

Tephritoidea (Diptera) species from Myrtaceae fruits in the State of São Paulo, Brazil

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Abstract

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A field survey was conducted from August 1997 to January 2003 to identify the Tephritoidea diversity from 15 Myrtaceae species (including guavas) collected in the State of São Paulo, Brazil. A total of 38,386 fruits (419.93 kg) were collected from unsprayed trees. From 188 samples of fruits 25,162 puparia and 15,439 adults of Tephritoidea were recovered. *Anastrepha* spp. and *Ceratitis capitata* (Wied.) flies were obtained from 78.7% and 16.5% of the samples, respectively. About 95.8% of all flies belonged to Tephritidae (98.3% *Anastrepha* spp. and 1.7% *C. capitata*) and 4.2% belonged to Lonchaeidae (*Neosilba* spp.). From 14,540 specimens of *Anastrepha*, it was obtained 6,642 *Anastrepha* females identified as: *A. fraterculus*, *A. bistrigata*, *A. obliqua*, *A. sororcula*, *A. zenildae*, *A. striata*, *A. turpiniae* and *A. bahiensis*. *Anastrepha fraterculus* (Wied.) was dominant. Mean infestation indices were 0.66 puparium of Tephritoidea/fruit and 59.9 puparia/kg of fruit.

Additional key words: Insecta, fruit flies, hosts, diversity.

Resumo

RAGA A, MACHADO RA, SOUZA FILHO MF, SATO ME, SILOTO RC. 2005. Ocorrência de espécies de Tephritoidea (Diptera) em frutos de Myrtaceae no Estado de São Paulo, Brasil. Entomotropica 20(1): 11-14.

Um levantamento foi conduzido entre agosto 1997 e janeiro de 2003 para avaliar a diversidade de Tephritoidea em 15 espécies de Myrtaceae coletadas no Estado de São Paulo, Brasil. Um total de 38.386 frutos (419,93 kg) foi coletado de árvores isentas de agrotóxicos. Das 188 amostras de frutas foram obtidos 25.162 pupários e 15.439 adultos de Tephritoidea. Adultos de *Anastrepha* spp. e de *Ceratitis capitata* (Wied.) foram obtidos de 78,7% e 16,5% das amostras, respectivamente. Aproximadamente 95,8% dos adultos eram de Tephritidae (98,3% *Anastrepha* spp. e 1,7% *C. capitata*) e 4,2% de Lonchaeidae (*Neosilba* spp.). Dos 14.540 espécimes de *Anastrepha* foram obtidas 6.642 fêmeas de *Anastrepha*, identificadas como: *A. fraterculus*, *A. bistrigata*, *A. obliqua*, *A. sororcula*, *A. zenildae*, *A. striata*, *A. turpiniae* e *A. bahiensis*. *Anastrepha fraterculus* (Wied.) foi dominante. A infestação média foi de 0,66 pupário de Tephritoidea/fruto e 59,9 pupários/kg de fruto.

Palavras chaves adicionais: Insecta, moscas-das-frutas, hospedeiros, diversidade.

Introduction

The Myrtaceae, consisting of trees and shrubs, comprises about 102 genera and 3,000 species. Nowadays, from Myrtaceae family only four genus are considered of the economic importance: *Eugenia*, *Feijoa*, *Myrciaria* and *Psidium* (Manica 2000). Guava, *Psidium guajava* L. is the most important fruit crop among 150 species of the genus *Psidium* (Donadio et al. 2002).

Guava is native to the American tropics and today is found in all subtropical and tropical regions (Kwee and Chong 1990; Gould and Raga 2002). The largest production in the world is recorded in Brazil, where guavas are grown in commercial areas or as dooryard fruit. In 2002, guava

production in Brazil was estimated in 389.162 tons collected from 18,039 ha. More than 40.7% (5,201 ha) of the Brazilian guava yield is concentrated in the State of São Paulo (Agrianual 2004).

Fifteen *Anastrepha* species are infesting Myrtaceae fruits in Brazil (Zucchi 2000a), in addition to medfly - *Ceratitis capitata* (Wied., 1824). South American fruit fly *Anastrepha fraterculus* (Wied., 1830), *A. striata* Schiner 1868, *A. sororcula* Zucchi 1979 and *A. zenildae* Zucchi 1979 are strongly associated to Myrtaceae in the Americas (Malavasi et al. 2000). The objective of this study was to obtain basic information about the diversity and infestation levels of fruit flies from Myrtaceae fruits in the State of São Paulo, Brazil.

Materials and Methods

From August 1997 to January 2003, 188 fruit samples (38,386 fruits; 419.93 kg) were collected from 15 Myrtaceae species in 41 municipalities of the state of São Paulo. Mature fruits were picked up at random from the canopy of unsprayed trees as well as from the ground and put into the open plastic boxes. The fruits were brought to the laboratory of the Instituto Biológico, located in Campinas, SP, counted, weighed and placed in fruit-holding boxes with sand at the bottom and a piece of cotton cloth at the top. About 15 days later, the sand in the boxes was sieved to remove the fruit fly puparia. The puparia were counted and transferred to glass cage (6,000 cc) with a little amount of dry sand plus vermiculite at the bottom and kept at $25 \pm 2^\circ\text{C}$ and $70 \pm 10\%$ of relative humidity for 25 days to allow the maximum emergence rate. A mixture of sugar and yeast extract (3:1) and water was provided to the flies. After complete emergence, adults were killed in a freezer and placed in labeled vials with 70% alcohol. Identification of *Anastrepha* species were based on female (Stone 1942, Steyskal 1977, Zucchi 1978).

Results and Discussion

The results of Tephritoidea diversity and the infestation indices in different Myrtaceae species are summarized in Table 1. About 88% of samples were infested by fruit flies. From overall collections, the mean infestation indices were 0.66 puparium/fruit and 59.9 puparia/kg of fruit. *Eugenia leitonii* Legr., *Syzygium jambos* (L.) Alston, *Eugenia involucrata* DC. and *Psidium guajava* L. were the most infested species (4.83; 3.23; 3.15 and 2.69 puparium/fruit, respectively).

Except *Syzygium cumini* (L.) Skeels, all the remaining species of Myrtaceae were infested by Tephritoidea. Eight Myrtaceae species showed average infestations above 100 puparia/kg of fruit (Table 1). 'Cereja-da-terra' (*E. involucrata*), Surinam cherry (*Eugenia uniflora* L.) and 'goiabão' (*E. leitonii*) reaching mean infestation of 1,102.0; 447.6 and 207.9 puparia/kg of fruit, respectively. In isolated samples, Surinam cherry and 'cereja-da-terra' showed the highest values of puparia/ kg of fruit (1,810.1 and 1,533.9, respectively).

The potential of guavas as primary host for fruit fly was observed in some samples with infestations of up to 21.26 puparia/fruit and 298.2 puparia/kg of fruit. Considering all samples, it was estimated 2.69 puparia/fruit and 41.1 puparia/kg of guava. In earlier survey of fruit flies conducted in the State of São Paulo, Souza Filho (1999) obtained means of 1.72 puparium/guava and 36.9 puparia/kg of guava. In Venezuela, Katiyar et al. (2000) obtained 114.3 adults of *Anastrepha* spp/kg of guava.

A total of 25,162 puparia and 15,439 flies of Tephritoidea (females + males) were recovered from all collections. Among the flies, 95.8% belonged to Tephritidae (98.3% of *Anastrepha* spp. and 1.7% of *C. capitata*) and 4.2% belonged to Lonchaeidae (*Neosilba* spp.).

Ceratitis capitata emerged from nine species of Myrtaceae and from 16.5% of the total of samples. The medfly occurrence in fruits of *Eugenia brasiliensis* Lam., *E. involucrata*, *Eugenia schomburgkii* Benth. and *Plinia glomerata* (Berg) Amshoff represents the first report in Brazil. According to Zucchi (2000b), 20 of 58 medfly host plants recorded from Brazil are natives.

Flies of the genus *Anastrepha* infested all species of Myrtaceae, except *S. cumini*. In total, 78.7% of the samples were infested by *Anastrepha*. *Anastrepha fraterculus*, *A. bistrigata* Bezzi 1919, *A. obliqua* (Macquart, 1835), *A. sororcula*, *A. zenildae*, *A. striata*, *A. turpiniae* Stone 1942 and *A. bahiensis* Lima 1937 were identified from a total of 6,642 females (Table 2). These are the first reports of *A. bahiensis* in *P. glomerata* in Brazil and of *A. sororcula* for *Campomanesia pubescens* (DC.) Berg in the state of São Paulo.

In this study, with exception of *A. bahiensis*, all *Anastrepha* species were recovered from guava fruits. Souza Filho (1999) identified the same species in guavas, however, with different proportions of *A. bistrigata* and *A. sororcula*. In the state of Rio de Janeiro (Southeast of Brazil), Aguiar-Menezes and Menezes (2002) recovered *A. fraterculus* (55%), *A. sororcula* (38%) and *A. obliqua* (7%) from guavas. In the northeast part of Brazil, Araujo and Zucchi (2003) recovered 86.9% of *A. zenildae* and 13.1% of *A. sororcula* in guavas.

Anastrepha fraterculus has been reported from 24 host plants of the Myrtaceae and 18 botanic families in Brazil (Zucchi 2000a). In our survey, South American fruit fly infested fourteen species of Myrtaceae. Thus *A. fraterculus* was dominant, reaching 87.74% of the all *Anastrepha* females and 76.62% of females from guavas.

In the present study, *Neosilba* spp. (Lonchaeidae) were present in 33.5% of the samples (Table 1), infesting eleven species of Myrtaceae. Lonchaeidae species are important pests of several horticultural crops (Norrbom and Mcalpine 1997). Status of some Lonchaeidae species is increasing due to considerable populations in commercial fruits (Raga et al. 2004).

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Table 1. Rate of fruit fly infestation in Myrtaceae species in the State of São Paulo, Brazil, 1997-2003.

Botanical name	Common name	Total No. samples ¹	Total No. fruits	Total weight (kg)	Infestation Indices ²		<i>Ceratitis capitata</i>		<i>Anastrepha</i> spp.		<i>Neosilba</i> spp.
					Puparia/fruit	Puparia/kg	♀	♂	♀	♂	
<i>Campomanesia pubescens</i> (DC.) Berg	'Guabiroba'	1 (1)	793	2.98	0.05	12.4	0	0	5	23	0
<i>Campomanesia phaea</i> (Berg) Landrum	'Cambuci'	1 (1)	233	8.45	0.01	0.1	0	0	0	1	0
<i>Eugenia brasiliensis</i> Lam.	'Grumixama'	2 (2)	600	0.74	0.08 (0.05-0.25)	62.2 (48.5-95.5)	1	0	2	5	1
<i>Eugenia involucrata</i> DC.	'Cereja-da-Terra'	3 (3)	539	1.54	3.15 (0.00-4.57)	1,102.0 (0.0-1,533.9)	1	0	454	579	30
<i>Eugenia leitonii</i> Legr.	'Goiabão'	2 (2)	87	2.02	4.83 (2.04-14.79)	207.9 (93.9-520.4)	0	0	95	122	17
<i>Eugenia pyriformis</i> Cambess.	'Uvaia'	12 (12)	2,342	13.91	0.81 (0.10-3.09)	135.7 (8.21-379.7)	1	0	587	631	73
<i>Eugenia schomburgkii</i> Benth.	'Maria-preta'	4 (4)	983	4.31	0.85 (0.30-1.74)	193.0 (100.0-275.5)	2	0	216	214	48
<i>Eugenia uniflora</i> L.	Surinam cherry	29 (24)	5595	9.71	0.78 (0.00-3.99)	447.6 (0.0-1,810.1)	14	5	974	1212	67
<i>Myrciaria jaboticaba</i> (Vell.) Berg	'Jaboticaba'	31 (20)	18,369	98.46	0.08 (0.00-2.96)	14.3 (0.0-237.0)	2	0	494	531	7
<i>Plinia glomerata</i> (Berg) Amshoff	'Cabeluda'	8 (8)	2,860	9.23	0.42 (0.29-0.61)	130.9 (11.6-265.4)	15	9	373	436	19
<i>Plinia edulis</i> (Vell.) Sobral	'Cambuca'	2 (2)	178	7.84	0.43 (0.43-0.50)	9.8 (6.8-10.0)	0	0	11	12	5
<i>Psidium cattleianum</i> Sabine	'Araçá'	9 (8)	1,299	9.36	1.21 (0.00-3.18)	167.6 (0.0-395.2)	0	0	291	496	0
<i>Psidium guajava</i> L.	Guava	76 (74)	3,664	240.5	2.69 (0.00-21.26)	41.1 (0.0-298.2)	56	42	2,665	3,102	365
<i>Syzygium cumini</i> (L.) Skeels	Java plum	1 (0)	300	0.68	0.00	0.00	0	0	0	0	0
<i>Syzygium jambos</i> (L.) Alston	Rose apple	7 (7)	544	10.20	3.23 (0.61-7.29)	172.5 (45.3-403.6)	57	48	475	534	14
Total	-	188 (166)	38,386	419.93	-	-	149	104	6,642	7,898	646

¹Number of collected samples (Number of infested samples)²Mean (the lowest and the highest infestation)

Table 2. Diversity of *Anastrepha* females emerged from Myrtaceae fruit samples collected in the State of São Paulo, Brazil, 1997-2003.

Botanical name	No. of females	<i>fraterculus</i>	<i>bistrigata</i>	<i>obliqua</i>	<i>sororcula</i>	<i>zenildae</i>	<i>striata</i>	<i>turpiniae</i>	<i>bahiensis</i>
<i>Campomanesia pubescens</i>	5	3	0	0	2	0	0	0	0
<i>Eugenia brasiliensis</i>	2	2	0	0	0	0	0	0	0
<i>Eugenia involucrata</i>	454	454	0	0	0	0	0	0	0
<i>Eugenia leitonii</i>	95	94	0	0	1	0	0	0	0
<i>Eugenia pyriformis</i>	587	463	0	124	0	0	0	0	0
<i>Eugenia schomburgkii</i>	216	207	0	9	0	0	0	0	0
<i>Eugenia uniflora</i>	974	953	0	5	16	0	0	0	0
<i>Myrciaria jaboticaba</i>	494	494	0	0	0	0	0	0	0
<i>Plinia edulis</i>	11	11	0	0	0	0	0	0	0
<i>Plinia glomerata</i>	373	372	0	0	0	0	0	0	1
<i>Psidium cattleianum</i>	291	276	7	6	2	0	0	0	0
<i>Psidium guajava</i>	2,665	2,042	373	82	137	13	11	7	0
<i>Syzygium jambos</i>	475	457	0	18	0	0	0	0	0
Total	6,642	5,828	380	244	158	13	11	7	1

References

- AGUIAR-MENEZES EL, MENEZES EB. 2002. Effect of performance of host fruits in the field on natural parasitism of *Anastrepha* spp. (Diptera: Tephritidae). Neotrop Entomol 31(4): 589-595.
- AGRIBUS. Anuário da Agricultura Brasileira. 2004. São Paulo: FNP Consultoria e Agroinformativos. 498p.
- ARAUJO EL, ZUCCHI RA. 2003. Moscas-das-frutas (Diptera: Tephritidae) em goiaba (*Psidium guajava* L.), em Mossoró, RN. Arq Inst Biol 70(1): 73-77.
- DONADIO LC, MÔRO FV, SERVIDONE AA. 2002. Frutas brasileiras. Jaboticabal: Editora Novos Talentos. 288p.
- GOULD WP, RAGA A. 2002. Pests of guava. In: Peña JE, Sharp JL, Wysoki M. Tropical Fruit Pests and Pollinators - Biology, Economic Importance, Natural Enemies and Control. Wallingford: CAB. p 295-313.
- KATIYAR KM, MOLINA JC, MATHEUS R. 2000. Fruit flies (Diptera: Tephritidae) infesting fruits of the genus *Psidium* (Myrtaceae) and their altitudinal distribution in Western Venezuela. Florida Entomol 83(4): 480-486.
- KWEE LT, CHONG KK. 1990. Guava in Malasia: production, pests and diseases. Kuala Lumpur: Tropical Press Sdn. 260p.
- MALAVASI A, ZUCCHI RA, SUGAYAMA RL. 2000. Biogeografia. In: malavasi A, Zucchi RA. Moscas-das-frutas de Importância Econômica no Brasil – conhecimento básico e aplicado. Ribeirão preto: Editora Holos. p 93-98.
- MANICA I. Taxonomia, morfologia, anatomia. 2000. In: Manica i, Icuma i, Junqueira ntv, Salvador jo. Moreira a, Malavolta e. Fruticultura Tropical 6. – Goiaba. Porto Alegre: Cinco Continentes. p 23-35.
- NORRBOOM AL, MCALPINE JF. 1997. A revision of the neotropical species of *Dasiops* Rondani (Diptera: Lonchaeidae) attacking *Passiflora* (Passifloraceae). Mem Entomol Soc Wash 18: 189-211.
- RAGA A, PRESTES DAO, SOUZA FILHO MF, SATO ME, SILOTO RC; GUIMARÃES JA, ZUCCHI, RA. 2004. Fruit fly (Diptera: Tephritoidea) infestation in citrus in the State of São Paulo, Brazil. Neotrop Entomol 33: 85-89.
- SOUZA FILHO MF. 1999. Biodiversidade de moscas-das-frutas (Diptera: Tephritidae) e seus parasitóides (Hymenoptera) em plantas hospedeiras no Estado de São Paulo [Dissertation]. Piracicaba: Universidade de São Paulo, ESALQ. 173p.
- STEYSKAL G. 1977. Pictorial key to species of the genus *Anastrepha* (Dip., Tephritidae). Entomological Society of Washington. Washington, DC: 35 p.
- STONE A. 1942. The fruit flies of the genus *Anastrepha*. Washington: USDA Miscellaneous Publication 439. 112p.
- ZUCCHI RA. 1978. Taxonomia das espécies de *Anastrepha* Schiner, 1868 (Diptera, Tephritidae) assinaladas no Brasil [Thesis]. Piracicaba: Universidade de São Paulo, ESALQ. 105p.
- ZUCCHI RA. 2000a. Espécies de *Anastrepha*, sinônimos, plantas hospedeiras e parasitóides. In: Malavasi A, Zucchi RA. Moscas-das-frutas de Importância Econômica no Brasil – conhecimento básico e aplicado. Ribeirão preto: Editora Holos. p 41-48.
- ZUCCHI RA. 2000b. Mosca-do-mediterrâneo, *Ceratitis capitata* (Diptera: Tephritidae). In: Vilela, EF, Zucchi RA, Cantor F. Pragas Introduzidas no Brasil. Ribeirão Preto: Editora Holos. p 15-22.