

***Eugenia stipitata* McVaugh (Myrtaceae): food resource for frugivorous flies in the state of Amapá, Brazil**

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Resumo

***Eugenia stipitata* McVaugh (Myrtaceae): recurso alimentar para moscas frugívoras no estado do Amapá, Brasil.** Este trabalho foi realizado com o intuito de avaliar a infestação de frutos de *Eugenia stipitata* McVaugh (Myrtaceae) por moscas frugívoras no estado do Amapá, Brasil. Exatamente 95% dos frutos verdes e maduros apresentaram infestação. Porém, a infestação (pupários/fruto) foi maior em frutos maduros que em frutos verdes. Foram obtidas quatro espécies de Tephritidae e quatro de Lonchaeidae. *Bactrocera carambolae* (Tephritidae) predominou em frutos maduros. Não houve diferença na infestação por *Anastrepha* spp. (Tephritidae) e *Neosilba* spp. (Lonchaeidae) entre frutos verdes e maduros.

Palavras-chave: Amazônia; *Anastrepha*; *Bactrocera carambolae*; *Neosilba*

Abstract

This work was carried out to evaluate the infestation of fruits of *Eugenia stipitata* McVaugh (Myrtaceae) by fruit flies in the state of Amapá, Brazil. There was 95% infestation of the green and ripe fruits. However, infestation (puparia/fruit) was higher in ripe fruits than green fruits. Four species of Tephritidae and four species of Lonchaeidae were obtained. *Bactrocera carambolae* (Tephritidae) predominated in ripe fruits. There was no difference in infestation by *Anastrepha* spp. (Tephritidae) and *Neosilba* spp. (Lonchaeidae) between green and ripe fruits.

Key words: Amazon; *Anastrepha*; *Bactrocera carambolae*; *Neosilba*

Eugenia stipitata McVaugh is a Myrtaceae plant native to the Peruvian Amazon, being found in the wild in practically the entire region (PINEDO et al., 1981). It is shrub-sized and quite branched and has dense foliage and dark-green coloration (FERREIRA; RIBEIRO, 2006). The small inflorescences have three to ten hermaphrodite flowers, with white petals and 75 to 100 stamens (McVAUGH, 1956). The fruit is a berry, which varies from 30 to 800 g (average weight of 200 g) and exudes a pleasant aroma when ripe, and the pericarp is yellow, velvety and fine. The pulp is juicy and used in the preparation of soft drinks, juices, jams, creams, jellies and sweets, where it is rarely eaten raw due to its acidity. The seeds are of variable size, with 3 to 20 per fruit (CALZADA, 1980; FALCÃO et al., 1988; CAVALCANTE, 1991).

Despite the economic potential of the species, commercial cultivation is still little explored due to the organoleptic characteristics of the fruits and production rates, a fact that can be attributed to the limited knowledge of fruit utilization and management techniques (FERREIRA; GENTIL, 1999).

There is little information in the literature on insects associated with *E. stipitata*. However, it is known that frugivorous flies (Diptera: Tephritidae and Lonchaeidae) often infest fruits of this species (LEMOS et al., 2015; ADAIME et al., 2016a). To date, three species of *Anastrepha* have been recorded infesting *E. stipitata* in Amapá: *Anastrepha fraterculus* (Wiedemann), *A. obliqua* (Macquart) and *A. striata* Schiner (ADAIME et al., 2016b). In addition, this plant species was recently reported to be a host of the carambola fruit fly (*Bactrocera carambolae* Drew & Hancock) for the first time in Brazil, in the state of Amapá (LEMOS et al., 2014). It is an exotic species that entered Brazil along the border with French Guiana in 1996. It is considered a quarantine pest in Brazil, with the potential to have a great socioeconomic and environmental impact if it spreads to other regions (SILVA et al., 2004). Currently, it is restricted to the states of Amapá and Roraima, under official surveillance through the National Carambola Fruit Fly Eradication Program (PNEMC) (GODOY et al., 2011; BRASIL, 2013). This work was carried out to evaluate the infestation of *E. stipitata* fruits (in two

stages of maturation) by frugivorous flies (Diptera: Tephritidae and Lonchaeidae).

The experimental area is located in the Matapi Agricultural Colony (00°36'13.8"N – 51°27'10.8"W), in the municipality of Porto Grande, state of Amapá, in the North region of Brazil. The rural property had approximately 1,200 *E. stipitata* plants (4 years old), maintained without any phytosanitary treatment. On June 8, 2013, 60 green fruits and 60 mature fruits were randomly collected from *E. stipitata*, directly from the plants. The stage of maturation of the fruits was determined visually, where green fruits had this color and were already developed in size and ripe fruits were completely yellow. The fruits were individually weighed and placed in plastic jars (14.0 cm in diameter x 9.5 cm in height) containing a thin layer of sterilized sand, covered with organza fabric and a vented lid. The fruits were transported to Macapá, where they were stored in an airy room at ambient temperature. Five green and five ripe fruits were randomly collected to measure sugar concentration (°Brix) with the aid of a portable digital refractometer.

The flasks containing the fruits were examined every seven days (for 28 days) for removal of the puparia. The puparia obtained from the same fruit were placed in the same plastic bottle (6.5 cm in diameter) containing a thin layer of moist vermiculite. The emerged adults were stored in 70% ethanol for later identification. The insects were identified on the basis of keys of Zucchi (2000), Strikis (2011) and Zucchi et al. (2011). The Tephritidae specimens were deposited at the Embrapa Amapá Plant Protection Laboratory and the Lonchaeidae were incorporated into the work collection of the taxonomist Dr. Pedro Carlos Strikis.

The non-parametric Mann-Whitney test ($\alpha = 0.05$) was used to evaluate the possible difference in fruit fly infestation between green and ripe fruits, carried out with the Bioestat 5.0 program (AYRES et al., 2007).

The weight of collected fruits totaled 8.06 kg for green fruits and 10.01 kg for ripe fruits. The sugar concentration (°Brix) was 3.76 for green fruits and 4.60 for ripe fruits. Infestation by fruit flies was 95% in the green and ripe fruits, resulting in 1,676 puparia. Infestation was higher in ripe fruits (16.89 puparia/fruit)

than in green fruits (12.51 puparia/fruit) [$Z(U)=1.9892$; $p=0.0467$]. We obtained 366 specimens of *Anastrepha*, 318 of *B. carambolae* and 162 of *Neosilba* (Table 1).

Bactrocera carambolae predominated in ripe fruits (Table 1). On average, more specimens of *B. carambolae* were obtained per ripe fruit (3.88) than per green fruit (1.70) [$Z(U)=2,2754$; $p=0.0229$]. Specimens of *B. carambolae* were obtained from 57.9% of the green fruits and 71.9% of the ripe fruits. This higher infestation in ripe fruits was possibly due to the fact that these fruits had been exposed for more time in the field, increasing the possibility of infestation. However, there is a need for preference studies of *B. carambolae* oviposition in the maturation stages of *E. stipitata* fruits to clarify this issue.

There was no difference in the infestation of green versus ripe fruits by *Anastrepha* spp. [$Z(U)=0.5504$; $p=0.5820$] (Table 1). The species obtained were *A. obliqua* (169), *A. fraterculus* (3♀) and *A. striata* (1♀)

(Table 2). Specimens of *Anastrepha* spp. were obtained from 78.9% of the green fruits and 75.4% of the ripe fruits. These species are polyphagous, with several known hosts in Brazil (ZUCCHI, 2008).

The predominance of *A. obliqua* was evident (Table 2). Although it is a polyphagous species, with a preference for Myrtaceae (ZUCCHI, 2008), its predominance can be explained by the fact that the *E. stipitata* orchard studied is surrounded by cultivated *Spondias mombin* L. (Anacardiaceae), a species designated as a preferred host of *A. obliqua* in Amapá (DEUS; ADAIME, 2013). At the date of collection of the fruits of *E. stipitata*, *S. mombin* were not in fruit. Thus, fruits of *E. stipitata* were available as alternative hosts for *A. obliqua*.

There was no difference in the infestation of green versus ripe fruits by *Neosilba* spp. [$Z(U)=1.7740$; $p=0.0761$] (Table 1). The species obtained were *Neosilba bella* Strikis & Prado, *N. glaberrima* (Wiedemann), *N.*

TABLE 1: Rates of infestation of *Eugenia stipitata* by frugivorous flies in Porto Grande, Amapá, Brazil (June, 2013).

Fruits	Puparia (n)	Infestation		<i>B. carambolae</i> (♀+♂)		<i>Anastrepha</i> spp. (♀+♂)		<i>Neosilba</i> spp. (♀+♂)	
		%IF*	puparia/fruit**	(n)	adults/fruit**	(n)	adults/fruit**	(n)	adults/fruit**
Green	713	95	12.51 ± 1.09 a	97	1.70 ± 0.38 a	195	3.42 ± 0.50 a	58	1.02 ± 0.25 a
Ripe	963	95	16.89 ± 1.70 b	221	3.88 ± 0.68 b	171	3.00 ± 0.47 a	104	1.82 ± 0.39 a

* % IF = percentage of infested fruits; ** Means followed by different letters in a column differ significantly by the Mann-Whitney test.

TABLE 2: Fruit fly species obtained from *Eugenia stipitata* in Porto Grande, Amapá, Brazil (June, 2013).

Fruits	Tephritidae	Lonchaeidae
Green	<i>Bactrocera carambolae</i> (97*)	<i>Neosilba bella</i> (8♂)
	<i>Anastrepha obliqua</i> (95♀)	<i>Neosilba zadolicha</i> (7♂)
	<i>Anastrepha fraterculus</i> (1♀)	<i>Neosilba glaberrima</i> (5♂)
	<i>Anastrepha striata</i> (1♀)	<i>Neosilba pseudozadolicha</i> (2♂)
	<i>Anastrepha</i> sp. (98♂)	<i>Neosilba</i> sp. (36♀)
Ripe	<i>Bactrocera carambolae</i> (221*)	<i>Neosilba zadolicha</i> (21♂)
	<i>Anastrepha obliqua</i> (74♀)	<i>Neosilba bella</i> (11♂)
	<i>Anastrepha fraterculus</i> (2♀)	<i>Neosilba glaberrima</i> (4♂)
	<i>Anastrepha</i> sp. (95♂)	<i>Neosilba</i> sp. (36♀)

*♀+♂

zadolicha McAlpine & Steyskal and *N. pseudozadolicha* Strikis (Table 2). Species of *Neosilba* spp. were obtained from 43.8% of the green fruits and 56.1% of the ripe fruits.

In comparing green and ripe fruits, it was found that *A. striata* and *N. pseudozadolicha* occurred only in green fruits and in reduced numbers (Table 2). However, this result contributes to the discussion of the fruit infestation process by Lonchaeidae, since fruits infested exclusively by *N. pseudozadolicha* were found, demonstrating the ability of this species to oviposit on fruits without oviposition perforations made by tephritids. The status of Lonchaeidae species as agricultural pests was discussed by Santos et al. (2004). Recent research in the state of Amapá confirms that some species of this family are primary invaders of fruits (LEMOS et al., 2015; ALMEIDA et al., 2016; ADAIME et al., 2017).

Fruits infested only by *B. carambolae* corresponded to 10.5% of the green fruits and 8.8% of the ripe fruits. Fruits infested only by *Anastrepha* spp. corresponded to 22.8% of the green fruits and 12.3% of the ripe ones. Fruits infested only by Lonchaeidae corresponded to 3.5% of the green fruits and 1.7% of the ripe ones. On the other hand, 24.5% of the green fruits and 40.3% of the ripe fruits were infested simultaneously by *B. carambolae*, *Anastrepha* and *Neosilba*.

On the basis of the sampling of green and ripe fruits of *E. stipitata*, we conclude that: 1) this species is a good food resource for the larvae of frugivorous flies; 2) *B. carambolae* predominates in ripe fruits; 3) there is no difference in infestation by *Anastrepha* spp. and *Neosilba* spp. between green and ripe fruits; and 4) fruits are shared by *B. carambolae*, *Anastrepha* spp. and *Neosilba* spp. Also, considering the number of specimens of *B. carambolae*, *A. obliqua* and *N. zadolicha* obtained from green and mature fruits of *E. stipitata*, we suggest conducting further surveys to assess the potential damage from these species.

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