

Lonchaeidae (Diptera) species and their host plants in the Cerrado biome in the state of Piauí, Brazil

Espécies de Lonchaeidae (Diptera) e seus hospedeiros no bioma Cerrado no estado do Piauí, Brasil

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ABSTRACT: Some species of Lonchaeidae (Diptera) are considered frugivorous and polyphagous pests, and are widely distributed in Neotropical regions. The relationship between a fly and its host plant is important for studies on behavior and distribution of frugivorous flies. The objective of this work was to identify the Lonchaeidae fly species and their host plants in the Cerrado biome, specifically in the state of Piauí, Brazil. Eighty-one adults (33 ♀ and 48 ♂) from the genus *Neosilba* McAlpine (Lonchaeidae), represented by the species *Neosilba inesperata* Strikis & Prado, *Neosilba pendula* Bezzi, and *Neosilba zadolicha* McAlpine, were collected from fruit samples. Oranges [*Citrus sinensis* (L.) Osbeck] and guava (*Psidium guajava* L.) had the highest frequencies of infestation. A *Neosilba* species was considered a primary invader in orange. These results are the first ones reported of Lonchaeidae species and their host plants in the state of Piauí.

KEYWORDS: *Neosilba*; host fruits; *Citrus sinensis*; primary invader.

RESUMO: Algumas espécies de Lonchaeidae (Diptera) são consideradas pragas frugívoras e polífagas, com ampla distribuição geográfica em regiões neotropicais. A relação mosca/planta hospedeira é de grande valor para estudos de comportamento e distribuição de moscas frugívoras. O objetivo deste trabalho foi identificar as espécies de Lonchaeidae e suas plantas hospedeiras no bioma Cerrado, especificamente no estado do Piauí, Brasil. Oitenta e um adultos (33 ♀ e 48 ♂) do gênero *Neosilba* McAlpine (Lonchaeidae), pertencentes às espécies *Neosilba inesperata* Strikis & Prado, *Neosilba pendula* Bezzi e *Neosilba zadolicha* McAlpine, foram coletados de amostras de frutas, sendo a laranja [*Citrus sinensis* (L.) Osbeck] e a goiaba (*Psidium guajava* L.) as de maiores frequências de infestação. Uma espécie de *Neosilba* foi considerada um invasor primário em laranjas. Esses resultados são os primeiros relatos de espécies de Lonchaeidae e suas plantas hospedeiras no estado do Piauí.

PALAVRAS-CHAVE: *Neosilba*; frutos hospedeiros; *Citrus sinensis*; invasor primário.

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Received on: 03/06/2018. Accepted on: 07/29/2019

Family Lonchaeidae (Diptera) is composed of a group of black flies with metallic glows. They are between 3 and 6 mm long and are mainly found in the Neotropical region. Lonchaeidae develop in flowers, fruits, seeds, cacti and decomposing organic matter during immature stages (MCALPINE, 1961). The genera *Dasiops* Rondani has 128 species, and *Neosilba* McAlpine has 40 species (EDIT, 2013). *Dasiops* and *Neosilba* are the most economically important genera, including frugivorous and polyphagous species (STRIKIS et al., 2011).

The first studies on Lonchaeidae described its species as secondary pests due to their attack on already infested fruits by Tephritidae (STRIKIS; PRADO, 2005). However, new studies characterize some of these species as primary, polyphagous, and economically important pests for fruit crops (UCHÔA-FERNANDES et al., 2002; RAGA et al., 2015; RIQUELME et al., 2015).

Studies in Brazil report the use of McPhail traps with food bait to evaluate the presence of Lonchaeidae in the states of São Paulo (RAGA et al., 2006), Mato Grosso do Sul (UCHÔA-FERNANDES et al., 2003) and Tocantins (BOMFIM et al., 2007). In addition, there are reports of infestations in barbados cherry (*Malpighia emarginata* Sessé & Moc. Ex DC), in Rio Grande do Norte (ARAÚJO; ZUCCHI, 2002); guava (*Psidium guajava* L.), loquat [*Eriobotrya japonica* (Thunb.) Lindl.], peach [*Prunus persica* (L.) Batsch] (SOUZA FILHO et al., 2009), and coffee (*Coffea arabica* L.), in São Paulo (RAGA et al., 1996); orange [*Citrus sinensis* (L.) Osbeck], in Rio de Janeiro (SOUZA et al., 2008); tangerine (*Citrus reticulata* Blanco), in Paraíba (LOPES et al., 2007); and in several fruits collected in Acre, Amapá, Pará, Rondônia, and Roraima (SILVA et al., 2011).

Some species of Lonchaeidae are frugivorous and polyphagous pests and are widely distributed throughout Brazil. Information on the relationship between flies and their host plants is important to study spatial distribution of frugivorous flies and their use of host plants. These studies allow us to know the behavior of these insect pests in Brazil's atypical environments, such as the Cerrado biome, in the state of Piauí, and the Lonchaeidae's potential to be a primary invader of fruits in these environments.

Therefore, our goals were to identify the Lonchaeidae fly species and their host plants in the state of Piauí, located in the Cerrado biome, and to assess if these insects are primary invaders of fruits in this region.

Fruit samples were collected in the municipality of Corrente based on the availability in rural and urban areas and were separated by species. Then, they were counted, weighed, and placed in plastic trays (36 × 27 × 12 cm) containing sterilized sand. Thereafter, they were labeled and covered with cotton cloth fixed with rubber band. The pupae were sieved and separated every seven days and were placed in 500-mL-glass pots containing moistened sand, which were sealed with cotton cloth fixed with rubber band. The adults were killed by

freezing at -11°C, and then transferred to labeled vials with alcohol 70%. The infestation index and infestation frequency were evaluated to establish the status of the host plant in relation to its susceptibility to attack by frugivorous Lonchaeidae.

The infestation index used was the number of pupae divided by the number of fruit and the number of pupae divided by the fruit's weight (kg). The infestation frequency used was the number of infested fruit samples divided by the total of samples of each species multiplied by 100 and the number of flies of a species divided by the total number of flies multiplied by 100 (SOUZA FILHO et al., 2000; ARAÚJO et al., 2005).

A total of 2,966 fruits from 22 species and 14 botanical families were collected. Eighty-one flies from the genus *Neosilba* (Lonchaeidae) were collected in these fruits (33 females and 48 males). The *Neosilba* species collected were: *N. inesperata* Strikis & Prado (2009), *N. pendula* Bezzi (1919) and *N. zadolicha* McAlpine (1982). These species are widely distributed in Brazil as they have been found in fruit in several Brazilian states (CAIRES et al., 2009; DIAS et al., 2012; LEMOS et al., 2015; RAGA et al., 2015; SOUZA et al., 2008; STRIKIS et al., 2011).

The highest frequencies of infestation by flies were in the Rutaceae (45%), Anacardiaceae (19%) and Myrtaceae (17%) families, followed by Malpighiaceae (7%), Rubiaceae (7%) and Annonaceae (5%). Although some species of Lonchaeidae are polyphagous (LEMOS et al., 2015; RAGA et al., 2015), these flies are ovipositors, and prefer to lay eggs in species of Rutaceae. The frequency of the Lonchaeidae infestation in some varieties of *Citrus* is higher than the Tephritidae species (RAGA et al., 2004; UCHÔA; NICÁCIO, 2010). The *Neosilba* species have predominance in oranges and tangerines than the other frugivorous flies (UCHÔA-FERNANDES et al., 2002).

Neosilba species were collected from 10 fruit species from seven botanical families in the Cerrado biome of Piauí. *Neosilba* flies were related to native fruit species and fruit species that were introduced to the Cerrado biome, infesting 22 of them (UCHÔA-FERNANDES et al., 2002); and in the Semi-Arid region, infesting eight of these species (ARAÚJO; ZUCCHI, 2002).

The low number of hosts found in the Semi-Arid region by these authors, and in the Cerrado biome of Piauí in the present work, is possibly due to the low availability of fleshy fruits, which are potential hosts of frugivorous flies (ARAÚJO; ZUCCHI, 2002).

Oranges had the largest number of adult Lonchaeidae (Table 1). Several fruit flies use oranges as hosts, such as the *Anastrepha* Schiner, *Ceratitidis capitata* (Wiedemann, 1824) and *Neosilba* spp. (SOUZA et al., 2008). Moreover, *N. zadolicha* collected in orange samples was the only fruit fly considered a primary invader of oranges in the Cerrado biome of Piauí.

Neosilba zadolicha was the most common and polyphagous fly species. It was found in six species of five plant families.

This fly species has the widest geographical distribution and host diversity in Brazil and is considered an important fruit pest grown in the Northeast and Southeast regions of the country (LOPES et al., 2007; RAGA et al., 2015).

However, *N. inesperata* and *N. pendula* did not show signs of polyphagia in the Cerrado biome, specifically in the state of Piauí. These species were considered polyphagous in the state of São Paulo, with infestations of 37 (*N. inesperata*) and 21 (*N. pendula*) botanical species (RAGA et al., 2015). Moreover, *N. pendula* was considered an important primary invader of barbados cherry in the Semi-Arid region (ARAÚJO; ZUCCHI, 2002). Although the Semi-Arid region and the Cerrado biome in the state of Piauí present similar environmental conditions,

N. pendula was not considered a primary invader of the fruit species in Piauí.

Fly species of the Lonchaeidae family infests native fruit species and fruit species that were introduced to the Cerrado biome in the state of Piauí, especially typical fruit species that are commonly found in this region, such as those from the genus *Spondias*.

Orange is an economic important fruit and the most produced in Brazil. This fruit is not cultivated commercially in the southern Piauí. However, the occurrence of infestation by *N. zadolicha*, considered a primary invader of this fruit in this region, is an important factor for the commercial production of oranges.

Table 1. Lonchaeidae species and their host plants in the Cerrado biome in the state of Piauí, Brazil.

Plant Family	Plant Species	Origin	Total samples	Fruit		Collected flies			Neosilba species found	Infestation index	
				Number	Weight (kg)	Total	♂	♀		Pupae per fruit	Pupae per kg
Anacardiaceae	<i>Anacardium occidentale</i> L.	N	2	6	0.40	-	-	-	-	-	-
	<i>Mangifera indica</i> L.	I	2	18	7.52	2	1	1	<i>N. zadolicha</i>	0.555	0.13
	<i>Spondias dulcis</i> Parkinson	I	2	57	2.48	1	1	-	<i>N. inesperata</i>	0.010	0.40
	<i>Spondias purpurea</i> L.	I	3	134	1.28	7	4	3	<i>N. pendula</i>	0.022	2.34
	<i>Spondias tuberosa</i> Arruda	N	8	359	4.97	5	3	2	<i>N. zadolicha</i>	0.008	0.60
Annonaceae	<i>Annona squamosa</i> L.	I	5	26	4.05	5	2	3	<i>N. zadolicha</i>	0.077	0.49
Caricaceae	<i>Carica papaya</i> L.	I	2	3	3.81	-	-	-	-	-	-
Cucurbitaceae	<i>Cucurbita moschata</i> (Dusc.) Poir	I	3	6	6.56	-	-	-	-	-	-
Lythraceae	<i>Punica granatum</i> L.	I	1	1	0.15	-	-	-	-	-	-
Malpighiaceae	<i>Malpighia emarginata</i> Sessé & Moc. Ex DC	I	9	955	6.02	3	3	-	<i>N. pendula</i>	0.003	0.49
Myrtaceae	<i>Psidium guajava</i> L.	N	12	415	18.59	12	7	5	<i>N. pendula</i> <i>N. zadolicha</i>	0.002 0.014	0.05 0.32
	<i>Psidium cattleianum</i> Sabine	N	5	747	6.07	-	-	-	-	-	-
Musaceae	<i>Musa × paradisiaca</i> L.	I	2	17	0.73	1	-	1	<i>Neosilba</i> spp.	0.060	1.36
Oxalidaceae	<i>Averrhoa carambola</i> L.	I	2	64	1.84	-	-	-	-	-	-
Passifloraceae	<i>Passiflora edulis</i> Sims	N	2	9	0.75	-	-	-	-	-	-
Rosaceae	<i>Malus domestica</i> Borkh	I	2	5	0.65	-	-	-	-	-	-
Rubiaceae	<i>Duroia valesca</i> C. H. Perss. & Delprete	N	1	30	1.05	-	-	-	-	-	-
	<i>Genipa americana</i> L.	N	1	3	0.17	3	3	-	<i>N. zadolicha</i>	1.000	17.64
	<i>Morinda citrifolia</i> L.	I	2	16	1.30	-	-	-	-	-	-
Rutaceae	<i>Citrus limonia</i> Osbeck	I	3	72	1.82	-	-	-	-	-	-
	<i>Citrus sinensis</i> (L.) Osbeck	I	6	20	4.51	42	24	18	<i>N. zadolicha</i>	0.950	4.21
Solanaceae	<i>Solanum lycopersicum</i> L.	N	1	3	0.14	-	-	-	-	-	-
Total			76	2,966	73.02	81	48	33			

N: native; I: introduced.

ACKNOWLEDGEMENTS

The authors thank the professor Laura Jane Gisloti, of the Indigenous Intercultural Faculty (Universidade Federal da Grande Dourados, Mato Grosso do Sul, Brazil) for the identification of

the insects of the family Lonchaeidae. To the teacher Dr. Adalton Raga (Instituto Biológico, São Paulo, Brazil) for the suggestions in scientific writing. The Universidade Estadual do Piauí, *Campus Corrente* (UESPI, Piauí, Brazil), for making available the Zoology Laboratory for field material screening.

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