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PREDATION OF *ZAPRINUS INDIANUS* (DIPTERA: DROSOPHILIDAE) BY THE SOCIAL WASP *SYNOECA CYANEA* (HYMENOPTERA: VESPIDAE)

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Fruit fly species in several dipteran families are mainly responsible for the damage dealt to fruit in Brazil by insects (Fernandes & Elton 2011; Zart et al. 2011). The females of such dipteran families inflict direct damage to fruit by puncturing it with their ovipositors, and the larvae, which develop within the fruit, render it largely unmarketable. Also these actions result in premature fruit drop, and facilitate the entry of bacteria or fungi that cause rotting, which strongly devalues the fruit (Souza-Filho et al. 2003).

The control of these pests is difficult because of their prolific production of viable eggs, high capacity of dispersion of the adults and colonization in many different ecological conditions, and very importantly, because the immature stages develop within the fruits (Copeland et al. 2002; Raga et al. 2005).

The best known species in the genus *Zaprionus* (Drosophilidae), is the fig fly, *Zaprionus indianus* (Gupta), a pest species, which is reported with increasing frequency in the Brazilian territory. The polyphagous *Z. indianus* species, which is believed to have originated from Africa, was first reported in Brazil in 1999, near Valinhos, São Paulo State, in a culture of figs. Subsequently, because this species multiplied very rapidly (Vilela 1999; Raga et al. 2003), it is now one of the principal economic pests in national fruit production.

In Brazil, the fly *Z. indianus* has already been observed to inflict damage to the following fruits: acerola (*Malpighia glabra* L., Malpighiaceae), banana (*Musa* sp. Musaceae), cashew (*Anacardium occidentale* L., Anacardiaceae), carombola (*Averrhoa carambola* L., Oxilidaceae), citrus (*Citrus* spp., Rutaceae), guava (*Psidium guajava* L., Myrtaceae), jaboticaba (*Myrcia jaboticaba* Baill., Myrtaceae), iamb (*Syzygium jambos* L. (Alston), Myrtaceae), mango (*Mangifera indica* L., Anacardiaceae), strawberry (*Fragaria* sp., Rosaceae), peach (*Prunus persica* (L.) Stokes, Rosaceae), Spanish prune (*Spondias purpurea* L., Anacardiaceae) and tomato (*Lycopersicon esculentum* L., Solanaceae) (Raga 2002).

Social wasps visit a wide variety of fruits to obtain nutrients such as carbohydrates and animal protein derived from the capture of adult insects and/or immature insects that occur in fruits and that are used for feeding wasp larvae (Prezoto et al. 2008). In the Neotropics, several studies have described the predatory behavior of

social wasps on different groups of insect pests in agroecosystems (Giannotti et al. 1995; Elisei et al. 2010), and in urban gardens (Andrade & Prezoto 2001; Prezoto et al. 2005; Prezoto et al. 2006). This study is the first record of predation of *Z. indianus* (Gupta) larvae by the social wasp *Synoeca cyanea* (F.), which suggests that natural enemy is potentially useful as a biocontrol agent for practical use in fruit protection Brazil.

During the month of Apr 2012, we registered the predatory behavior of the social wasp *S. cyanea* on larvae of *Z. indianus* in fruits of Spanish prune (*S. purpurea*) in an agricultural property at Piracicaba city (S 22° 43' W 47° 38'), São Paulo State, Brazil. During 23 consecutive days, we conducted observations *ad libitum* (*sensu* Altmann, 1974) on the behavior of wasps *S. cyanea* foraging on ripe fruits of Spanish prune from 8 AM to 6 PM.

Synoeca cyanea initiated foraging behavior by landing on the fruits of Spanish prune antennating them, i.e., continually touching different points on the fruit surface with the antennae, possibly in search of chemical cues of prey (Fig. 1). We observed that *S. cyanea* workers always exhibited antennation of the fruit of Spanish prune, and this behavior was more prolonged when the fruit being inspected had holes in its skin (exocarp) created by other insects.

When the wasps detected the presence of *Z. indianus* larvae, they persistently malaxed the site, sometimes shifting to a new site, but always on the same fruit in their quest to capture the prey. Larvae of *Z. indianus* that were captured were 2-4 mm in length, and they were captured individually. When the larva was removed from the fruit, the wasp was seen to be malaxing it, transforming it into the form of an acorn, which the wasp transported to the colony.

The capture of *Z. indianus* larvae occurred throughout the day, being more intense in the hottest hours (1-3 PM), when we recorded 3 catches per hour. We did not register any other species of wasp foraging in Spanish prune.

The wasps of the genus *Synoeca* have colonies with hundreds of individuals and their nests can stay active for many years (Castellón 1980). Of the 4 species of this genus found in Brazil, *S. cyanea* is the most abundant, and easily located in different kinds of phyto-physiognomy (Elisei et al. 2005; Henrique-Simões et al. 2011). In a study on the foraging activity of *S. cyanea*, Elisei et al.



Fig. 1. A social wasp, *Synoeca cyanea* (F.), apparently hunting larvae of *Zaprinus indianus* (Gupta) in fruits of Spanish prune (*Spondias purpurea*, Anacardiaceae).

(2005) reported that this species presents intense activity, with an average of 76 sorties and returns per h, and Elisei et al. (2010) verified that this wasp species is capable of carrying a load that corresponds to 10% of its body weight.

Sometimes the interactions between social wasps and fruit are not harmonious. De Souza et al. (2010) reported that *S. cyanea* is capable of breaking the skin of jaboticaba fruits (*Myrciaria* sp.; Myrtales: Myrtaceae), which entails a loss, since the damaged fruit rots and loses its commercial value. In another study, Brugger et al. (2011) verified that the same wasp species also damages *Psidium* sp. fruits. In both cases, the authors believe that this action of wasps on fruits is the result of depletion of natural resources in their environment, which forces individuals to forage on alternative resources.

This intense foraging activity of *S. cyanea* associated with predation and its broad distribution throughout Brazil qualifies it as an interesting natural enemy of larvae of *Z. indianus*, and also as a prospective candidate for use in integrated pest management programs against dipteran pests of fruit crops.

SUMMARY

This study is the first record of predation of *Zaprinus indianus* (Gupta) (Drosophilidae) fig fly larvae—which has recently become a major pest in fruit production in Brazil—by the social wasp *Synoeca cyanea* (F.) (Hymenoptera: Vespidae) in fruits of Spanish prune (*Spondias purpurea* L. Anacardiaceae) in an agricultural property, at Piracicaba city, São Paulo State, Brazil.

Key Words: fruit fly, natural enemy, biological control, exotic pest

RESUMO

Este estudo é o primeiro registro da predação de larvas da mosca do figo *Zaprinus indianus*(Gupta) (Drosophilidae)—que tem se tornado recentemente uma das principais pragas da produção de frutas no Brasil—pela vespa social *Synoeca cyanea* (F.) (Hymenoptera: Vespidae) em frutos de seriguela (*Spondias purpurea* L. Anacardiaceae) em uma propriedade agrícola, na cidade de Piracicaba, estado de São Paulo, Brasil.

Palavras Chave: mosca-das-frutas, inimigo natural, controle biológico, praga exótica

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