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

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*Abstract*

Medfly population and rate of fruit infestation were studied in three apricot orchards at Kalubia governorate during one season, 1995. In the same three apricot orchards, integrated control was carried out during the two successive seasons, 1996 and 1997.

In the 1st apricot orchard (surrounding by about five hundred citrus feddans), medfly male catches per trap per day " CTD" was ranged between 0.03 to 19.63, and percentages of fruit infestation ranged between 23.30% to 100% during the season before treatments (1995). Percentages reduction in adult population ranged between 21.43% to 87.75% and 35.71% to 86.75% and percentages reduction in fruit infestation ranged between 18.07% to 69.10% and 9.89% to 46.78% during the two treatments seasons (mechanical, horticultural and chemical), respectively.

In the 2nd apricot orchard (surrounding by apricot and citrus orchards), the "CTD" was between 0.03 and 12.46 and percentages of fruit infestation were between 2.10% and 18.70% during the season before treatments (1995). Percentages reduction in adult population ranged between 63.64% to 86.0% and 63.64% to 88.00%, and percentages reduction in fruit infestation ranged between 71.43% to 75.40% and 71.43% and 78.61% during the two treatment seasons, respectively.

In the 3rd apricot orchard (surrounding by about seven hundred apricot feddans), the "CTD" ranged between 0.03 to 0.83 and percentages of fruit infestation ranged between 0.10% to 0.90% during the season before treatments (1995). Percentages reduction in adult population ranged between 17.65% to 62.65% and 27.28% to 65.06%, and percentages reduction in fruit infestation ranged between 22.22% to 40.00% and 33.33% to 60.00% during the two treatment seasons, respectively.

## INTRODUCTION

The Mediterranean fruit fly, *Ceratitis capitata* is widely distributed allover several ecological regions and infests wide range of fruit species. In Egypt, *C.capitata* was reported ninety years ago (Compere, 1912 and El-Ghawabi, 1928).

This pest causes considerable damage which inflicts significantly economic losses to peach, apricot, guava, mango, fig and citrus allover the governorates of Egypt (Awadallah *et al.*, 1974 and Saafan, 1986). 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.*, 1987), yet it need more study in this way. Therefore, the aim of the present study is to evaluate the effect of integrated control (mechanical, horticultural and chemical) on medfly in apricot orchards.

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

## MATERIALS AND METHODS

Studies were carried out throughout the three successive seasons, 1995-1997 from early April to late July for each season., to evaluate the effect of integrated pest management; mechanical, horticultural and chemical treatments on the reduction of medfly infestation in apricot orchards at Kalubia governorate.

### Season before treatments (1995)

Three apricot orchards were chosen represent the status of situation of apricot orchards as follow: The first orchard (eighty apricot trees) surrounding by five hundred citrus feddans at Benha district, the second one (seventy apricot trees) neighbouring by apricot and citrus orchards at Tokh district, and the third one (about one hundreed apricot trees) surrounding by seven hundred apricot feddans at Tokh district.

To study medfly population fluctuation, five Jackson sticky traps (Harris *et al.*, 1971) were baited weekly with trimedlure and distributed in each chosen apricot orchard from early April to late July. Traps were insepected weekly and catches were counted and the sticky inserts were substituted. Mean catches per trap per day "CTD" was calculated and recorded.

Rate of apricot fruit infestation were conducted from early May to the last date of fruit harvesting. One thousand apricot fruits (fallen or gathered from trees) from each orchard were examined weekly and percentages of fruits infestation were estimated.

**Treatments during seasons (1996 and 1997)**

**The 1st orchard** During the two successive seasons, April-July, 1996 and 1997, mechanical, horticultural and chemical treatments were carried out as follow:

**Mechanical treatments**

**A. Fruit burrying:** During March and April, citrus infested fallen fruits were burried at the neighbour citrus orchards. From early May - where the early ripening apricot varieties-burrying of apricot infested fallen fruits were conducted daily.

**B. Mass trapping:** From early May, forty McPhail traps (McPhail *et al.*, 1963) were baited with 10% Buminal (protein hydrolyzate) and distributed on the border trees of apricot orchard. Intensive traps on the external rows trapped migrated medfly from neighbouring citrus orchards.

**Horticultural treatments**

Flooding irrigation was conducted to neighbour citrus orchards as soon as harvesting of fruits was ended. The same trial was conducted in apricot orchards.

**Chemical treatments**

**A. Bait spray:** From the 2nd week of May, bait spray was applied on trunks of apricot trees using a mixture of 1/2 L. Actellic + 2 L. Buminal + 17.5 L. water. Knapsack sprayer (20 L. capacity) was used and each tree required 200 ml. of the mixture. Three sprays were applied (every ten days) during each season.

**B. Killing bags:** Killing bags (described by Saafan *et al.*, 1993) as a specific method of chemical control was used during the 2nd week of May. The bags were dipped in the previous mixture mentioned before in bait spray and hanged on apricot trees at a rate of one bag per tree. The bags were saturated with the mixture every two days.

**The 2nd orchard:** The same previously treatments applied in the 1st orchard were applied in the 2nd one during the two seasons (1996 and 1997).

**The 3rd orchard:** Fruit burrying only was conducted as a mechanical treatment and heavy irrigation as a horticultural treatment were applied in the 3rd apricot orchard during the two seasons (1996 and 1997).

## RESULTS AND DISCUSSION

Medfly population, represented by the mean catches per trap per day "CTD" and percentages of apricot fruit infestation were studied in three apricot orchards at Kalubia governorate throughout the three successive seasons; 1995-1997. Study during the 1st season (1995) was conducted without any control treatments, but the integrated control was applied through the next two seasons; 1996 and 1997.

**The 1st orchard**

From early May, medfly adults migrate from summer citrus orchards to the neighbouring apricot orchards, to infest their early ripening apricot fruits. This early infestation on apricot fruit develop a new generation which attack the mature apricot fruits during late May and June.

Data in Table 1 indicate that medflies started to visit apricot orchards during the 3rd week of April (CTD: 0.03) throughout the three successive seasons.

During the season before treatments (1995), medfly population increased gradually until the 4th week of May (CTD: 0.14-2.63), then increased suddenly during June (CTD: 16.43-19.63). Medfly population decreased during late July, 1995, because the flies migrate from apricot orchard to the neighbouring host plants (peach and mango) (CTD: 11.06-1.51). During the same season (1995), apricot fruit infestation started at the 2nd week of May in the early ripening apricot varieties (23.30%), then percentages of infestation increased sharply from the 3rd week of May until the last date of fruits harvesting (41.10% - 100.00%). 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 apricot varieties.

Data in Table 1 show the effect of mechanical treatments (fruit burrying and mass trapping), horticultural practices (heavy irrigation) and chemical treatments (bait spray and killing bags) on reduction of medfly adults and percentages of medfly larval infestation during the two successive seasons; 1996 and 1997. Throughout the 1st season (1996), medfly population increased slightly during the period from the 4th week of April to the 2nd week of June, where the CTD ranged between 0.11-13.00 and reduction in adult population ranged between 21.43-52.63%. After the last date of fruit harvesting and the heavy irrigation was conducted, reduction in adult population increased during the 3rd week of June to the 3rd week of July (71.81-84.77).

Table 1. Medfly population and percentages of infestation in the first apricot orchard treated with mechanical, horticultural and chemical treatments at Kalubia Governorate during 1995, 1996 and 1997 seasons.

| Date of inspection | | Season before treatments | | Treatments seasons | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | First season (1996) | | | | Second season (1997) | | | |
| Month | week | CTD* | % Infestation | CTD | % Reduction in adult population | % Infestation | Reduction in percentages of infestation | CTD | % Reduction in adult population | % Infestation | Reduction in percentages of infestation |
| April | 1st | 0.0 | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | - | - |
| | 2nd | 0.0 | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | - | - |
| | 3rd | 0.03 | - | 0.03 | 0.0 | - | - | 0.03 | 0.0 | - | - |
| | 4th | 0.14 | - | 0.11 | 21.43 | - | - | 0.09 | 35.71 | - | - |
| May | 1st | 0.26 | - | 0.14 | 46.15 | - | - | 0.14 | 46.15 | - | - |
| | 2nd | 0.43 | 23.30 | 0.23 | 46.51 | 7.20 | 69.10 | 0.26 | 39.53 | 12.40 | 46.78 |
| | 3rd | 1.14 | 41.10 | 0.54 | 52.63 | 20.00 | 51.34 | 0.60 | 47.37 | 30.70 | 25.30 |
| | 4th | 2.63 | 67.50 | 1.34 | 49.05 | 55.30 | 18.07 | 1.43 | 45.63 | 61.50 | 8.89 |
| June | 1st | 16.43 | 100.00 | 9.03 | 45.04 | 100.00 | 0.0 | 8.71 | 46.99 | 100.00 | 0.00 |
| | 2nd | 18.57 | 100.00 | 13.00 | 29.99 | 100.00 | 0.0 | 13.46 | 27.52 | 100.00 | 0.00 |
| | 3rd | 18.94 | ** | 5.34 | 71.81 | ** | - | 4.34 | 77.09 | ** | - |
| | 4th | 19.63 | | 2.91 | 85.18 | | - | 2.77 | 85.89 | | - |
| July | 1st | 11.06 | | 1.83 | 83.45 | | - | 1.66 | 84.99 | | - |
| | 2nd | 4.80 | | 0.60 | 87.75 | | - | 0.66 | 86.25 | | - |
| | 3rd | 1.51 | | 0.23 | 84.77 | | - | 0.20 | 86.75 | | - |

* CTD : Medfly adult captured per trap per day.

** : The last date of fruit harvesting.

In the same season (1996), mechanical and chemical treatments had shown affected medfly infestation during the early two weeks of fruit harvesting, where the reduction in percentages of infestation ranged between 51.34% and 69.10%, although these treatments were very slow affected on fruit infestation during the next three weeks (0.0% - 18.7%). During the 2nd treatment, season (1997), medfly population was affected slightly by mechanical and chemical treatments which conducted through the period from early May till the last date of fruit harvesting, where the reduction in adult population ranged between 27.52% and 47.37%, while after horticultural treatment was applied, medfly population reduced by 77.09% - 86.75%.

As a result for treatments control, slightly reduction in percentages of infestation during the early two weeks of fruit harvesting (25.30% - 46.78%), while during the next three weeks, treatments control were useless, where reduction in percentages of fruit infestation was 0.0% - 8.89%.

The final solution for medfly outbreak in this apricot orchard was the removal of apricot trees because it became source of medfly production, then the flies migrate to the next neighbouring host plants.

**The 2nd orchard**

Table 2 show medfly male catches per trap per day "CTD", percentages of infestation and reduction in adult population during the three successive seasons; 1995-1997 from 1995 to 1997.

During the season before treatments (1995), " CTD" ranged between 0.03 to 7.26 through the period from 4th week of April to 2nd week of June. After the last date of fruit harvesting, the "CTD" ranged between 1.11 to 12.46. In the same season, percentages of fruit infestation ranged between 2.10% to 18.70%.

During the 1st treatment season (1996), where mechanical, chemical and horticultural treatments were conducted, medfly population was reduced during the fruit existence (CTD: 0.03-2.40) and percentages reduction in adult population ranged between 63.64% to 72.19%. After last date of fruit harvesting, percentages reduction in adult population increased as a result of horticultural treatment (71.81% - 86.06%). Fruit infestation affected by mechanical and chemical treatments which conducted through May, where reduction in percentages of infestation ranged between 65.38% and 75.40%.

Table 2. Medfly population and percentages of infestation in the second apricot orchard treated with mechanical, horticultural and chemical treatments at Kalubia Governorate during 1995, 1996 and 1997 seasons.

| Date of inspection | | Season before treatments | | Treatments seasons | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | First season (1996) | | | | Second season (1997) | | | |
| Month | week | CTD* | % Infestation | CTD | % Reduction in adult population | % Infestation | Reduction in percentages of infestation | CTD | % Reduction in adult population | % Infestation | Reduction in percentages of infestation |
| April | 1st | 0.0 | | 0.0 | - | - | - | 0.0 | | - | - |
| | 2nd | 0.0 | | 0.0 | - | - | - | 0.0 | | - | - |
| | 3rd | 0.0 | | 0.0 | - | - | - | 0.0 | | - | - |
| | 4th | 0.03 | | 0.03 | 0.0 | - | - | 0.03 | 0.0 | - | - |
| May | 1st | 0.11 | | 0.04 | 63.64 | - | - | 0.04 | 63.64 | - | - |
| | 2nd | 0.23 | 2.10 | 0.08 | 65.22 | 0.60 | 71.43 | 0.07 | 69.57 | 0.60 | 71.43 |
| | 3rd | 0.94 | 5.20 | 0.32 | 65.96 | 1.80 | 65.38 | 0.27 | 71.28 | 1.50 | 71.15 |
| | 4th | 1.69 | 9.40 | 0.47 | 72.19 | 2.90 | 69.15 | 0.49 | 71.01 | 2.10 | 77.66 |
| June | 1st | 5.09 | 13.50 | 1.52 | 70.14 | 3.90 | 71.11 | 1.41 | 72.30 | 3.20 | 76.30 |
| | 2nd | 7.26 | 18.70 | 2.40 | 66.94 | 4.60 | 75.40 | 2.10 | 71.07 | 4.00 | 78.61 |
| | 3rd | 10.89 | ** | 3.07 | 71.81 | ** | - | 2.80 | 74.29 | ** | - |
| | 4th | 12.46 | | 2.40 | 80.73 | - | | 2.03 | 83.71 | - | - |
| July | 1st | 11.17 | | 1.57 | 82.97 | - | | 1.34 | 88.00 | - | - |
| | 2nd | 5.31 | | 0.74 | 86.06 | - | | 0.65 | 87.76 | - | - |
| | 3rd | 1.11 | | 0.20 | 81.98 | - | | 0.14 | 87.39 | - | - |

* CTD : Medfly adult captured per trap per day.

** : The last date of fruit harvesting.

Throughout the 2nd treatment season (1997), percentages reduction in adult population ranged between 63.64% and 72.30% during the period from 1st week of May until 2nd week of June. Percentages reduction in adult population increased after horticultural treatment (74.29% - 88.00%).

Table 2 show that the infestation in apricot fruits were observed from 2nd week of May (0.60%) and the infestation increased slightly till the last date of fruit harvesting (1.50% - 4.00 %). Reduction in percentages of infestation were noticed during the fruit harvesting (71.15% - 78.61 %).

For the second apricot orchard (neighbouring by apricot and citrus orchards), the applying of mechanical treatments (fruit burrying and mass trapping), chemical treatments (bait spray and killing bags), and horticultural treatment (heavy irrigation) gave satisfactory control of medfly *Ceratitis capitata*.

**The 3rd orchard**

This apricot orchard surrounded by seven hundred apricot feedans, was treated by mechanical treatment (fruit burrying only) and horticultural treatment (heavy irrigation) during the two successive seasons (1996 and 1997).

The data in Table 3 show male medfly catches per trap per day "CTD" as well as the percentages of fruit infestation during the three successive seasons; 1995-1997, and percentages reduction in adult population and in fruit infestation during the two seasons; 1996 and 1997. Data indicated that medfly population was lower than the two previously apricot orchards through the three successive seasons.

During the season before treatments (1995), "CTD" ranged between 0.03 and 0.26 through the period from 1st week of May to last date of fruit harvesting, while it increased sharply from the 4th week of June to the 2nd week of July (CTD: 0.49-0.83). During the same season, apricot fruit infestation started at the 3rd week of May (0.10%), then the infestation increased slowly, but gradually till the last date of fruit harvesting (0.10% - 0.90%).

During the 1st season (1996), medfly population decreased slightly during the period from the 4th week of May till the last date of fruit harvesting, where the percentages reduction in adult population were 18.18% - 26.09%. After agricultural treatment was conducted, percentages reduction in medfly population increased (30.00% - 62.65%). Reduction in percentages of infestation ranged between 22.22% and 40.00%.

Table 3. Medfly population and percentages of infestation in the third apricot orchard treated with mechanical, and horticultural treatments at Kalubia Governorate during 1995, 1996 and 1997 seasons.

| Date of inspection | | Season before treatments | | Treatments seasons | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | First season (1996) | | | | Second season (1997) | | | |
| Month | week | CTD* | % Infestation | CTD | % Reduction in adult population | % Infestation | Reduction in percentages of infestation | CTD | % Reduction in adult population | % Infestation | Reduction in percentages of infestation |
| April | 1st | 0.0 | - | | - | - | - | 0.0 | - | - | - |
| | 2nd | 0.0 | - | | - | - | - | 0.0 | - | - | - |
| | 3rd | 0.0 | - | | - | - | - | 0.0 | - | - | - |
| | 4th | 0.0 | - | | - | - | - | 0.0 | - | - | - |
| May | 1st | 0.03 | - | 0.03 | 0.0 | - | - | 0.03 | 0.0 | - | - |
| | 2nd | 0.03 | - | 0.03 | 0.0 | - | - | 0.03 | 0.0 | - | - |
| | 3rd | 0.05 | 0.10 | 0.05 | 0.0 | 0.10 | 0.0 | 0.03 | 40.00 | 0.10 | 0.0 |
| | 4th | 0.11 | 0.10 | 0.09 | 18.18 | 0.10 | 0.0 | 0.08 | 27.28 | 0.10 | 0.0 |
| June | 1st | 0.17 | 0.50 | 0.14 | 17.65 | 0.30 | 40.0 | 0.11 | 35.29 | 0.20 | 60.00 |
| | 2nd | 0.23 | 0.70 | 0.17 | 26.09 | 0.50 | 28.57 | 0.14 | 39.13 | 0.40 | 42.86 |
| | 3rd | 0.26 | 0.90 | 0.20 | 23.08 | 0.70 | 22.22 | 0.17 | 34.62 | 0.60 | 33.33 |
| | 4th | 0.49 | ** | 0.29 | 40.82 | ** | - | 0.26 | 46.94 | ** | - |
| July | 1st | 0.83 | | 0.31 | 62.65 | | - | 0.29 | 65.06 | | - |
| | 2nd | 0.51 | | 0.23 | 54.90 | | - | 0.26 | 49.02 | | - |
| | 3rd | 0.20 | | 0.14 | 30.00 | | - | 0.11 | 45.00 | | - |

* CTD : Medfly adult captured per trap per day.

** : The last date of fruit harvesting.

Throughout 2nd season (1997), agricultural treatment reduced the population to 27.28% - 40.00% and 45.00%-65.06% during fruit existance and after the last date of fruit harvesting, respectively.

Reduction in percentages of infestation ranged between 33.33% and 60.00%. Results in the 3rd apricot orchard appeared that in a main plantation of a single medfly host resulted in low infestation than area of a mixed hosts, certainly it didn't need chemical control, yet agricultural and mechanical control were enough.

The results emphasizes the urgent need of medfly integrated control, specially in mixed orchard, and partly in big area of single host, but it is useless to achieve any control to apricot orchard surrounded by summer citrus.

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# المكافحة المتكاملة لذبابة الفاكهة في حدائق المشمش بمحافظة القليوبية

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معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقى - الجيزة .

تسبب ذبابة فاكهة البحر المتوسط خسائر فادحة لثمار المشمش بالاضافة إلي الخوخ والجوافة والمانجو والتين والموالح وغيرها ... وقد أجريت دراسات علي مكافحتها بالرش الجزئي والأكياس القاتلة. في هذه الدراسة تم دراسة تذبذب تعداد ذبابة الفاكهة وتقدير نسبة الإصابة في ثمار المشمش في ثلاثة حدائق مختلفة الموقع وذلك لمدة موسم واحد (١٩٩٥)، وفي الموسمين التاليين (١٩٩٦ ، ١٩٩٧) تم إجراء المكافحة المتكاملة (ميكانيكية، زراعية، كيماوية) لذبابة الفاكهة في الثلاث حدائق المختارة سابقا.

- حديقة المشمش الأولي - تقع وسط حوالي ٥٠٠ فدان موالح - تراوح متوسط تعداد الذبابة في اليوم الواحد للمصيدة الواحدة للمصيدة الواحدة CTD ما بين ٠,٠٣ - ١٩,٦٣ ، وتراوحت نسبة الإصابة في ثمار المشمش ٢٣,٣٠ ٪ - ١٠٠٪ وذلك في موسم ما قبل المعاملات (١٩٩٥)، بينما في موسمي المعاملات (ميكانيكية ، زراعية، كيماوية) (١٩٩٦ ، ١٩٩٧) تراوحت نسبة الخفض في تعداد الذبابة ٢١,٤٣٪ - ٨٧,٧٥٪، ٣٥,٧١٪ - ٨٦,٧٥٪، وتراوحت نسبة الخفض في الاصابة في ثمار المشمش ١٨,٠٧٪ - ٦٩,١٠٪، ٨,٨٩٪، - ٤٦,٧٨٪ علي التوالي.

- الحديقة الثانية - محاطة بحدائق مشمش وموالح - تراوحت قيم الـ CTD ٠,٠٣ - ١٢,٤٦ وتراوحت نسبة الاصابة في الثمار ٢,١٠٪ - ٧١,٧٠٪ وذلك خلال موسم ما قبل المعاملات (١٩٩٥)، بينما تراوحت نسبة الخفض في تعداد الذبابة ٦٣,٦٤٪ - ٨٦,٠٦٪، ٦٣,٦٤٪ - ٨٨,٠٠٪ كما تروحت نسبة الخفض في الاصابة ٧١,٤٣٪ - ٧٥,٤٠٪ ، ٧١,٤٣٪ - ٧٨,٦١٪ وذلك خلال موسمي المعاملات (ميكانيكية، زراعية، كيماوية) علي التوالي.

- الحديقة الثالثة - محاطة بحوالي ٧٠٠ فدان مشمش - تراوحت قيم الـ CTD ٠,٠٣ - ٠,٨٣، وتراوحت نسبة الاصابة في الثمار ما بين ٠,١٠٪ - ٠,٩٠٪ وذلك خلال موسم ما قبل المعاملات (١٩٩٥)، وتراوحت نسبة الخفض في تعداد الذبابة ١٧,٦٥ ٪ - ٦٢,٦٥٪ ، ٢٧,٢٨٪ - ٦٥,٠٦٪، كما تراوحت نسبة الخفض في الاصابة ٢٢,٢٢٪ - ٤٠,٠٠٪ ، ٣٣,٣٣٪ - ٦٠,٠٠٪ وذلك خلال موسمي المعاملات (ميكانيكية، زراعية) علي التوالي.