SCIENTIFIC NOTE

Diversity of Fly Species (Diptera: Tephritoidea) from *Passiflora* spp. and Their Hymenopterous Parasitoids in Two Municipalities of the Southeastern Brazil

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Diversidade de Espécies de Moscas (Diptera: Tephritoidea) em *Passiflora* spp. e Seus Parasitóides (Hymenoptera) em Dois Municípios do Sudeste do Brasil

RESUMO - Este trabalho avaliou a infestação de duas espécies de maracujá por tefritídeos e lonqueídeos em dois municípios produtores do Sudeste do Brasil. Botões florais de maracujá doce (*Passiflora alata*) e maracujá azedo (*Passiflora edulis* f. *flavicarpa*) foram coletados em Seropédica (RJ) e Vila Valério (ES), respectivamente. Frutos de *P. alata* foram também coletados em Seropédica. Três espécies de Lonchaeidae foram obtidas de botões florais de *P. alata* (*Neosilba zadolicha* McAlpine & Steyskal, *Neosilba* sp. e *Dasiops longulus* Norrbom & McAlpine), e espécies de quatro gêneros de Tephritoidea foram obtidas de frutos: *Anastrepha pseudoparallela* Loew (Tephritidae), *Dasiops frieseni* Norrbom & McAlpine (Lonchaeidae), *Euxesta* sp. e *Notogramma cimiciforme* Loew (Otitidae). Exemplares de *Ganaspis* sp. (Figitidae: Eucoilinae) foram obtidos de alguns frutos de maracujá doce infestados por tefritídeos ou lonqueídeos. Dos botões florais de maracujá azedo, foram obtidos apenas espécimes de *Dasiops inedulis* Steyskal (Lonchaeidae). Parasitóides do gênero *Opius* Wesmael (Braconidae: Opiinae) foram também coletados associados a essa espécie de mosca.

PALAVRAS-CHAVE: Insecta, Tephritidae, Lonchaeidae, Otitidae, maracujá

ABSTRACT - This paper evaluated the infestation of two passion fruit species by tephritids and lonchaeids in two municipalities of southeastern Brazil. Floral buds of sweet passion fruit (*Passiflora alata*) and yellow passion fruit (*Passiflora edulis* f. *flavicarpa*) were collected in Seropédica (RJ) and Vila Valério (ES), respectively. Fruits of *P. alata* were also collected in Seropédica. Three species of Lonchaeidae were obtained from floral buds of *P. alata* (*Neosilba zadolicha* McAlpine & Steyskal, *Neosilba* sp. and *Dasiops longulus* Norrbom & McAlpine), and species of four genera of Tephritoidea were obtained from fruits: *Anastrepha pseudoparallela* Loew (Tephritidae), *Dasiops frieseni* Norrbom & McAlpine (Lonchaeidae), *Euxesta* sp. and *Notogramma cimiciforme* Loew (Otitidae). Specimens of *Ganaspis* sp. (Figitidae: Eucoilinae) were recovered from some sweet passion fruits infested by tephritids or lonchaeids. Only specimens of *Dasiops inedulis* Steyskal (Lonchaeidae) were obtained from floral buds of yellow passion fruit. Parasitoids belonging to the genus *Opius* Wesmael (Braconidae: Opiinae) were also collected in association with this fly species.

KEY WORDS: Insecta, Tephritidae, Lonchaeidae, Otitidae, passion fruit

The majority of *Passiflora* species are indigenous to the tropical and subtropical regions of South America, including Brazil (Cunha 1996). Of the 400 known species of *Passiflora,* about 50 and 60 bear edible fruits. A few species are economically important such as *Passiflora edulis* f. *flavicarpa* Deneger (yellow passion fruit), *Passiflora edulis* Sims. (purple passion fruit) and *Passiflora alata* Dryand (sweet passion fruit), which are the main species cultivated in the world (Martin & Nakasone 1994). Several species of insects were listed as passion fruit pests around the world; the flies belonging to the superfamily Tephritoidea are major pests of this fruit crop. Some fly species feed on floral buds of *Passiflora* spp., and other infest the fruits (Aguiar-Menezes *et al.* 2002).

In Brazil, three genera of flies that damage fruits of *Passiflora* spp. are commonly reported: *Anastrepha* Schiner (Tephritidae), *Lonchea* Fallén and *Dasiops* Rondani (Lonchaeidae). *Neosilba pendula* (Bezzi) and *Dasiops* spp.

(Lonchaeidae) are the most common species attacking floral buds of passion fruits (Santos & Costa 1983, Teixeira 1994, Fancelli & Mesquita 1998, Zucchi 2000, Aguiar-Menezes *et al.* 2002).

In the southeastern Brazil, at least in the states of Rio de Janeiro and Espírito Santo, commercial production of passion fruits is currently increasing due to the incentives of governmental programs. According to IBGE (2001), the area under cultivation with passion fruit increased from 936 ha and 671 ha in 1998 to 1,306 ha and 1,502 ha in 2002, respectively. However, the establishment and expansion of this fruit crop have been hindered by pest problem. In this context, the objective of this study was to survey the diversity of tephritid and lonchaeid species attacking *Passiflora* spp. in two producer municipalities of these states: Seropédica (RJ) and Vila Valério (ES).

Samplings were carried out on a vine of sweet passion fruit (*P. alata*) in the campus of the Universidade Federal Rural do Rio de Janeiro (UFRuralRJ) in Seropédica (22º 46' S, 43º 41' W and 33 m), and in a property that cultivates yellow passion fruit (*P. edulis* f. *flavicarpa*) for commercial propose in Vila Valério (18º 59' S, 40º 23' W and 140 m). Floral buds, that dropped prematurely were collected from the ground in July 2000 in Seropédica (150 buds of *P. alata*) and in October 2000 in Vila Valério (150 buds of *P. edulis*). In the laboratory of the UFRuralRJ the buds were placed individually in 250-ml transparent plastic cups with a 2-cm layer of slightly moistened sand and screened lids to hold the flies and parasitoids after emergence. The cups were kept at room-environmental conditions and inspected every day to ascertain if the sand needed to be remoistened and to check for adult emergence. The adults were killed and preserved in 70% ethanol for further identification.

In October 2000, we collected a sample of 300 immature green fruits of *P. alata* (10.7 kg) that showed wrinkling and breakdown in Seropédica. One-hundred and fifty fruits were immediately transferred to the laboratory, whereas 150 remained in the field and were divided into 15 batches of 10 fruits each. Each batch was placed on a 2-cm layer of slightly moistened sand inside a 40 cm x 30 cm x 6 cm tray. The trays were placed at ground level under canopies. The fruits stayed in the field for 15 days in order to get puparia of frugivorous flies. Afterwards the fruits were dissected in the laboratory and the sand were sifted to remove larvae and/or puparia, which were counted and transferred into 250-ml transparent cups with a 2-cm layer of slightly moistened sand and screened lids to hold the flies and parasitoids after emergence. The 150 fruits that were taken directly to the laboratory were weight and kept individually in 600-ml transparent plastic cups partially filled with a 3-cm layer of damp sand used as pupation substrate, and covered with organdy screen. The cups were kept at room-environmental conditions and inspected every day to ascertain if the sand needed to be remoistened and to check for adult emergence. The adults were killed and preserved in 70% ethanol for further identification.

Tephritidae specimens were identified based on taxonomic key (Zucchi 2000). Braconidae and Lonchaeidae specimens were sent to the Systematic Entomology Laboratory (USDA-ARS, Betsville, MD, USA), and Eucoilinae specimens were sent to Jorge A. Guimarães (Escola Superior de Agricultura Luiz de Queiróz, Piracicaba, state of São Paulo, Brazil) for identification. Voucher specimens of flies and their parasitoids were placed in the entomological collection of the UFRuralRJ and the U.S. National Collection.

The index of infestation was estimated by means of the total number of puparia recovered per fruit. Pupal viability was calculated based on the percentage of puparia that resulted in fly emergence. The puparia that did not result in emergence of adults 30 days after pupation were sifted from the sand, counted and dissected to verify if the death was caused by parasitism. Percent parasitism was defined as the number of parasitized pupae divided by the sum of parasitized pupae and unparasitized pupae.

Five genera of Tephritoidea were associated to the genus *Passiflora*: *Anastrepha* (Tephritidae), *Dasiops, Neosilba* (both Lonchaeidae), *Euxesta* and *Notogramma* (both Otitidae).

Floral buds of *P. alata* collected from Seropédica were infested by three species of Lonchaeidae: *Neosilba zadolicha* McAlpine & Steyskal, *Neosilba* n. sp. near *batesi* Curran, and *Dasiops longulus* Norrbom & McAlpine (Table 1). *N. zadolicha* was the most common species, representing 65.0% of all Lonchaeidae obtained from this host. These lonchaeids caused a mean infestation index of 2.1 puparia/bud, ranging from one to five puparia/bud. *N. zadolicha* has been reared from fruits of several plants. Most *Neosilba* spp. are reported as secondary invaders of plant tissues damaged by other insects or otherwise injured (McAlpine & Steykal 1982). Uchôa-Fernandes *et al.* (2002) reported infestation by *N. zadolicha* in fruits of a wild species of *Passiflora*. *D. longulus*

Table 1. Fly species (Lonchaeidae) reared from floral buds of *Passiflora* spp. and their parasitoids, indices of infestation, pupal viability and percent parasitism in Seropédica (RJ) and Vila Valério (ES) in July and October 2000, respectively.

Host species (n)	Collecting sites	Fly species (n)	Infestation index (mean nº of puparia/bud)	Pupal viability (%)	Parasitoid species (n)	Parasitism (%)
P. alata (150)	Seropédica	*N. zadolicha* (82) *Neosilba* sp. (27) *D. longulus* (17)	2.1	42.5	—	—
P. edulis f. *flavicarpa* (150)	Vila Valério	*D. inedulis* (756)	6.0	86.1	*Opius* sp. (76)	8.6

(n) Number of samples

is a poorly known species, previously recorded from only two specimens reared from a *Passiflora* sp. in Brazil. This species is presumably a primary invader like its closest relatives within *Dasiops* (Norrbom & McAlpine 1997).

Only *Dasiops inedulis* Steyskal was identified from *P. edulis* f. *flavicarpa* floral buds collected in Vila Valério (Table 1), causing a high mean infestation index (6.0 puparia/bud, ranging from 1 to 15) and with high pupal viability (86.1%). Chacon & Rojas (1984) observed from one to three larvae per floral buds of *P. edulis* f. *flavicarpa* in the Cauca Valley (Colombia). According to Norrbom & McAlpine (1997), *D. inedulis* is a primary invader in *Passiflora* spp. flowers. Larvae of this species bore into the anthers and the ovary, and may cause intensive dropping of floral buds and young fruits (Peñaranda *et al.* 1986, Aguiar-Menezes *et al.* 2002). In Brazil, Uchôa-Fernandes *et al.* (2002) reported that *D. inedulis* fed in floral buds of a wild passion fruit, causing an infestation index of approximately 0.7 larvae of 3rd instar per fruit with only 9.6% of larval viability. *D. inedulis* was reported in Panama as a serious pest of purple granadilla, *P. edulis* (Steyskal 1980). This species has been implicated in 21-65% loss of floral buds of *P. edulis* f. *flavicarpa* collected in the Cauca Valley (Colombia) (Peñaranda *et al.* 1986). It is also considered an important pest of *P. edulis* and *P. quadrangularis* in the USA (Norrbom & McAlpine 1997). In Vila Valério, hymenopterous parasitoids belonging to *Opius* sp. (Braconidae: Opiinae) were also recovered from floral buds of *P. edulis* f. *flavicarpa* infested by *D. inedulis* and caused 8.6% of parasitism. In Colombia, Peñaranda *et al.* (1986) also reported *Opius* sp. as parasitoid of this fly species.

Anastrepha pseudoparallela Loew was the only species of Tephritidae obtained from immature fruits of *P. alata* in Seropédica (Table 2). Lonchaeids were also reared from this host, and all belonged to *Dasiops frieseni* Norrbom & McAlpine. Two species of Otitidae were also obtained: *Euxesta* sp. and *Notogramma cimiciforme* Loew, but they were not very abundant; the few specimens recovered represented only 3.4% of all flies recovered from *P. alata* fruits. The lonchaeids and tephritids were more abundant, accounting for 48.5% and 48.1% respectively of all flies recovered from this host. *D. frieseni* caused the highest mean infestation index (12.7 puparia/fruit, ranging from 1 to 98), but with pupal viability lower than *A. pseudoparallela* (59.1% and 72.2%, respectively). This tephritid species caused a mean infestation index of 9.6 puparia/fruit, ranging from 3 to 47. Specimens of the genus *Ganaspis* Foester (Figitidae: Eucoilinae) were obtained in association with these flies and caused, respectively, 12.2 and 9.3% of parasitism of all tephritid and lonchaeid puparia recovered from sweet passion fruits that remained in the field for 15 days after harvest.

A. pseudoparallela lays eggs in unripe fruits of *P. alata*, and the larvae develop by feeding on the seeds. Cyanogenic compounds are present in all parts of *Passiflora* plants, including seeds, and these glycosides protect the plant by preventing feeding by herbivore species; therefore, the use of these resources by *A. pseudoparallela* for larval development is probably associated with its ability to tolerate these chemical defenses and suggests a high degree of specialization (Stefani & Morgante 1996). *D. frieseni* was originally described based on specimens collected from the municipality of Teresópolis, RJ in 1939, and appear to be a primary invader in *Passiflora* spp. fruits (Norrbom & McAlpine 1997). *N. cimiciforme* presents a wide geographical distribution in the New World, and is a saprophagous species reported from a broad range of plants (Steyskal 1963). Uchôa-Fernandes *et al.* (2002) reported *N. cimiciforme* obtained from fruits of *P. edulis* and from wild passion fruit colleted in Aquidauana and Terenos in the state of Mato Grosso do Sul, Brazil.

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Table 2. Fly species reared from immature fruits of *P. alata* and their parasitoids, indices of infestation, pupal viability and percent parasitism in Seropédica, RJ.

Fly family and species (n)	Infestation index (mean nº of puparia/fruit)	Pupal viability (%)	Parasitoid species (n)	Parasitism (%)
Tephritidae *A. pseudoparallela* (716)	9.6	72.2	*Ganaspis* sp. (18)	12.2
Lonchaeidae *D. frieseni* (721)	12.7	59.1	*Ganaspis* sp. (23)	9.3
Otitidae *Euxesta* sp. (11) *N. cimiciforme* (39)	1.8	18.7	—	—

(n) Number of samples

Literature Cited

Aguiar-Menezes, E.L., E.B. Menezes, P.C.R. Cassino & M.A. Soares. 2002. Passion fruit, p. 361-390. In J.E. Peña, J.L. Sharp & M. Wysoki (eds.), Tropical fruit pests and pollinators: Biology, economic importance, natural enemies and control. Wallingford, CABI Publishing, 430p.

Chacon, P. & M. Rojas. 1984. Entomofauna asociada a *Passiflora mollissim, P. edulis* f. *flavicarpa* y *P. quadrangularis* en el Departamento del Valle del Cauca. Turrialba 34: 297-311.

Cunha, M.A.P. 1996. Recursos genéticos e modificações em métodos de seleção para produtividade em maracujá. Rev. Bras. Frutic. 18: 413-423.

Fancelli, M. & A.L.M. Mesquita. 1998. Pragas do maracujazeiro, p. 169-180. In R. Braga Sobrinho, J.E. Cardoso & F.C.O. Freire (eds.), Pragas de fruteiras tropicais de importância agroindustrial. Brasília, EMBRAPA/SPI, 207p.

IBGE. 2001. Produção Vegetal, Seção 3, p. 30-31. In Anuário estatístico do Brasil, v. 60. Rio de Janeiro, IBGE.

Martin, F.W. & H.Y. Nakasone. 1994. The edible species of *Passiflora,* p. 101-103. In B. Schaffer & P.C. Andersen (eds.), Handbook of environmental physiology of fruit crops, subtropical and tropical crops. Boca Raton, CRV Press, 364p.

McAlpine, J.F. & G.C. Steyskal. 1982. A revision of *Neosilba* McAlpine with a key to the world genera of Lonchaeidae (Diptera). Can. Entomol. 54: 504-505.

Norrbom, A.L. & J.F. McAlpine. 1997. A revision of the Neotropical species of *Dasiops* Rondani (Diptera: Lonchaeidae) attaching *Passiflora* (Passifloraceae). Mem. Entomol. Soc. Wash. 18: 189-211.

Peñaranda, A., P.C. Ulloa & M.R. Hernández. 1986. Biologia de la mosca de los botones florales del maracuyá *Dasiops inedulis* (Diptera: Lonchaeidae) en el Valle del Cauca. Rev. Colomb. Entomol. 12: 16-22.

Santos, Z.F.A.F. & J.M. Costa. 1983. Pragas da cultura do maracujá no estado da Bahia. Salvador, EPABA, 10p. (Circular Técnica, 4).

Stefani, R.N. & J.S. Morgante. 1996. Genetic variability in *Anastrepha pseudoparallela*: a specialist species, p. 277-280. In B.M. McPheron & G.J. Steck (eds.), Fruit fly pests, a world assessment of their biology and management. Delray Beach, St. Lucie Press, 586p.

Steyskal, G.C. 1963. The genus *Notogramma* Loew (Diptera: Acalyptratae, Otitidae). Proc. Entomol. Soc. Wash. 65: 195-200.

Steyskal, G.C. 1980. Two-winged flies of the genus *Dasiops* (Diptera: Lonchaeidae) attacking flowers or fruit of species of *Passiflora* (passion fruit, granadilla, curuba, etc.). Proc. Entomol. Soc. Wash. 82: 166-170.

Teixeira, C.G. 1994. Maracujá. I – Cultura, p. 3-131. In C.G. Teixeira, J.V. Castro, R.P. Tocchini, A.L.A.C. Nishida, J.M. Turatii, R.S.S. Leite, F.M.M. Bliska & E.B. Garcia (eds.), Maracujá, cultura, matéria-prima, processamento e aspectos econômicos. Campinas, ITAL, 267p.

Uchôa-Fernandes, M.A., I. Oliveira, R.M.S. Molina & R.A. Zucchi. 2002. Species diversity of frugivorous flies (Diptera: Tephritoidea) from hosts in the Cerrado of the state of Mato Grosso do Sul, Brazil. Neotrop. Entomol. 31: 515-524.

Zucchi, R.A. 2000. Espécies de *Anastrepha,* sinonímias, plantas hospedeiras e parasitóides, p. 41-48. In A. Malavasi & R. A. Zucchi (eds.), Moscas-das-frutas de importância econômica no Brasil: Conhecimento básico e aplicado. FAPESP-Holos, Ribeirão Preto, 327p.

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