

INTEGRATED CONTROL OF THE MEDITERRANEAN FRUIT FLY, *CERATITIS CAPITATA* (WIED.) IN GUAVA ORCHARDS IN EGYPT

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Abstract

Integrated control against the Medfly, *Ceratitis capitata* (Wied) was carried out in two guava orchards during the two successive seasons; 1997 and 1998.

In the first season (1997), medfly male catches per trap per day "CTD" ranged between 0.07 to 16.14 and percentages of infestation ranged between 8.5 to 100 % in untreated orchard, while the "CTD" ranged between 0.03 to 2.14 and 0.07 to 6.00 and percentages of infestation ranged between 1.00 % to 21.40 % and 4.00 % to 57.00 % in the 1st and 2nd treated orchards, respectively. Percentages reduction in adult population ranged between 57.14 % to 91.51 % and 42.00 % to 74.78 % and percentages reduction in fruit infestation ranged between 82.60 % to 89.00 % and 43.00 % to 53.37 % at the two treatment guava orchards, respectively.

In the second season (1998), the "CTD" ranged between 0.07 to 14.07 and percentages of infestation ranged between 5.50 % to 100 % in untreated orchard, while the "CTD" ranged between 0.03 to 2.91 and 0.07 to 5.29 and percentages of infestation ranged between 1.00 % to 27.80 % and 2.50 % to 58.50 % in the 1st and 2nd orchards, respectively. Percentages reduction in adult population ranged between 57.14% to 83.33 % and 41.67 % to 67.52 % and percentages reduction in fruit infestation ranged between 72.02 % to 82.50 % and 41.50% to 54.54% at the two treatment guava orchards, respectively.

INTRODUCTION

The Mediterranean fruit fly, *Ceratitis capitata* (Wied.) is one of the most serious fruit flies in the world because of the great variety of its host plants and its geographical distribution. In Egypt, this pest causes considerable damage which inflicts significantly economic losses to peach, apricot, guava, mango, fig and citrus all over the governorates of Egypt (Awadallah *et al.*, 1974). Although partial bait spray and killing bags were used for controlling medfly on citrus, peach and apricot (Hashem *et al.*, 1987 and Saafan *et al.*, 1993), yet it need more study in this way. Therefore, the aim of the present study is to evaluate the effect of integrated control (mechanical, agricultural

and chemical) on medfly in guava orchards.

These means of control minimize the environmental pollution, eliminate the control expenses and magnify the biological control agents in guava orchards.

MATERIALS AND METHODS

Studies were carried out throughout the two successive seasons; 1997 & 1998 from early August to late November for each season, to evaluate the effect of integrated pest management; mechanical, agricultural and chemical treatments on the reduction of medfly infestation in guava orchards at Kalubia Governorate.

Treatments sites: Three guava orchards were chosen at Banha district, kalubia Governorate as follow:

The first orchard (about two feddans), the second one (about half feddan) one kilometer faraway from the first orchard and the third orchard (about half feddan) half kilometer faraway from the first and second orchards.

To study medfly population fluctuation, Jackson sticky traps (Harris *et al.*, 1971) were baited weekly with trimedlure and distributed in each chosen guava orchard from early August to late November (five traps in the first orchard and two traps in each of the other two orchards). Traps were inspected weekly, catches were counted and the sticky inserts were substituted. Mean catches per trap per day "CTD" were calculated and recorded.

Rate of guava fruit infestations were conducted from late August to the last date of fruit harvesting. Five hundred guava fruits (fallen fruits) from the first orchard and two hundred guava fruits from each other two orchards were examined weekly and percentages of fruit infestation were estimated.

Treatments (1997 & 1998)

1. The first orchard: During the two successive seasons (1997 & 1998); mechanical, agricultural and chemical treatments were carried out as follow:

Mechanical treatments :

A. Mass trapping: From late July, one hundred McPhail traps (McPhail *et al.*, 1963) were baited with diammonium phosphate solution 2 % weekly and distributed on the border trees of guava orchard to trap migrated adults from neighbouring orchards.

B. Collecting fallen fruits: From late August, infested fallen fruits were gathered daily and put in thick plastic bag, closed tightly and remained under direct sunrays for a long time (about three months) to be sure enough that the confined larvae died. This trial, specially in early ripening guava varieties eliminate for a big extent medfly re-infestation in the next ripening guava varieties.

Agricultural treatment: Flooding irrigation was conducted shortly after harvesting. This trial kill the newly jumped medfly larvae and pupae in the soil of guava orchard, then reduce medfly adult flies migration to the neighbouring citrus orchards.

Chemical treatment (killing bags): In the first season (1997), killing bags (described by Saafan *et al.*, 1993) - as a specific method of chemical control - was used during the late of August until the last date of fruit harvesting. The bags were dipped in a mixture of 1/2 L. actellic + 2 L. buminal + 17.5 L. water until the bags were saturated. The bags were hanged on guava trees at a rate of one bag per two trees and saturated with the mixture every two days.

In the second season (1998), buminal was substituted by fresh local attractant (Saafan, 1998) because fresh buminal was not available.

2. The second orchard: Only infested fruits gathering was conducted as a mechanical treatment and flooding irrigation as an agricultural treatment were applied in the second orchard during the two successive seasons (1997 & 1998).

3. The third orchard: This orchard remained without any treatment as an untreated orchard.

RESULTS AND DISCUSSION

The first season (1997)

Table 1 shows the "CTD" (medfly male catches per trap per day) reduction in medfly population, percentages of infestation and reduction in percentages of infestation at the two treated and the untreated orchards.

Data indicated that medfly adults began to campaign guava orchards during early August, while guava fruits infestation with medfly larvae were noticed during the 4th week of August, (this period for the fruits to be suitable to egg laying, egg incubation period and 1st & 2nd instar of larval duration).

Table 1. Medfly population and percentages of infestation in guava orchards treated with mechanical, agricultural and chemical treatments at Kalubia Governorate, during 1st season (1997).

Date of inspection	TREATED ORCHARDS											Untreated orchard	
	First orchard (Mechanical, agricultural and chemical treatments)					Second orchard [Mechanical (only infested fruits gathering) and agricultural treatments]					CTD	% Infestation	
	CTD*	% Reduction in adult population	% Infestation	Reduction in percentage of infestation	CTD	% Reduction in adult population	% Infestation	Reduction in percentage of infestation	CTD	% Infestation			
2.8.1997	0.03	57.14	-	-	0.07	0.00	-	-	0.07	-	-	0.07	-
9.8	0.09	82.00	-	-	0.29	42.00	-	-	0.50	-	-	0.50	-
16.8	0.29	82.32	-	-	0.64	60.98	-	-	1.64	-	-	1.64	-
23.8	0.43	79.30	1.00	88.24	0.93	55.07	4.00	52.94	2.07	4.00	8.50	2.07	8.50
30.8	0.69	73.86	1.80	85.60	1.43	45.83	6.00	52.00	2.64	6.00	12.50	2.64	12.50
6.9	0.77	74.92	5.00	87.01	1.71	44.30	17.50	54.55	3.07	17.50	38.50	3.07	38.50
13.9	0.66	83.21	7.80	82.86	2.00	49.11	22.00	51.65	3.93	22.00	45.50	3.93	45.50
20.9	0.80	85.45	8.40	85.13	2.79	49.27	26.50	53.10	5.50	26.50	56.50	5.50	56.50
27.9	1.29	85.32	9.40	86.18	3.79	56.88	29.00	48.67	8.79	29.00	68.00	8.79	68.00
4.10	1.60	85.55	10.60	86.99	5.36	56.88	38.00	53.37	11.07	38.00	81.50	11.07	81.50
11.10	1.83	83.89	11.00	89.00	5.29	43.43	49.00	51.00	11.36	49.00	100.00	11.36	100.00
18.10	1.80	85.35	13.40	86.60	5.50	55.25	53.50	46.50	12.29	53.50	100.00	12.29	100.00
25.10	2.00	84.86	17.40	82.60	5.71	56.78	55.00	45.00	13.21	55.00	100.00	13.21	100.00
1.11	2.14	84.79	21.40	86.60	6.00	57.36	57.00	43.00	14.07	57.00	100.00	14.07	100.00
8.11	2.04	86.71	* *	-	4.36	71.60	* *	-	15.35	* *	-	15.35	* *
15.11	1.37	91.51	-	-	4.07	74.78	-	-	16.14	-	-	16.14	-
22.11	1.03	89.00	-	-	2.71	71.05	-	-	9.36	-	-	9.36	-
29.11	0.71	86.37	-	-	1.71	67.18	-	-	5.21	-	-	5.21	-
Average	1.12	82.14	9.75	85.35	2.99	53.97	31.59	50.16	7.57	31.59	64.64	7.57	64.64

*: Medfly adult captured per trap per day

** : The last date of fruit harvesting.

In the untreated orchard, medfly population increased gradually from early August until mid November (CTD: 0.07-16.14), then the population decreased during the 2nd half of November (CTD: 5.21-9.36) because flies migrated from guava orchard to the neighbouring citrus orchards. In the same orchard, guava fruits infestation started at late August in the early ripening guava varieties (8.5 % - 12.5 %), then percentages of infestation increased sharply from early September until the last date of fruit harvesting (38.5 % - 100 %). It is considered that the highest rate of fruit infestation with medfly larvae (100 %) during the late weeks of fruit harvesting was due to the rapid build up of medfly population in early ripening guava varieties.

In the first treated orchard (which was treated with all treatments), medfly population increased slightly from early August to the 2nd week of November, where the "CTD" ranged between 0.03-2.04 and the reduction in adult population ranged between 57.14 % - 86.71 %. After last date of fruits harvesting and the treatment with flooding irrigation was conducted, reduction in adult population increased during November (84.79 % - 91.51 %).

In the same orchard, mechanical and chemical treatments had shown a great effect on medfly infestation, where the reduction in percentages of infestation ranged between 82.60 % - 89.00 %.

In the second treated orchard (gathering the infested fruits and flood irrigation), medfly population increased slightly from early August to the 1st week of November, where the "CTD" ranged between 0.07-6.00 and the reduction in adult population ranged between 42.00 % - 60.98 %. After the last date of fruits harvesting and the treatment of flooding irrigation was conducted, the reduction in adult population increased during November (67.18 % - 74.78 %).

In the same orchard, mechanical treatment (infested fruits gathering) had shown affected in medfly infestation, where the reduction in percentages of infestation ranged between 43.00 % - 54.55 %.

The second season (1998)

Data in Table 2 show the medfly catches per trap per day "CTD" as well as the percentages of fruits infestation at the two treated orchards and untreated one. The same table also shows percentages reduction in adult population and in fruits infestation at the two treated orchards.

Data indicated that the persistent of medfly adults in guava orchards was during

Table 2. Medfly population and percentages of infestation in guava orchards treated with mechanical, agricultural and chemical treatments at Kalubia Governorate, during 2nd season (1998).

Date of inspection	TREATED ORCHARDS										Untreated orchard	
	First orchard (Mechanical, agricultural and chemical treatments)					Second orchard [Mechanical (only infested fruits gathering) and agricultural treatments]					CTD	% Infestation
	CTD*	% Reduction in adult population	% Infestation	Reduction in percentage of infestation	CTD	% Reduction in adult population	% Infestation	Reduction in percentage of infestation	CTD	% Reduction in percentage of infestation		
5.8.1998	0.03	57.14	-	-	0.07	0.00	-	-	0.07	-	0.07	-
12.8	0.06	83.33	-	-	0.21	41.67	-	-	0.36	-	0.36	-
19.8	0.23	79.82	-	-	0.57	50.00	-	-	1.14	-	1.14	-
26.8	0.34	77.33	1.00	81.82	0.71	52.67	2.50	54.54	1.50	5.50	1.50	5.50
2.9	0.63	74.07	1.40	82.50	1.29	46.91	4.00	50.00	2.43	8.00	2.43	8.00
9.9	0.71	75.77	4.20	79.51	1.57	46.42	9.50	53.66	2.93	20.50	2.93	20.50
16.9	0.89	76.94	7.20	80.27	1.93	50.00	18.00	50.68	3.86	36.50	3.86	36.50
23.9	1.54	76.31	10.60	79.62	3.21	50.62	25.50	50.96	6.50	52.00	6.50	52.00
30.9	2.03	75.06	14.60	78.05	4.21	48.28	33.5	49.62	8.14	66.50	8.14	66.50
7.10	2.09	76.16	18.80	76.05	4.29	50.35	41.00	47.77	8.64	78.50	8.64	78.50
14.10	2.14	77.47	25.60	74.40	4.64	51.16	55.50	44.50	9.50	100.00	9.50	100.00
21.10	2.31	77.22	27.80	72.02	5.00	50.69	58.50	41.50	10.14	100.00	10.14	100.00
28.10	2.54	76.46	**	-	5.29	50.97	**	-	10.79	**	10.79	**
4.11	2.74	79.15	-	-	4.71	64.16	-	-	13.14	-	13.14	-
11.11	2.91	79.32	-	-	4.57	67.52	-	-	14.07	-	14.07	-
18.11	1.97	77.59	-	-	3.43	60.98	-	-	8.79	-	8.79	-
25.11	1.17	75.16	-	-	2.21	53.08	-	-	4.71	-	4.71	-
Average	1.43	76.14	12.35	78.27	2.81	49.15	27.56	49.25	6.25	51.94	6.25	51.94

*: Medfly adult captured per trap per day

**: The last date of fruit harvesting.

early August and fruits infestation with medfly larvae were noticed during the last week of August.

In the untreated orchard, medfly population increased gradually from early August until mid November (CTD: 0.07-14.07), then the population decreased during the 2nd half of November (CTD: 4.71-8.79) because medfly adults migrate from guava orchard to the neighbouring citrus orchards.

In the same orchard, guava fruits infestation started at the last week of August and early September in the early ripening guava varieties (5.50 % - 8.00 %), then percentages of infestation increased sharply from the 2nd week of September until the last date of fruits harvesting (20.50 % - 100.00 %). The highest rate of guava fruits infestation with medfly larvae (100.00 %) during the late weeks of fruits harvesting was due to that guava fruits are preferred host for medfly, suitable weather conditions prevailing during the period of ripening guava fruits and the build up of medfly population in early ripening guava varieties.

In the first treated orchard (which was treated with all treatments), medfly population increased slightly from early August to the 2nd week of November (CTD : 0.03-2.91) and the reduction in adult population ranged between 57.14 % - 83.33 %. After last date of fruits harvesting and the treatment with flooding irrigation was conducted, the reduction in adult population increased during November (75.16 % - 79.32 %).

In the same orchard, percentages of infestation ranged between 1.00 % - 27.80%. Mechanical and chemical treatments had shown a great effect on medfly infestation, where the reduction in percentages of medfly infestation ranged between 72.02 % - 82.50 %.

In the second treated orchard (gathering the infested fruits and flood irrigation), medfly population increased slightly - but more than the first orchard - from early August until the late of October, where the "CTD" ranged between 0.07-5.29 and the reduction in adult population ranged between 41.67 % - 52.67 %. After last date of fruits harvesting and the treatment of flooding irrigation was conducted, the reduction in adult population increased during November (50.97 % - 67.52 %).

In the same orchard, mechanical treatment (infested fruits gathering) had shown affected medfly infestation, where the reduction in percentages of infestation ranged between 41.50 % - 54.54 %. These results are in agreement with that obtained by Saafan (1998).

The results emphasizes the urgent need of medfly integrated control, specially in mixed orchards, on a large scale and allowver the year in medfly hosts sequence.

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المكافحة المتكاملة لذبابة فاكهة البحر المتوسط في حدائق الجوافة بمحافظة القليوبية

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تسبب ذبابة فاكهة البحر المتوسط خسائر كبيرة لثمار الجوافة بالإضافة إلى الخوخ والمشمش والمانجو والتين والموالج، .. وغيرها. وقد أجريت دراسات على مكافحتها بالرش الجزئي والأكياس القاتلة. وفي هذه الدراسة أجريت المكافحة المتكاملة (ميكانيكية، زراعية، كيميائية) في حديقة جوافة، وفي حديقة أخرى أجريت المكافحة الميكانيكية والزراعية فقط، وتركت حديقة جوافة ثالثة بدون أى معاملات للمقارنة. وقد أجريت الدراسة على مدار موسمين متتاليين ١٩٩٧، ١٩٩٨.

في الموسم الأول (١٩٩٧) تراوحت قيم الـ CTD (متوسط تعداد الذباب في اليوم الواحد للمصيدة الواحدة) ما بين ٠.٧ - ١٦.١٤ ذبابة وتراوحت نسبة الإصابة في ثمار الجوافة ما بين ٨,٥% - ١٠٠% وذلك في حديقة الجوافة غير المعاملة، بينما تراوحت قيم الـ CTD ما بين ٠.٣ - ٢.١٤ و ٠.٧ - ٦.٠٠ ذبابة، وتراوحت نسبة الإصابة ما بين ٨,٠٠% - ٢١,٤٠% و ٤,٠٠% - ٥٧,٠٠%، وتراوحت نسبة الخفض في تعداد الذبابة ما بين ٥٧,١٤% - ٩١,٥١% و ٤٢,٠٠% - ٧٤,٧٨%، وتراوحت نسبة الخفض في الإصابة في ثمار الجوافة ما بين ٨٢,٦٠% - ٨٩,٠٠% و ٤٣,٠٠% - ٥٣,٣٧% وذلك في حديقتي المعاملات على التوالي.

وفي الموسم الثاني (١٩٩٨) تراوحت قيم الـ CTD ما بين ٠.٧ - ١٤.٠٧ ذبابة وتراوحت النسبة المثوية للإصابة في ثمار الجوافة ما بين ٥,٥٠% - ١٠٠% وذلك في حديقة الجوافة غير المعاملة، بينما تراوحت قيم الـ CTD ما بين ٠.٣ - ٢,٩١ و ٠.٧ - ٥,٢٩ ذبابة، وتراوحت نسبة الإصابة في الثمار ما بين ٨,٠٠% - ٢٧,٨٠% و ٢,٥٠% - ٥٨,٥٠% وتراوحت نسبة الخفض في تعداد الذباب ما بين ٥٧,١٤% - ٨٣,٣٣% و ٤١,٦٧% - ٦٧,٥٢%، كما تراوحت نسبة الخفض في الإصابة في ثمار الجوافة ما بين ٧٢,٠٢% - ٨٢,٥٠% و ٤١,٥٠% - ٥٤,٤٠% وذلك في حديقتي المعاملات على التوالي.