

CROP PROTECTION

Susceptibility of Guava Genotypes to Natural Infestation by *Anastrepha* spp. (Diptera: Tephritidae) in the Municipality of Monte Alegre do Sul, State of São Paulo, BrazilADALTON RAGA¹, MIGUEL F. DE SOUZA FILHO¹, DANIELA A.O. PRESTES¹, JOAQUIM A. DE AZEVEDO FILHO² AND MÁRIO E. SATO¹¹Instituto Biológico, C. postal 70, 13001-970, Campinas, SP²Agência Paulista de Tecnologia dos Agronegócios (APTA), Rodovia Municipal Monte Alegre - Pinhalzinho, km 3 13910-000, Monte Alegre do Sul, SP

Neotropical Entomology 35(1):121-125 (2006)Susceptibilidade de Genótipos de Goiaba à Infestação Natural por *Anastrepha* spp. (Diptera: Tephritidae) no Município de Monte Alegre do Sul, SP

RESUMO - As espécies infestantes de moscas-das-frutas e seus índices de infestação foram determinados para onze genótipos de goiaba (*Psidium guajava* L.). De março a abril de 2000, dez frutos maduros de cada genótipo foram coletados em intervalos semanais, de plantas não pulverizadas com inseticidas, instaladas no município de Monte Alegre do Sul, SP. Os frutos foram trazidos para o laboratório, pesados e colocados em copos plásticos contendo areia para obtenção de pupas de tefritídeos. De 95% das goiabas coletadas foram obtidos pupários de moscas-das-frutas. Das 682 fêmeas de *Anastrepha* recuperadas, quatro espécies foram identificadas: *A. fraterculus* (Wied.) (86,5%), *A. obliqua* (Macquart) (10,8%), *A. bistrigata* Bezzi (1,8%) e *A. sororcula* Zucchi (0,9%). Três espécies de parasitóides Braconidae (Opiinae) foram recuperadas: *Doryctobracon areolatus* (Szépligeti), *Doryctobracon brasiliensis* (Szépligeti) e *Utetes anastrephae* (Viereck). Os genótipos diferiram quanto aos níveis de infestação dependendo da época da coleta. Os genótipos 'L2P4 Vermelha', 'Ruby Supreme' e 'Webber Supreme' mostraram menor susceptibilidade em termos de produção de pupários por fruto. A variabilidade de infestação entre os genótipos de goiaba e as razões do aumento no nível de infestação ao longo do tempo são discutidas.

PALAVRAS-CHAVE: Insecta, mosca-das-frutas, *Psidium guajava*, Myrtaceae, índice de infestação

ABSTRACT - The infesting species and their infestation indices of fruit flies were determined for eleven guava genotypes (*Psidium guajava* L.). From March to April 2000, ten mature fruits of each genotype were harvested at weekly intervals from insecticide unsprayed trees located in the municipality of Monte Alegre do Sul, SP, Brazil. Fruits were brought to the laboratory, weighed and placed in individual plastic cups containing sand at the bottom to obtain the tephritid pupae. About 95% of guavas produced fruit fly puparia. Of the 682 *Anastrepha* females recovered, four species were identified: *A. fraterculus* (Wied.) (86.5%), *A. obliqua* (Macquart) (10.8%), *A. bistrigata* Bezzi (1.8%) and *A. sororcula* Zucchi (0.9%). Three species of parasitoids Braconidae (Opiinae) were recovered: *Doryctobracon areolatus* (Szépligeti), *Doryctobracon brasiliensis* (Szépligeti) and *Utetes anastrephae* (Viereck). The genotypes differ in level of infestation depend on the collecting time. The genotypes 'L2P4 Vermelha', 'Ruby Supreme' and 'Webber Supreme' showed the lowest susceptibility to tephritids in terms of puparia per fruit. The variability of infestation among the guava genotypes and the reasons for increasing fruit fly infestations along the time were discussed.

KEY WORDS: Insecta, fruit fly, *Psidium guajava*, Myrtaceae, infestation index

Guava, *Psidium guajava* L. (Myrtaceae), is native to the American tropics and today is found in all subtropical and tropical regions (Kwee & Chong 1990, Gould & Raga

2002). The largest production in the world is registered in Brazil, where guavas are grown in commercial areas or as backyard fruits. In 2002, guava production in Brazil was

estimated at 389.162 tons grown on 18,039 ha. About 37% of the commercial guava yield is concentrated in the State of São Paulo (Southeastern region) on 5,201 ha (Agrianual 2004).

Wherever guavas are grown commercially, fruit flies (Diptera: Tephritidae) are the key pests, including some species of the quarantine importance (Gould & Raga 2002). In Brazil, the medfly - *Ceratitidis capitata* (Wied.) - and eleven *Anastrepha* species have been reported in guavas (Zucchi 2000a, 2001).

In four municipalities of São Paulo State, Bressan & Teles (1991) registered from guavas *Anastrepha obliqua* (Macquart), *A. sororcula* Zucchi, *A. bistrigata* Bezzi and *A. zenildae* Zucchi. The authors obtained 4.4 to 1082.7 puparia/kg of guava. Canal et al. (1998a) recovered *A. zenildae* and *A. sororcula* in guavas from north of the State of Minas Gerais (dry area), with a maximum of 116 larva/kg of fruits.

The host resistance to tephritids is an under-exploited control strategy, although review of literature yields numerous examples of fruits that are resistant to fruit flies, such as citrus, apples, avocados, mangoes, peaches and carambolas (Greany 1989, Branco et al. 2000). However, there are few studies concerned about plant resistance against *Anastrepha* species in guavas (Gould & Raga 2002).

To prevent fruit fly infestation in guavas, Brazilian growers adopted cover sprays for killing adults or wrapping of fruits (paper bag). New strategies are demanded by the IPM program to guarantee safety to growers and consumers. In this context, the objective of the present study was to evaluate the susceptibility of guava genotypes to the attack of the *Anastrepha* fruit flies under natural field infestation.

Material and Methods

Eleven guava genotypes were selected from a germplasm of 54 guava genotypes (408 trees, nine years old) belonging to APTA Regional Agricultural Station, in the municipality of Monte Alegre do Sul (22°41'S; 46°41'W; 748m), State of São Paulo, Brazil.

Choice of genotypes was based on former studies of yield (Santos et al. 1998) and physico-chemical parameters (Nascimento et al. 1991). The guava genotypes evaluated were 'Shimoda Vermelha', 'Monte Alto Vermelha', 'Webber Supreme', 'Indiana Vermelha', 'Ruby Supreme', 'Torrão de Ouro', 'Campos', 'Ogawa 3 Vermelha', 'Monte Alto Comum 1', 'Ogawa x Kumagai' and 'L2P4 Vermelha'. The grove was set at a 2.5 x 4.0 m space planting without irrigation system. Trees with 3.0 - 3.5 m high were kept free from pruning and insecticide treatments during fructification. During the fruit collection, the average temperature ranged from 21.5° to 22.7° C, with a rainfall of 219 mm.

Ten mature fruits of each genotype were picked from the canopy at a height of 1.3 to 2.0 m, on the following dates: March 16, 24 and 31, and April 06, 2000, totalizing four evaluation times. The fruits were brought to the laboratory, weighed and placed into individual plastic cups (460 cc) containing dry sand at the bottom (230 g) and covered by voile. Recovered puparia were counted and individually transferred to similar recipients as described above for guavas. Puparia were kept at about 25°C and 70%

of RH for 25 days, thus allowing for maximum emergence rate. A mixture of sugar and yeast extract (3:1) and water was used as food for adult flies. The infestation indices were estimated by means of the total number of puparia. Pupal viability was calculated based on the percentage of puparia that resulted in fly emergence. Identification of *Anastrepha* specimens were based on Zucchi (2000b). Braconidae wasps were identified according to Canal & Zucchi (2000).

Weight of fruits and infestation indices were transformed into $\log(x + 1)$ before the analyses of variance (ANOVA), and means were separated by Tukey's test ($P \leq 0.05$). Untransformed means are shown in Tables 1 and 2. The relationship between the weight of fruits and the number of puparia for each genotype was examined with bivariate correlation analysis (Ayres & Ayres 2003).

Results and Discussion

Fruit fly puparia were recovered from 95% of guava fruits. On the first evaluation (March 16, 2000) and the third evaluation (March 31, 2000), 'L2P4' was the genotype with the lowest infestation index of fruit flies, with means of 2.0 and 5.0 puparia/fruit, respectively (Table 1), and no significant differences were detected among the remaining genotypes. 'Indiana Vermelha' showed the highest infestation indices during the experiment, achieving 49 puparia from one fruit.

Infestation indices of the genotypes did not differ statistically on the second evaluation (March 24, 2000). On the last evaluation (April 06, 2000), the number of puparia/fruit in 'Webber Supreme' and 'Ruby Supreme' was significantly lower than in 'Indiana Vermelha', 'Ogawa 3 Vermelha', 'Monte Alto Comum 1', 'Ogawa x Kumagai', and 'Campos', and the remainder being similar among themselves (Table 1). The infestation indices by fruit flies increased in some genotypes during the collections, mainly for 'L2P4 Vermelha', whose mean infestation index increased eight times in comparison to the first evaluation (Table 1), probably due to the very ripe stage of its fruits. In general, senescent fruits are markedly more susceptible to attack by fruit flies than early season fruits (Greany 1989).

On the last evaluation, the infestations of the 'Ruby Supreme' and 'Webber Supreme' were lower than seven puparia/guava (Table 1). Suplicy Filho et al. (1984) performed a study to define the chemical and physical bases for differential resistance among guava cultivars and low pH appears to have an important effect on guava susceptibility to fruit flies. These authors found that the cultivar 'Australiana' (pH of 3.5 - 4.1) was less susceptible than 'Azeda' (pH of 3.1 - 4.0) based on the number of fruits infested by *Anastrepha* spp. No attempt was made to investigate this internal property of the fruits among the genotypes evaluated. Nascimento et al. (1991) evaluated twenty two cultivars in the same experimental area of the present study, and 'Rubby Supreme' showed low means of total and titrable acidity (0.19 - 0.45) and pH of 4.0 - 4.6.

Suplicy Filho et al. (1984) also found that Brix and humidity of fruits have little effect on guava susceptibility, and there was no effect of weight of fruits. Results of overall

Table 1. Infestation indices by *Anastrepha* spp. of guavas collected from eleven genotypes at different times in the municipality of Monte Alegre do Sul, SP, Brazil.

Genotype	Mean number of puparia (\pm SE)/fruit [maximum number of puparia/fruit]			
	March 16, 2000	March 24, 2000 ^{n.s.}	March 31, 2000	April 06, 2000
'Shimoda Vermelha'	7.5 (2.3) a [26]	4.1 (0.9) [9]	10.8 (2.8) ab [29]	14.4 (2.5) abc [28]
'Monte Alto Vermelha'	5.8 (1.2) ab [14]	4.3 (0.9) [8]	7.7 (1.3) ab [17]	13.9 (4.5) abc [47]
'Webber Supreme'	4.3 (1.3) ab [15]	11.3 (2.4) [28]	5.0 (0.8) ab [10]	6.5 (2.1) c [24]
'Indiana Vermelha'	8.5 (1.6) a [17]	7.0 (1.4) [15]	17.1 (4.2) a [49]	19.4 (2.0) a [28]
'Ruby Supreme'	5.0 (0.7) ab [10]	4.5 (1.2) [14]	9.1 (1.5) ab [18]	6.7 (1.2) bc [12]
'Torrão de Ouro'	4.4 (1.0) ab [8]	4.5 (1.4) [15]	14.9 (2.9) a [28]	13.6 (2.4) abc [28]
'Campos'	5.0 (0.6) ab [8]	7.2 (1.7) [19]	8.2 (1.4) ab [15]	16.1 (2.8) ab [29]
'Ogawa 3 Vermelha'	8.0 (1.9) a [20]	8.1 (1.8) [19]	13.0 (1.7) a [20]	18.6 (3.2) a [39]
'Monte Alto Comum 1'	5.9 (1.0) ab [11]	4.2 (2.1) [19]	8.1 (1.5) ab [17]	15.1 (1.7) ab [23]
'Ogawa x Kumagai'	7.4 (2.0) ab [21]	10.0 (2.4) [27]	8.9 (1.5) ab [16]	18.9 (3.0) a [38]
'L2P4 Vermelha'	2.0 (0.7) b [6]	4.4 (2.1) [20]	5.0 (1.9) b [20]	15.8 (3.2) ab [39]

Untransformed data (n = 10). Means followed by the same letter in the columns are not statistically different by Tukey's test (P \leq 0.05); ^{n.s.} non-significant.

weight of fruits for each guava genotype and their overall infestation indices are summarized in Table 2. The fruits of the genotypes 'Shimoda Vermelha', 'Ogawa 3 Vermelha', 'Indiana Vermelha', 'Ruby Supreme', and 'Monte Alto Comum1' had significantly greater mean values (over than 100 g). 'L2P4' presented the lowest mean weight (38.7 g), followed by 'Torrão de Ouro' and 'Campos' whose mean weights were lower than 70 g. The overall infestation indices did not differ among the genotypes, ranging from 63.8 to 159.7 puparia/kg of fruit. No significant correlation (P > 0.05) was detected between the weight of fruits and the number of puparia for any evaluated genotype. Significant correlation (F = 5.02, degree of freedom = 1, P = 0.025, R² = 0.44) between these parameters were detected only for global analysis including the eleven studied genotypes. No statistical differences were detected among the genotypes in terms of pupal viability (Table 2), whose means after four collections ranged from 25.8 to 50.9. In the north of Minas Gerais State, the tephritid pupal viability collected from guava under natural field infestation ranged from 2.8% to 100% depending on the fruit fly species (Canal *et al.* 1998a).

A total of 1,429 adults (52.3% males and 47.7% females) of *Anastrepha* emerged during the experiment (Table 3). More than 30% of the flies were recovered from 'Ogawa 3 Vermelha' and 'Indiana Vermelha'. Although *C. capitata* attacks guava (Zucchi 2001), adults of this species were not recovered during the evaluations. Probably this was due to the low population densities of this species at the evaluation times, in which its population was equal or lower than 0.03 fly/trap/day using McPhail traps with hydrolyzed protein installed in the same experimental station.

From 682 *Anastrepha* females recovered (Table 3), four species were identified: *A. fraterculus* (Wied.) (86.5%), *A. obliqua* Macquart (10.8%), *A. bistrigata* Bezzi (1.8%) and *A. sororcula* Zucchi (0.9%). *A. fraterculus* emerged from all genotypes and *A. obliqua* was not detected only in 'Ruby Supreme'.

Similar results were found by Aguiar-Menezes & Menezes (2002) who recovered more than 50% of the adult fruit flies belonged to *A. fraterculus*, followed by *A. sororcula* (38%) and *A. obliqua* (7%) from guavas in the municipality of Itaguaí, State of Rio de Janeiro. In the north of Minas

Table 2. Mean weight of the guavas, their infestation indices by *Anastrepha* spp. and the respective pupal viability in the municipality of Monte Alegre do Sul, SP, Brazil.

Genotype	Mean fruit weight (± SE) (g)	Mean number of puparia (± SE)/kg of fruits ^{n.s.}	Pupal viability (± SE) ^{n.s.}
'Shimoda Vermelha'	117.7 (5.9) a	82.3 (23.0) ²	25.8 (11.2)
'Monte Alto Vermelha'	93.4 (6.9) bc	93.4 (32.0)	35.0 (5.7)
'Webber Supreme'	90.5 (8.2) bc	80.7 (16.5)	33.3 (7.6)
'Indiana Vermelha'	107.8 (5.3) ab	122.6 (30.6)	39.5 (10.5)
'Ruby Supreme'	104.1 (4.3) ab	63.8 (13.4)	33.7 (11.2)
'Torrão de Ouro'	66.8 (4.4) d	150.5 (49.9)	37.8 (10.5)
'Campos'	67.1 (3.9) d	145.8 (47.4)	37.6 (6.0)
'Ogawa 3 Vermelha'	125.9 (3.9) a	96.2 (23.0)	50.9 (5.5)
'Monte Alto Comum 1'	103.9 (10.6) ab	92.9 (35.6)	38.0 (7.4)
'Ogawa x Kumagai'	77.7 (3.6) cd	152.0 (31.6)	36.9 (9.1)
'L2P4 Vermelha'	38.7 (2.6) e	159.7 (62.5)	44.1 (5.8)

Untransformed data (n = 40). Means followed by the same letter in the columns are not statistically different by Tukey's test (P ≤ 0.05); ^{n.s.} non-significant.

Gerais, *Anastrepha zenildae* Zucchi is dominant in guavas, with high pupal viability (72.4% to 100%) (Canal et al. 1998a,b; Corsato 2004), whereas in the Brazilian Amazon and Venezuela, that status is represented by *A. striata* (Silva & Ronchi-Teles 2000, Katiyar et al. 2000).

In the present study, the parasitism of tephritid larva also occurred, but only 21 Hymenoptera parasitoids emerged during the experiment. All belonged to Braconidae (Opiinae): *Doryctobracon areolatus* (Szépligeti) (19 specimens), *Doryctobracon brasiliensis* (Szépligeti) and *Uletes anastrephae* (Viereck). These results agree with

Leonel Jr. et al. (1996) who mentioned that 90.4% of the braconids collected in guavas from the central region of São Paulo belonged to *D. areolatus*. Braconids recovered from guavas by Aguiar-Menezes & Menezes (2002), represented 73.6% of all parasitoids, from which the mean percent parasitism of *D. areolatus* ranged from 3.9 to 6.4%.

Results of this study demonstrate that all guava genotypes tested under natural infestation in the municipality of Monte Alegre do Sul, SP, are infested by *Anastrepha*. However, in addition to their advantages in commercial fruit size, 'Ruby Supreme' and 'Webber Supreme' showed to be promising

Table 3. Species of *Anastrepha* and number of their specimens infesting guavas of eleven genotypes (n = 40) in the municipality of Monte Alegre do Sul, SP, Brazil.

Genotype	No. of flies	%	♂ no.	♀ no.	AF	AO	AB	AS
'Shimoda Vermelha'	57	4.0	37	20	17	2	1	0
'Monte Alto Vermelha'	114	8.0	62	52	43	8	0	1
'Webber Supreme'	95	6.6	46	49	37	9	3	0
'Indiana Vermelha'	219	15.3	106	113	104	7	0	2
'Ruby Supreme'	80	5.6	43	37	34	0	0	3
'Torrão de Ouro'	96	6.7	45	51	40	9	2	0
'Campos'	132	9.2	72	60	58	2	0	0
'Ogawa 3 Vermelha'	246	17.2	127	119	103	12	4	0
'Monte Alto Comum 1'	110	7.7	52	58	48	10	0	0
'Ogawa x Kumagai'	145	10.1	89	56	46	9	1	0
'L2P4 Vermelha'	135	9.4	68	67	60	6	1	0
Total	1,429	100	747	682	590	74	12	6

AF = *A. fraterculus*, AO = *A. obliqua*, AB = *A. bistrigata*, AS = *A. sororcula*

genotypes in terms of low susceptibility to fruit flies and may contribute to the IPM programs against tephritid pests.

References

- Aguiar-Menezes, E.L. & E.B. Menezes. 2002. Effect of performance of host fruits in the field on natural parasitism of *Anastrepha* spp. (Diptera: Tephritidae). *Neotrop. Entomol.* 31: 589-595.
- Agriannual. 2004. São Paulo, FNP Consultoria e Agroinformativos, 498p.
- Ayres, M. & M. Ayres Jr. 2003. BioEstat 3.0 aplicações estatísticas nas áreas das ciências biológicas e médicas. Belém, Sociedade Civil Mamirauá/CNPq, 291p.
- Branco, E.S, J.D. Vendramim & F. Denardi. 2000. Resistência às moscas-das-frutas em fruteiras, p.161-167. In A. Malavasi & R.A. Zucchi (eds.), *Moscas-das-frutas de importância econômica no Brasil: Conhecimento básico e aplicado*. Ribeirão Preto, Holos, 327p.
- Bressan, S. & M.C. Teles. 1991. Lista de hospedeiros e índices de infestação de algumas espécies do gênero *Anastrepha* Schiner, 1868 (Diptera: Tephritidae) na região de Ribeirão Preto-SP. *An. Soc. Entomol. Brasil* 20: 5-15.
- Canal, N.A., C.D. Alvarenga & R.A. Zucchi. 1998a. Níveis de infestação de goiaba por *Anastrepha zenildae* Zucchi (Diptera: Tephritidae), em pomares comerciais do norte de Minas Gerais. *An. Soc. Entomol. Brasil* 27: 657-661.
- Canal, N.A., C.D. Alvarenga & R.A. Zucchi. 1998b. Análise faunística das espécies de moscas-das-frutas (Dip., Tephritidae) em quatro municípios do Norte do estado de Minas Gerais. *Sci. Agr.* 55: 15-24.
- Canal, N.A. & R.A. Zucchi. 2000. Parasitóides – Braconidae, p.119-126. In A. Malavasi & R.A. Zucchi (eds.), *Moscas-das-frutas de importância econômica no Brasil: Conhecimento básico e aplicado*. Ribeirão Preto, Holos, 327p.
- Corsato, C.D.A. 2004. *Moscas-das-frutas (Diptera: Tephritidae) em pomares de goiaba no Norte de Minas Gerais: biodiversidade, parasitóides e controle biológico*. Tese de doutorado, Escola Superior de Agricultura “Luiz de Queiroz”, USP, Piracicaba, 83p.
- Gould, W.P. & A. Raga. 2002. Pests of guava, p. 295-313. In J.E. Peña, J.L. Sharp & M. Wysoki (eds.), *Tropical fruit pests and pollinators: Biology, economic importance, natural enemies and control*. Wallingford, CAB, 430p.
- Greany, P.D. 1989. Host plant resistance to tephritids: An under exploited control strategy. p.353-362. In A.S. Robinson & G. Hooper (eds.). *Fruit flies: Their biology, natural enemies and control*. New York, Elsevier, 372 p. (World Crop Pest 3A).
- Katiyar, K.M., J.C. Molina & R. Matheus. 2000. Fruit flies (Diptera: Tephritidae) infesting fruits of the genus *Psidium* (Myrtaceae) and their altitudinal distribution in Western Venezuela. *Fla. Entomol.* 83: 480-486.
- Kwee, L.T. & K.K. Chong. 1990. *Guava in Malasia: Production, pests and diseases*. Kuala Lumpur, Tropical Sdn., 260p.
- Leonel Jr., F., R.A. Zucchi & N.A. Canal D. 1996. Parasitismo de moscas-das-frutas (Diptera: Tephritidae) por Braconidae (Hymenoptera) em duas localidades do estado de São Paulo. *An. Soc. Entomol. Brasil* 25: 199-206.
- Nascimento, L.M., R.R. Santos, I.J.A. Ribeiro, F.P. Martins, K. Yotsuyanagi & J.R. Coutinho. 1991. Caracterização físico-química dos frutos de 22 cultivares de goiabeiras (*Psidium guajava* L.) durante o processo de maturação. I. coloração da casca, textura, sólidos solúveis totais, acidez total titulável e pH. *Rev. Bras. Frutic.* 13: 35-42.
- Santos, R.R., F.P. Martins, I.J.A. Ribeiro, L.M. Nascimento & T. Igue. 1998. Avaliação de variedades de goiabeira em Monte Alegre do Sul (SP). *Bragantia* 57: 117-126.
- Silva, N.M. & B. Ronchi-Teles. 2000. *Moscas-das-frutas no estados brasileiros: Amapá, Amazonas, Pará, Rondônia e Roraima*, p.203-209. In A. Malavasi & R.A. Zucchi (eds.), *Moscas-das-frutas de importância econômica no Brasil: Conhecimento básico e aplicado*. Ribeirão Preto, Holos, 327p.
- Suplicy Filho, N., A.S. Sampaio, I. Myazaki, E.A. Bitran, D.A. Oliveira & A.A. Veiga. 1984. Estudos de fatores determinantes do grau de susceptibilidade ao parasitismo por “moscas das frutas” *Anastrepha* spp., em cinco variedades de goiaba. *Biológico* 50: 169-176.
- Zucchi, R.A. 2000a. Taxonomia, p.13-24. In A. Malavasi & R.A. Zucchi (eds.), *Moscas-das-frutas de importância econômica no Brasil: Conhecimento básico e aplicado*. Ribeirão Preto, Holos, 327p.
- Zucchi, R.A. 2000b. Espécies de *Anastrepha*, sinônimas, 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*. Ribeirão Preto, Holos, 327p.
- Zucchi, R.A. 2001. Mosca-do-mediterrâneo. *Ceratitis capitata* (Diptera: Tephritidae), p.15-22. In Vilela, E.F., R.A. Zucchi & F. Cantor, *Histórico e impacto das pragas introduzidas no Brasil*. Ribeirão Preto, Holos, 173p.

Received 28/XII/04. Accepted 22/VIII/05.