

Detection of juvenile stages of *Ceratitis capitata* and *Anastrepha fraterculus* in lemon fruit

L. Augier¹, G. Gastaminza¹, M. E. Villagrán¹, M. F. Villagrán¹, G. Zaia¹, E. Willink¹ and B. Stein²

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INTRODUCTION

Lemon (*Citrus limon* (L.) Burm. f.) is not considered a preferential host of the medfly *Ceratitis capitata* (Wiedemann) while for *Anastrepha fraterculus* (Wiedemann) lemon is not mentioned as a host by Norrbom and Kim (1988) and in the update of that list (Norrborm, 2004), the work of Salles (1995) is included where it would be reported as an alternative host. However, this mention arrises some controversy (see chapter II).

Back and Pemberton (1918) reported that *C. capitata* does not develop in lemons while they are still attached to the tree unless they are damaged.

However, there are a few isolated reports concerning the finding of *C. capitata* larvae in lemon fruit. Quayle (1938) reported fruit with larvae in packing houses in Sicily and Liquido (1990) in fruit collected from the ground in Hawaii. More recently, the USA detected larvae in lemons from Spain.

Argentina has exported lemons for 30 years to different markets in the world, with about 300.000 ton of lemons being commercialized yearly. Up to now no fruit have been detected with *C. capitata* or *A. fraterculus* juvenile stages. The aim of the present work was to detect the presence of juvenile stages of *C. capitata* and *A. fraterculus* in lemon fruit sampling in both lemon growing farm lands and in packing houses.

MATERIALS AND METHODS

1. Field fruit sampling

a) Localities

Fruit samplings were carried out in the same localities in which the monitoring of adult fruit flies was effected: El Rodeo, Burruyacu department (northeast); Los Nogales, Tafí Viejo department (northwest), Famaillá, Famaillá department (centre) and Monte Bello, Río Chico department (south) (see Fig. 1 in chapter VI).

b) Methodology

In each locality 10 sampling sites were established (in places where Jackson traps had been placed in the trees). Five lemons with more than 60 mm in diameter and over 35% juice were collected from the trees (Fig. 1) and five lemons were picked from the ground per sampling site (Fig. 2); the total being 50 lemons from trees and 50 from the ground per locality.

¹Centro de Investigaciones Cuarentenarias, Sección Zoología Agrícola, Estación Experimental Agroindustrial Obispo Colombres (EEAOC). William Cross 3150, 4101, Las Talitas, Tucumán Argentina. E-mail: Imaugier@eeaoc.org.ar ²Sección Fruticultura, Estación Experimental Agroindustrial Obispo Colombres (EEAOC).

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Samplings were carried out weekly during the whole year. Fruit were taken to the laboratory, weighed, and placed on trays with sterilized sand and incubated in chamber at $25 \pm 2^{\circ}$ C (Fig. 3). Two fifths of the fruit were dissected after 10 days to check for the presence of larvae (Fig. 4), while the rest was examined after 20 days to check for larvae or pupae.

2. Fruit sampling in the packing houses

a) Packing houses

Fruit samplings were carried out on a weekly basis during the export period (autumn winter). Five of the main packing houses in Tucumán (S. A. San Miguel, Citrusvil S. A., Citromax S. A., Vicente Trápani S. A. and Argenti-Lemon S. A.), which process about 60% of the total lemon production, were selected.

b) Methodology

Four thousand to 7,000 fruit from 40 to 60 export packing boxes were sampled per week. All the fruit were checked for juvenile stages whether dead or alive (Fig. 5). The boxes with sampled fruit had identification codes from the producing units (PU) that permitted the determination of the locality of production of the fruit and their variety, among other parameters.

At the same time, 500 fruit from the first discard of the packing line were sampled every week (Fig. 6).



Figure 1. Fruit harvest from lemon trees.



Figure 2. Lemon fruit collection from the ground.



Figure 3. Sand boxes with lemons in incubation chamber.



Figure 4. Disection and revision of lemons searching for larvae.



Figure 5. Disection and revision of fruit for export at the packing house.

RESULTS

1. Field fruit sampling

The results of the field samplings are shown in Tables 1 and 2 for the export period (April -September) and the non export period (October -March) respectively.

After analyzing a total of 69,200 fruit (obtained in equal quantities from trees and from the ground) during the May 2004 -September 2007 period, no juvenile stages of *C. capitata* or *A. fraterculus* either dead or alive



Figure 6. Sampling of fruit for discard at the packing house.

were found.

2. Fruit sampling in the packing houses

The results of the fruit samplings from the packing houses during the 2005 - 2007 export periods are shown in Table 3, while the location of the producing units (PU) is shown in Figure 7.

After analyzing a total of 403,220 fruit in export boxes and 33,500 fruit for discard during the 2005 - 2007 export periods, no juvenile stages of *C. capitata* or *A. fraterculus* were found.

Table 1. Lemon fruit sampling collected from trees and from the ground during the export periods (autumn - winter), during the years 2004 - 2007.

Export periods (autumn winter)		TREE			GROUND		
		Weight (kg)	Number of Fruit	Larvae or pupae	Weight (kg)	Number of fruit	Larvae or pupae
2004	May 27 - Sep 23	276.29	3,600	0	265.90	3,600	0
2005	April 01 - Sep 30	263.75	5,400	0	221.33	5,400	0
2006	April 05 - Sep 27	244.80	5,200	0	228.10	5,200	0
2007	April 06 - Sep 14	288.80	4,800	0	246.50	4,800	0
	TOTAL	1,073.64	19,000	0	961.83	19,000	0

Table 2. Lemon fruit sampling collected from trees and from the ground during the non export periods (spring - summer), during the years 2004 - 2007.

	Non export periods – (spring summer)		TREE			GROUND		
			Weight (kg)	Number of Fruit	Larvae or pupae	Weight (kg)	Number of fruit	Larvae or pupae
						× 5/		
	2004	Oct 01 - Dec 30	158.29	2,800	0	174.49	2,800	0
	2005	Jan 07 - Mar 25	349.26	5,000	0	370.43	5,000	0
	2006	Jan 06 - Mar 31	249.07	5,200	0	248.47	5,200	0
	2007	Jan 05 - Mar 30	156.10	2,600	0	148.60	2,600	0
		TOTAL	912.72	15,600	0	941.99	15,600	0

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	Number of sampled PU*	Varieties	Fruit for e	export	Fruit for discard	
Year			Number of fruit	Larvae	Number of fruit	Larvae
	80	Lisbon	48,511	0	10,000	0
		Limoneira 8A	15,977	0		
2005		Genoa	15,135	0		
		Eureka	32,485	0		
		Fino	600	0		
		Lisbon	33,559	0	11,500	0
	31	Limoneira 8A	23,406	0		
2006		Genoa	7,262	0		
		Eureka	62,520	0		
		Fino	11,818	0		
	72	Lisbon	28,463	0	11,500	0
2007		Limoneira 8A	36,570	0		
2007		Genoa	5,218	0		
		Eureka	81,696	0		
	TOTAL		403,220	0	33,500	0

Table 3. Samplings of fruit for export and fruit for discard in packing houses during the 2005 - 2007 periods.

* PU: Producing Unit in the orchard.



Figure 7. Location of the Producing Units sampled during the 2005-2007 export periods.

CONCLUSIONS

On the basis of the results obtained from the samplings, the following conclusions were reached:

1. No lemon fruit (collected from trees or from the ground) with juvenile stages of *C. capitata* o *A. fraterculus* were found during the period May 2004 - September 2007.

2. No lemon fruit from export boxes or for discard were found with juvenile stages of *C. capitata* o *A. fraterculus* during the 2005 - 2007 export periods.

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