoid, *Palmistichus elaeisis* Delvare & LaSalle (Hymenoptera: Eulophidae), in the laboratory (Pereira et al. 2008). This natural enemy is a promising biological control agent for defoliators in agroforestry systems (Tavares et al. 2011a, 2012a, 2013a, 2013b).

Belvosia Robineau-Desvoidy (Diptera: Tachinidae) species parasitize caterpillars and pupae of moths of the families Hesperiidae, Noctuidae, Saturniidae and Sphingidae (Arnaud 1978). *Belvosia* spp. (Diptera: Tachinidae) emerged from 70.7 to 96.2% of *Hylesia metabus* Cramer (Lepidoptera: Saturniidae) pupae during 6 generations in northeastern Venezuela (Hernandez et al. 2009). *Belvosia bifasciata* F. (Diptera: Tachinidae) emerged from 0.7% of *Anisota senatoria* J. E. Smith (Lepidoptera: Saturniidae) pupae in 2 generations in southeast Virginia, USA (Coffelt & Schultz 1993) and *Belvosia bicincta* Robineau-Desvoidy (Diptera: Tachinidae) emerged from 26% of the *Hyles lineata* F. (Lepidoptera: Saturniidae) pupae in eastern New Mexico, USA (Jorgensen 1988).

The aim of this study was to assess the emergence of *Belvosia* sp. from *Halysidota* sp. pupae obtained from caterpillars aggregated on *F. benjamina* trunk bases in Viçosa, Minas Gerais, Brazil.

Hundreds of *Halysidota* sp. caterpillars on *F. benjamina* were allowed to feed during the night on leaves of this plant until the last instar. Four separate groups of last-instar *Halysidota* sp. caterpillars (158, 144, 137 and 129 individuals) were collected daily over 4 days at 10:00 A.M. (Fig. 1). Caterpillars were collected from the base of 4 mature *F. benjamina* trees, which were 10 m tall and spaced 3 m apart in the "Recanto da Cigarra" locality (S 20° 45' W 42° 51', 651 m asl) on the campus of the Federal University of Viçosa (UFV) in Viçosa, Minas Gerais, Brazil. These groups were chosen because they were observed to be the most numerous during sampling.

Each group of *Halysidota* sp. caterpillars was placed in a 5 L-plastic container in the Laboratory of Biological Control of Insects (LCBI) of the UFV in a room at 25 ± 1 °C, 12:12 h L:D and 70 ± 10% R.H. Each group was separated in rearing cages (32 cm long × 30 cm wide × 30 cm high) with *F. benjamina* branches for *ad libitum* feeding and the branches were changed daily. Each cage had sterilized fine sand at the bottom with leaves and thin branches under the sand to favor cocoon formation and pupation. The bases of the branches were moistened with water in

Fig. 1. Last-instar *Halysidota* sp. (Lepidoptera: Arctiidae) caterpillars on *Ficus benjamina* L. (Moraceae) trunk in Viçosa, Minas Gerais, Brazil.

dental type anesthetic tubes to reduce leaf wilting. Each *Halysidota* sp. pupa was placed in a 50 mL-plastic cup sealed with polyvinyl chloride (PVC) film and held for lepidopteran or parasitoid emergence. The numbers of pupae formed from last-instar *Halysidota* sp. caterpillars collected on *F. benjamina* plants and the emergence of this lepidopteran and its dipteran parasitoid (*Belvosia* sp.) were carefully recorded.

This is the first report of *Halysidota* sp. developing on *F. benjamina* as the host plant. Parasitoids were identified by E.N. as an undescribed species of *Belvosia*. The lepidopteran defoliator of *F. benjamina* was identified by Dr. Olaf Hermann Hendrik Mielke of the Department of Zoology of the Federal University of Paraná in Curitiba, Paraná, Brazil as an undescribed *Halysidota* species. Some of these individuals (flies and lepidopteran adults) were deposited at the Regional Museum of Entomology, Department of Entomology, UFV.

One species of Lepidoptera (*Halysidota* sp.) and one of Diptera (*Belvosia* sp.) were collected on plants of *F. benjamina* in this study. Groups of *Halysidota* sp. with an average of 142 caterpillars on *F. benjamina* trunks displayed a gregarious habit during the day. Each group of pupae had an average of 118 individuals (Table 1). Only one *Halysidota* sp. adult emerged in the laboratory from 472 pupae of this insect (Table 1). One *Belvosia* sp. parasitoid individual emerged per *Halysidota* sp. pupa, and the average emergence rate was 62.5 individuals per 118 *Halysidota* sp. pupae (Table 1).

This is the first report of *Halysidota* sp. defoliating *F. benjamina* in Brazil and the second record of a lepidopteran pest on this plant. *Ammalo helops* Cramer (Lepidoptera: Arctiidae) caterpillars were reported defoliating this plant in El Salvador (Horgan 2005). Natural enemies identified on this plant include the predator *Montandoniola confusa* Streito & Matocq (Hemiptera: Anthocoridae), which reduced the galls caused by *Gynaikothrips uzeli* Zimmerman (Thysanoptera: Phlaeothripidae) on *F. benjamina* plants by 95% (Arthurs et al. 2011). Defoliation of *F. benjamina* plants by *Halysidota* sp. can reduce its biomass (Tavares et al. 2012b).

The gregarious habit of *Halysidota* sp. caterpillars on *F. benjamina* trunks facilitates observa-

TABLE 1. NUMBER OF CATERPILLARS AND PERCENT PUPATION AND MORTALITY (%) OF *HALYSIDOTA* SP. (LEPIDOPTERA: ARCTIIDAE), AND THE NUMBER OF *BELVOSIA* SP. (DIPTERA: TACHINIDAE) INDIVIDUALS THAT EMERGED FROM *HALYSIDOTA* SP. PUPAE. THE *HALYSIDOTA* SP. CATERPILLARS WERE COLLECTED FROM *FICUS BENJAMINA* (MORACEAE) AT VIÇOSA, MINAS GERAIS, BRAZIL.

	Number of caterpillars per group			
Parameters observed	158	144	137	129
No. *Halysidota* pupae & % pupation	132; 83.54%	122; 84.72%	116; 84.67%	102; 79.07%
No. and % of dead caterpillars	26; 16.46%	22; 15.28%	21; 15.33%	27; 20.93%
No. of emerged lepidopterans	0	1[1]	0	0
No. of emerged *Belvosia* sp. & % emergence	68; 51.52%	61; 50.00%	57; 49.14%	64; 62.75%
No. of unviable *Belvosia* sp. pupae and % unviable	64; 32.02%	60; 33.72%	59; 35.53%	38; 16.32%

[1]Emergence of one *Halysidota* sp. (Lepidoptera: Arctiidae).

tion of their behavior during the day, but at night they disperse to feed on leaves of upper branches of this plant, as was found for *A. helops* (Horgan 2005). The early instars of the latter species may aggregate on *F. benjamina* stems plants in refuge areas not filled by older instars of the same species. Small groups of *A. helops* caterpillars were present in holes of rotting wood and among branches and aerial roots of *F. benjamina*. On the other hand, large groups of caterpillars aggregated mainly on trunks of this plant (Horgan 2005).

Although in this study more than 50% of *Halysidota* sp. pupae were parasitized by *Halysidota* sp., the emergence of only 1 *Halysidota* sp. adult from 472 pupae is consistent with the low emergence rate of *H. orientalis*. Caterpillars fed on host leaves in the laboratory, yielded only 1 female and 4 males from a large number of them collected in São Paulo, Brazil (Sánchez-Soto et al. 2004). However, an artificial diet for caterpillars and optimum temperature, photoperiod and R.H. conditions and protection from natural enemies might increase the emergence rate of Lepidoptera not adapted to the laboratory (Tavares et al. 2011b; Costa et al. 2012).

Identification of adults of the *Halysidota* genus is complex and based on wing color and morphology, especially the variations in the chromatic patterns of the forewings. Two *H. orientalis* males observed that had the reniform spot united with a medial band in the costal region and an incomplete postmedial band, while others had this reniform spot separated from the medial band and the post-medial band complete (Sanchez-Soto et al. 2004). The lengths of the labial palps can be used to differentiate *Halysidota* spp. pupae from those of other genera of Arctiidae (Mosher 1969). *Halysidota* species can be differentiated by the morphology of male genitalia, and in this way *Halysidota interlineata* Walker (Lepidoptera: Arctiidae) is distinguished from *H. orientalis* (Watson 1980). Ferguson & Opler (2006) asserted that 282 Arctiidae species from North America to northern Mexico were reported since the last revision of this group in 1983.

The emergence of *Belvosia* sp. from *Halysidota* sp. pupae suggests that has considerable potential as a biocontrol agent. *Belvosia* sp. parasitized 22% of *A. helops* caterpillars, but lower rates of larger and older groups in large refuge areas on *F. benjamina* trees. This shows that larger groups of caterpillars and gregariousness are defensive formations (Horgan 2005). Tachinidae were reported flying near *F. benjamina* trunks with infested with *A. helops* caterpillars during the day (Horgan 2005). This lepidopteran showed defensive behavior with sudden movements of the head, while those in plant refuges were not disturbed (Horgan 2005). The parasitism rate of 50% by *Belvosia* sp. suggests that the final instar caterpillars in small groups on open trunks of trees (not refugees) were more vulnerable to natural enemies than those in refugees and in large groups (Horgan 2005).

Halysidota sp. caterpillars were found feeding on *F. benjamina* plants in Viçosa, Minas Gerais, Brazil and they were heavily parasitized by *Belvosia* sp. This parasitoid can reduce *Halysidota* sp. populations, and thereby facilitate the propagation and use of *F. benjamina* as a popular ornamental.

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SUMMARY

Ficus benjamina L. (Moraceae) is an exotic ornamental plant in Brazil. The aim of this study was to identify a defoliator and its parasitoid on *F. benjamina* plants in Viçosa, Minas Gerais, Brazil and to determine the number of pupae and the emergence of lepidopteran and a dipteran. Four *Halysidota* sp. (Lepidoptera: Arctiidae) groups, with 158, 144, 137 and 129 last-instar caterpillars aggregated on the trunks of 4 *F. benjamina*

trees. These caterpillars were collected, held in plastic containers with ficus leaves until development and emergence were completed. Adults of 1 undescribed lepidopteran species (*Halysidota*) and 1 dipteran species [*Belvosia* (Tachinidae)] emerged from the *Halysidota* pupae. An average of 118 viable *Halysidota* pupae per group were formed, and an average of 62.5 *Belvosia* individuals emerged from these host pupae per *Halysidota* group. From a grand total of 472 *Halysidota* pupae only one adult emerged. *Halysidota* sp. damaged *F. benjamina* plants in Viçosa, Minas Gerais, Brazil, but this defoliator was parasitized by *Belvosia* sp. The findings reported here indicate that *Belvosia* sp. appears to have the potential to reduce populations of *Halysidota* sp. and possibly protect *F. benjamina* in ornamental plantings.

Key Words: Arctiinae, Exoristinae, gregarism, parasitism, Rosales

Resumo

Ficus benjamina L. (Moraceae) é uma espécie ornamental exótica cultivada no Brasil. O objetivo foi identificar um desfolhador e seu parasitoide em plantas de *F. benjamina* em Viçosa, Minas Gerais, Brasil e determinar o número de pupas e a taxa de emergência dos Lepidoptera e dos Diptera. Quatro grupos de *Halysidota* sp. (Lepidoptera: Arctiidae), com 158, 144, 137 e 129 lagartas de últimos estádios agregadas sobre os troncos de 4 árvores de *F. benjamina* foram coletados. Uma espécie não-descrita de Lepidoptera (*Halysidota*) e outra de Diptera [*Belvosia* (Tachinidae)] foram obtidas. Os números de pupas foram, em média, de 118 por grupo. A taxa de emergência do Diptera foi de 62,5 indivíduos por grupo de lagartas. *Halysidota* sp. danificou plantas de *F. benjamina* em Viçosa, Minas Gerais, Brasil, mas foi parasitada por *Belvosia* sp. Isso mostra a importância desse Tachinidae para reduzir populações deste desfolhador de *F. benjamina*, a qual é cultivada como ornamental.

Palavras Chave: Arctiinae, Exoristinae, gregarismo, parasitismo, Rosales

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