Lance flies associated with sweet passion fruit and contributions to the knowledge on Lonchaeidae in Peru

Moscas-lança associadas ao maracujá-doce e contribuições para o conhecimento de Lonchaeidae no Peru

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ABSTRACT: The Lonchaeidae family comprises species that are considered of major economic importance due to their damage in several crops. In sweet passion fruit (Passiflora ligularis Juss), these flies cause high infestation in flower buds and fruits, however only a few basic studies about the species associated with the damage are available. Samples of flower buds and fruits were taken and McPhail trap baits with Torula yeast were placed in sweet passion fruit orchards in Oxapampa (Pasco, Peru) in 2015–2016. In addition, other hosts were collected in this period. We found Dasiops inedulis Steykal infesting the flower buds, while Dasiops frieseni Norrbom & McAlpine infesting sweet passion fruits. Moreover, other Lonchaeidae-hosts interactions are related. Through Torula yeast baits, 14 species of lance flies were detected and high numbers of D. inedulis specimens were captured.

KEYWORDS: Dasiops inedulis; Dasiops frieseni; Torula yeast; hosts; Passiflora ligularis.

RESUMO: A família Lonchaeidae inclui espécies que são consideradas de grande importância econômica devido aos seus danos em diferentes cultivos. No maracujá-doce (Passiflora ligularis Juss), essas moscas causam altas infestações em botões florais e frutos, tendo ainda poucos estudos sobre as espécies associadas aos danos. Amostragem de botões florais e frutos foram realizadas em fazendas de maracujá em Oxapampa (Pasco, Peru) durante os anos de 2015 e 2016. Além disso, outros hospedeiros foram coletados nesse período. Nós encontramos Dasiops inedulis Steykal infestando botões florais e Dasiops frieseni Norrbom & McAlpine em frutos de maracujá-doce. Além disso, outras interações Lonchaeidae-hospedeiro são relacionadas. Mediante iscas de levedura de Torula, 14 espécies de Lonchaeidae foram detectadas e altos números de D. inedulis foram capturados.

PALAVRAS-CHAVE: Dasiops inedulis; Dasiops frieseni; levedura de Torula; hospedeiros; Passiflora ligularis.
Lance flies are insects belonging to the family Lonchaeidae (Diptera: Tephritoidea) that in Neotropical region are represented by the genera Dasiops Rondani, Neosilba McAlpine, and Lonchaea Fallén. Although this family has been considered of secondary importance (KORYTKOWSKI; OJEDA, 1971), in the last decades, various species are reported as of economic importance due to the damage produced in fruits, flowers and fruit buds (ADAIMÉ et al., 2012; SALAZAR-MENDEZA; ROMERO-RIVAS, 2016; DOS SANTOS et al., 2017). Moreover, they are being considered as key pest in several crops (ARAÚJO; ZUCCHI, 2002; DELGADO et al., 2010; QUINTERO et al., 2012). Nevertheless, there are still little knowledge about the taxonomic position of the species associated with damages and about the existent trophic relationships, hindering biological and ecological studies with the aim to manage these flies.

Among the studies that sought to know the relationship between Passifloraceae and Lonchaeidae, STEYSKAL (1980) recorded for the first time flies of the genus Dasiops attacking species of Passifloraceae. Posteriorly, D. curubae was suggested to be used in the control of P. mollisima in Hawaii (CAUSTON et al., 2000). Henceforth, many species of this genus has been associated to damages in several Passifloraceae grown in South America.

Sweet passion fruit (Passiflora ligularis Juss) is a fruit original of Tropical America, cultivated in altitude of 1,700 – 2,500 masl (DELGADO et al., 2008). In the last decade, this crop has had a great growth in cultivated area turning Oxpampa city (Pasco region) into the first in this ranking in Peru (MENDIETA, 2015). Despite that growth in cultivated area, still few basic studies have been carried out about the species of Lonchaeidae associated with the damage in flower buds and fruits that frequently cause great economic losses with infestation levels up to 80 – 100% (CARRERO et al., 2013). Meanwhile, D. frieseni was associated with damage in fruits of the same botanical family (AGUIAR-MENEZES, 2004; RAGA et al., 2015), however it is for the first time associated to P. ligularis.

Field studies were conducted at six locations within sweet passion fruit orchards (2 – 5 years old and 1 ± 2 ha): Lanturachi (10°23′09″S 75°34′27″W, 1,862 masl), San Martin (10°35′46″S 75°29′03″W, 1,933 masl), La Florida (10°36′30″S 75°29′34″W, 1,982 masl), Torrebamba (10°22′26″S 75°34′43″W, 2,133 masl), Milpo (10°22′24″S 75°34′57″W, 2,140 masl), and Santa Bárbara 4 (10°22′12″S 75°35′10″W, 2,227 masl) within the province of Oxpampa (Pasco, Peru), from September 2015 to August 2016. In each orchard, we collected 50 samples of flower buds (ten flower buds per sampling, totaling 500 buds comprising 5.1 kg) and 25 samples of immature fruits (five fruits per sampling, totaling 125 buds comprising 9.35 kg) of sweet passion fruit. Additionally, other hosts that grew in the orchard were collected: 10 samples of sweet lemon Citrus limon L. (five fruits per sampling, totaling 50 comprising 4.5 kg), 15 samples of rocoto pepper Capsicum pubescens R. & P. (four fruits per sampling, totaling 60 comprising 3.1 kg), and 10 samples of stuffing cucumber Cyclanthera pedata Schraban (four fruits per sampling, totaling 40 comprising 3.6 kg). The samples collected were taken to the laboratory of the Universidad Nacional Daniel Alcides Carrión (UNDAC), where they were weighed and placed for 48 – 72 h in plastic cups (flower buds) or technopor boxes (fruits) to allow larval development and pupal stage formation. Subsequently, the fruits and flower buds were dissected, the larvae and pupae were transferred to other plastic cups kept at 22°C, 70% RH, and 12:12 L:D until adult emergence.

Furthermore, from May to August of 2016, one McPhail trap with Torula yeast as bait (5 pallets/250 mL water) was placed in each orchard. Traps were placed in the same height of the fruits and floral buds. After seven days, the flies inside the traps were removed and the bait replaced. The adults were preserved in 70% ethanol for further identification. The numbers of Lonchaeidae trapped and those that emerged from the sampled were identified at species level using a stereomicroscope and biological microscope (MCALPINE; STEYSKAL, 1982; NORRBOM; McALPINE, 1997). Voucher specimens were deposited in the personal collection of P.C. Striks and the entomological collection of the UNDAC filial Oxpampa.

Two species of genus Dasiops were associated to the damage to sweet passion fruit. Dasiops inedulis Steyskal (429 specimens) occasioned the ovarian rot and subsequent fall of flower buds and Dasiops frieseni Norrbom & McAlpine (81 specimens) the wrinkling of immature fruits. The species D. inedulis is known as the bud flower fly because it feeds from tissues in the inside of the floral buds of various species of Passifloraceae (AGUIAR-MENEZES, 2004; LUNZ et al., 2006; STRIKIS et al., 2011; SANTOS et al., 2017) including sweet passion fruit in Colombia (AMAYA et al., 2009; CARRERO et al., 2013). Meanwhile, D. frieseni was associated with damage in fruits of the same botanical family (AGUIAR-MENEZES, 2004; RAGA et al., 2015), however it is for the first time associated to P. ligularis. Other bi-trophic relationships between Neosilba zadolicha McAlpine & Steyskal (12) in sweet lemon, Neosilba certa (Walker) (7) in rocoto pepper, and Neosilba pseudopendula Korytkowski & Ojeda (10) in stuffing cucumber were found. The genus Neosilba is the most studied of the Lonchaeidae and includes 40 species (GISLOTI et al., 2017). Neosilba zadolicha, which was considered a primary pest of commercial Citrus reticulata orchards in Paraíba, Northwest of Brazil (LOPES et al., 2008), is highlighted and is of great economic importance in South America due to the damage it causes in cultivated fruits and vegetables (NICÁCIO; UCHOA, 2011). Meanwhile, N. certa was associated with family host Myrtaceae, Annacardiaceae, Malpighiaceae (SANTOS et al., 2017), Rubiaceae, Rosaceae (STRIKIS; PRADO, 2009), and Fabaceae (GISLOTI et al., 2017). N. pseudopendula was associated to Coffea arabica L. (SOUZA et al., 2005). GISLOTI et al. (2017) cite that Neosilba obtain food resources from a wide
range of hosts belonging to 39 families, and this list includes Rutaceae, Solanaceae, and Cucurbitaceae, whose species were approached in our study. Nevertheless, very little is known about bi-trophic relations existing between *Neosilba* and hosts cultivated in Andean regions (>1,800 masl).

McPhail traps baited with Torula yeast captured 8,209 species of Lonchaeidae containing the three genera related for Neotropical regions. Except for *N. certa*, this lure was efficient to catch species associated with damage in the different host and could be used as a tool for studies regarding the diversity of these species. Other species captured with Torula yeast were: *Dasiops rugifrons* (Hennig 1948), *Dasiops plasmanni* McAlpine 1964, *Dasiops luzestellae* Castro, Korytkowski, Ebratt & Brochero, 2013, *Neosilba pendula* (Bezzi 1919), *Neosilba glaberrima* (Wiedemann 1830), *Neosilba plana* Galeano-Olaya & Canal 2012, *Neosilba amphora* Galeano-Olaya & Canal, *Neosilba* sp, and *Lonchaeua* sp.

KORYTKOWSKI; OJEDA (1971) did a review of the systematic of the species Lonchaeidae from Peru, mainly collected in McPhail traps in the Northern of the country between 1967-1970; since then, there have been no documented studies on these species in Peru. Nevertheless, the amount of lance flies species found in traps were different. In all weeks evaluated, *D. inedulis* was the most captured species (Fig. 1) with a mean of 87.9% of the total captures, 4.5% of *D. frieseni*, and 7.7% of other species this family, showing the potential of this substance as attractive to *D. inedulis*. IMBACHI et al. (2012) showed that the hydrolyzed proteins tested captured highest number of Lonchaeidae, but very few specimens of *Dasisps saltans* Townsend, the specie associated with damage to floral buds in yellow pitaya (Cactaceae). CARRERO et al. (2013) reported low capture of adult *D. inedulis*, with a maximum of 35 specimens captured with McPhail traps with bait made of hydrolyzed protein over a 15-day period. Meanwhile, SALAZAR-MENDOZA; ROMERO-RIVAS (2016) showed the efficacy of attractiveness of hydrolyzed proteins just to flies of genera *Dasiops* in sweet passion fruit. Currently, there are no baits available for *D. inedulis*, as there are lures based on protein hydrolysates employed to capture fruit flies (UCHOA, 2012). Thus, the use of Torula yeast as food bait may become an important tool in monitoring adult lance flies of some species of genus *Dasiops*, which have a great economic importance.

ACKNOWLEDGMENTS

The authors are grateful to National Agrarian Health Service (SENASA) for the logistical support, and the sweet passion fruit growers who allowed us access to their orchards.

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