

**ECOLOGICAL STUDIES OF FLIES ON DIFFERENT HOSTS AT
FAYOUM GOVERNORATE
3- ECOLOGICAL STUDIES OF MEDITERRANEAN FRUIT FLY,
Ceratitis capitata (Wied.) AND PEACH FRUIT FLY,
Bactrocera zonata (Saund.) IN APRICOT ORCHARDS**

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(Manuscript received 12 December 2004)

Abstract

The population dynamics of Mediterranean fruit fly (MFF), *Ceratitis capitata* (Wied.) and Peach fruit fly (PFF), *Bactrocera zonata* (Saund.) were studied in apricot orchards at Sinuris and Ibshaway districts, Fayoum Governorate, Egypt during the two successive seasons 2003 and 2004. In the mean time, rate of infestation in apricot fruits with MFF & PFF together and separately were estimated. During the two successive seasons, MFF population was low compared with PFF population. Captured per trap per day "CTD" for MFF ranged between 0.1-8.4 flies with mean of 2.4 flies, and between 0.0-1.05 flies with mean of 0.42 fly, during the two successive seasons, respectively. "CTD" of PFF ranged between 12.2-133.9 flies with mean of 54.2 flies and between 7.00-23.57 flies with mean of 13.16 flies during the two successive seasons, respectively.

Total percentages of infestation with MFF & PFF together at apricot locations ranged between 6.99 % - 22.17 % with mean of 15.00 % and between 8.40 % - 11.67 % with mean of 9.86 %, during the two successive seasons, respectively. Percentages of infestation with MFF separately ranged between 0.18 % - 5.85 %, with mean of 2.24 % and between 0.46 % - 0.76 % with mean of 0.64 %, during the two successive seasons, respectively. Percentages of infestation with PFF separately ranged between 6.81 % - 19.93 % with mean of 12.76 %, and between 7.64 % - 11.13 % with mean of 9.22 % during the two successive seasons, respectively.

INTRODUCTION

The Mediterranean fruit fly, *Ceratitis capitata* (Wied.) (Diptera : Tephritidae) is a major pest all over the world for as many as 200 tropical and subtropical fruit species (Christenson and Foote, 1960). In the Mediterranean basin, the pest attacks citrus, deciduous fruits (mainly stone fruits) and other cultivated hosts. In Egypt, the Medfly was first recorded at the northern coast of the Mediterranean Sea (Compere, 1912).

The pest causes considerable damage which inflicts significantly economic losses to peach, apricot, guavà, mango, fig and citrus all over the governorates of Egypt (Awadallah *et al.*, 1974 and Saafan *et al.*, 1989).

During 90's of the last century, the Egyptian ecosystem was attacked by one of the most harmful pest, the peach fruit fly, *Bactrocera zonata* (Saunders), to be a new record in the north of Africa. Peach fruit fly was previously recorded in Egypt in 1924 (Efflatoun, 1924), but it hasn't any distribution before 90's of 20 Century. Peach fruit fly (PFF) infested different fruit and vegetable hosts (*e.g.* mango, peach, fig, guava, apple, citrus, tomato, ... etc.). El-Minshawy *et al.* (1999) mentioned that larvae of *Bactrocera zonata* was found seriously damaging guava fruits in Alexandria.

Awadallah (1978) carried out ecological studies on medfly at Fayoum governorate, to determine the seasonal abundance of MFF and population estimation of the wild flies existing in the area. He used Di-ammonium phosphate in McPhail traps for studying population dynamics. He mentioned that, "CTD" in Sinuris district ranged between 0.68-5.32 flies during the period 2/7/1975 - 14/1/1976. In the same period, "CTD" in Ibshaway district ranged between 0.08 - 17.33 flies.

Saafan and taadros (1996) carried out an ecological studies on the medfly in apricot orchards in relation to neighbouring citrus orchards. They found that trap catches indicated that medfly population was higher in Summer citrus orchards than in apricot orchards through the period from early March to mid-May / early June, then adults migrate to apricot orchards giving rise to high population until late July. The percentages of larval infestation in apricot orchards were higher in those near to citrus orchards than in far away ones during the three successive seasons.

In India, Gupta *et al.* (1990) studied the seasonal fluctuation of *B. zonata* and *B. dorsalis* in semi-isolated peach, plum and apricot orchards in 1986-87. Traps baited with methyl eugenol and malathion captured males of the two species from the 2nd week of April until the 2nd week of November during both years. In 1986, peak adult activity occurred during the 3rd week of June on apricot, 4th week of June on plum and the 2nd week of July on peach. Similar trend occurred in 1987, however, the maximum catch on peach occurred during the 3rd week of June. Rana *et al.* (1992) mentioned that the greatest infestations of *B. zonata* were recorded in the orchard when the temperature and relative humidity was 26-30°C and 70-75 % R.H., respectively.

Ahmed (2000) studied the population dynamics of peach fruit fly in different plant hosts in kalubia governorate. He found that the "CTD" of PFF ranged between 2.3-114.3 flies on mango plantation during the period from 10/5/1999 to 1/1/2000.

Hashem *et al.* (2001) investigated the distribution of MFF and PFF in four different orchards in Kalubia governorate during two fruiting seasons (1998-1999). The population fluctuation, as measured by weekly mean catches of male flies in Jackson traps baited with trimedlure and methyl-eugenol increased gradually with fruiting and ripening, where the peak of infestation in mango and apple orchards occurred in July for both flies. The highest infestation of MFF and PFF in citrus (mandarin) was in November/ December.

Mohammed (2003) mentioned that the seasonal abundance of *B. zonata* for two successive years by using McPhail traps baited with Di-ammonium phosphate 3 %, reached 73.80 and 24.79 flies at weekly intervals in Fayoum governorate.

The aim of the present study is to gain sufficient information about :

- Population dynamics of medfly (MFF) and peach fruit fly (PFF) on apricot plantation at Sinuris and Ibshaway districts, Fayoum Governorate during the two successive seasons, 2003 and 2004.
- Percentages of infestation with MFF & PFF together and with MFF and PFF separately in apricot fruits.

The present investigation is one of a serial investigations carried out on mango plantation (very high population of PFF), on citrus plantation (low population of PFF), and on apricot plantation (medium population of PFF).

MATERIALS AND METHODS

Studies were carried out in apricot plantations at Sinuris & Ibshaway districts, Fayoum governorate during the two successive seasons, 2003 and 2004.

A- Population studies :

Eight and three apricot locations (orchards) were chosen at Sinuris & Ibshaway districts during the 1st and 2nd seasons, respectively.

To study MFF and PFF population fluctuation, Jackson sticky traps (Harris *et al.*, 1971) baited with trimedlure (pheromone of MFF), and another Jackson traps baited with methyl eugenol (pheromone of PFF) were distributed in the chosen apricot orchards at a rate of one trap for MFF and one trap for PFF per one location. Traps

were inspected weekly, replaced the sheets, and replenished by pheromone and counted the captured male flies. Mean catch per trap per day "CTD" calculated and recorded to compare between population fluctuation of MFF and PFF.

B- Fruit incubation and rate of infestation :

Because symptoms of infestation by MFF or PFF can't be detected separately, the following procedures were conducted :

In every location, five apricot trees were chosen randomly and fruits on every chosen tree were counted. Fallen fruits were gathered weekly from the chosen orchards and checked for infestation.

Every two weeks, fallen fruits were transferred to laboratory for incubation in a special wood cages. The produced pupae from the incubated fallen fruits were counted and reserved in plastic tube until emergence. The emerged flies were identified to MFF (males and females) and PFF (males and females).

The percentages of infestation in apricot fruits with the two flies (MFF & PFF) can be estimated depending on the whole counted fruits on the determined trees and the infested fallen fruits.

Now, we had the total percentages of infestation with MFF & PFF together, but how can we estimate percentages of infestation with every fly separately (MFF or PFF)

The data obtained from incubation fallen fruits were :

- Number of emerged adults of MFF and (or) number of emerged adults of PFF **(B)**.
- Total percentages of infestation with MFF & PFF together **(C)**.
- Total number of emerged adults (MFF & PFF together) **(D)**.
- To estimate the percentages of infestation with MFF or PFF separately **(A)** we applied the following equation :

$$A = \frac{B \times C}{D}$$

Degrees of temperature and relative humidity for Fayoum governorate were obtained from Central Laboratory for Agricultural Climate, ARC, and the correlation coefficient between "CTD" values for MFF and PFF and degrees of temperature and relative humidity during population dynamics studies period on apricot plantation were carried out.

RESULTS AND DISCUSSION

A- Population fluctuation :

Population fluctuation for MFF & PFF represented by the mean male catch per trap per day "CTD" was studied on apricot plantation in Sinuris and Ibshaway districts during the two successive seasons, 2003 and 2004.

1) The first season (2003) :

* MFF population fluctuation :

Data in Table1 indicate that, MFF was very low compared to PFF population. Mean "CTD" was between 0.1-8.4 flies with a mean of 2.4 flies during checking periods. It is noticed that the highest mean of "CTD" was at the mid-June, while the lowest mean of "CTD" was during April (0.1-0.5 fly).

* PFF population fluctuation :

Data in Table 1 show that PFF population was very high during the whole period of study. Means of "CTD" ranged between 12.2-133.9 flies, with mean of 54.2 flies. The highest population occurred during June and July (CTD: 90.2-133.9 flies), while the lowest population was at May (CTD: 12.2-21.8 flies).

Table 1 also shows that the correlation coefficient between values of "CTD" of MFF and temperatures was positively significant, while it was negatively insignificant with relative humidity. For PFF, it was positively.

Table 1. Mean numbers of males per trap per day "CTD" for Mediterranean fruit fly (MFF) and Peach fruit fly (PFF) by pheromone traps distributed in apricot orchards at Sinuris and Ibshaway districts, Fayoum Governorate, during the two successive seasons, 2003 and 2004.

Date of inspection		2003 season				2004 season			
Month	Week	MFF	PFF	Average of		MFF	PFF	Average of	
				Temp. (°C)	R.H. (%)			Temp. (°C)	R.H. (%)
April	1 st	0.5	23.4	27.0	53.0	-	-	-	-
	2 nd	0.1	20.6	22.0	56.5	0.33	23.57	21.5	51.1
	3 rd	0.1	19.1	23.5	54.5	0.07	10.88	21.8	51.4
	4 th	0.1	17.9	24.0	47.5	0.09	11.41	22.3	48.4
May	1 st	0.5	15.7	27.5	52.0	0.00	8.57	27.5	51.5
	2 nd	0.3	12.2	30.0	55.0	0.14	8.62	29.5	52.0
	3 rd	0.7	13.9	29.0	52.0	0.00	7.14	29.1	51.5
	4 th	1.9	21.8	30.5	46.0	0.76	7.00	35.4	48.0
June	1 st	6.5	107.3	30.5	52.5	0.42	13.09	25.7	52.7
	2 nd	8.4	90.2	30.5	52.0	1.05	14.56	26.8	51.4
	3 rd	4.4	106.3	32.0	53.0	0.93	18.21	30.1	51.8
	4 th	4.2	122.3	32.0	53.0	0.78	21.74	28.8	51.5
July	1 st	3.1	133.9	21.0	53.0	-	-	-	-
Mean		2.4	54.2			0.42	13.16		
MFF "r"				0.637	-0.046			0.424	-0.029
PFF "r"				0.684	0.115			-0.349	0.262

insignificant between "CTD" values and the degrees of temperature, and it was positively significant with R.H. %.

2) The second season (2004) :

* MFF population fluctuation :

Data in Table 1 show that the comparison between captured MFF population during the two successive seasons illustrate that MFF population during the 2nd season was low compared to the 1st season. In the same time, MFF population was low compared to PFF population. Mean of "CTD" ranged between 0.0-1.05 flies, with high mean of 0.42 fly during the checking periods. The highest population was during end of May until end of June, where the mean of "CTD" was between 0.42-1.05 flies, while the lowest population occurred during the 3rd week of April until the 3rd week of May (CTD : 0.0-0.14 fly).

*** PFF population fluctuation :**

Data in Table 1 indicate that PFF population was high compared to MFF population. In the same time, PFF population was low during the 2nd season than that of the 1st season. Mean "CTD" was between 7.00-23.57 flies, with high mean of 13.16 flies during the checking periods. The high population occurred during the 2nd week of April (CTD : 23.57 flies), and also during June (CTD: 13.09-21.74 flies), while the lowest population occurred during the 3rd week of April until the 4th week of May (CTD : 7.00-11.41 flies).

The same table also shows the correlation coefficient between values of "CTD" of MFF and temperatures was positively insignificant, while it was negatively insignificant with relative humidity. For PFF, it was negatively insignificant between "CTD" values and the degree of temperature, and it was positively insignificant with R. H. %.

B- Rate of infestation :**1) The first season (2003) :**

Table 2 illustrates data about incubation of fallen apricot fallen fruits. Total number of fruits on five trees at the six locations were 34000 fruits, and the total number of fallen fruits were 4816 fruits. Total percentages of infestation for the six locations ranged between 6.99 % - 22.17 %, with mean of 15.00 %. Total number of produced pupae were 2541 pupae, and total number of emerged flies were 1692 flies, with mean of percentages of emergence (66.6 %). Total number of MFF and PFF adults were 227 and 1465 flies, respectively.

Table 3 clarifies the percentages of infestation with MFF & PFF together, and the emerged flies. Total percentages of infestation with MFF and PFF flies together ranged between 6.99 % - 22.17 %, with mean of 15.00 %. Percentages of infestation with MFF ranged between 0.18 % - 5.85 %, with mean of 2.24 %, and percentages of infestation with PFF ranged between 6.81 % - 19.93 %, with mean of 12.76 %.

2) The second season (2004) :

Table 4 shows the data about incubation of apricot fallen fruits. Total number of fruits on five trees at the three locations were 12000 fruits, and the total number of fallen fruits were 1150 fruits. Total percentages of infestation (MFF & PFF) for the three locations ranged between 8.4 % - 11.67 % with mean of 9.86 %. Total number of produced pupae were 4383 pupae, and total number of emerged flies were 2287 flies, with mean of percentages of emergence (52.18 %). Total number of emerged MFF flies were 148 flies (74 males and 74 females), and total number of PFF flies were 2139 flies (1099 males and 1040 females).

Table 2. Percentage of apricot fruits infested with MFF & PFF, and total number of pupae and adults emerged from incubated fruits, during the 1st season, 2003.

Locations (orchards)	Total No. of fruits on five trees	Total No. of fallen fruits	Total % of infestation (MFF & PFF)	Total No. of produced pupae	Total No. of emerged flies	% Emer- gence	Total No. of MFF			Total No. of PFF		
							Male	Female	Total	Male	Female	Total
1	8000	559	6.99	296	234	79.1	2	4	6	139	89	228
2	6000	817	13.62	470	313	66.6	10	6	16	161	136	297
3	7000	1453	20.76	560	427	76.3	8	9	17	202	208	410
4	5000	454	9.08	209	131	62.7	16	15	31	52	48	100
5	3000	665	22.17	412	243	59.0	22	19	41	118	84	202
6	5000	868	17.36	594	344	54.9	44	72	116	119	109	228
Total	34000	4816	-	2541	1692	-	102	125	227	791	674	1465
Mean	-	-	15.00	-	-	66.6	-	-	-	-	-	-

Table 3. Percentage infestation of MFF & PFF together and separately in apricot fruits during the 1st season, 2003.

Locations (orchards)	Total % of infestation (MFF&PFF)	Total no. of emerged files	% Emergence	MFF		PFF		% infestation with MFF	% infestation with PFF
				No. files	% Emergence	No. files	% Emergence		
1	6.99	234	79.1	6	2.03	228	77.03	0.18	6.81
2	13.62	313	66.6	16	3.40	297	63.19	0.70	12.92
3	20.76	427	76.3	17	3.04	410	73.21	0.83	19.93
4	9.08	131	62.7	31	14.83	100	47.85	2.15	6.93
5	22.17	243	59.0	41	9.95	202	49.03	3.74	18.43
6	17.36	344	54.9	116	19.53	228	38.38	5.85	11.51
Total	-	1692	-	227	-	1465	-	-	-
Mean	15.00	-	66.6	-	8.93	-	57.65	2.24	12.76

Table 4. Percentage of apricot fruits infested with MFF & PFF, and total number of pupae and adults emerged from incubated fruits, during the 2nd season, 2004.

Locations (orchards)	Total No. of fruits on five trees	Total No. of fallen fruits	Total % of infestation (MFF & PFF)	Total No. of produced pupae	Total No. of emerged flies	% Emer- gence	Total No. of MFF			Total No. of PFF			
							Male	Female	Total	Male	Female	Total	
1	4000	380	9.50	1576	827	52.5	19	21	40	404	383	787	
2	5000	420	8.40	1418	903	63.7	43	39	82	426	395	821	
3	3000	350	11.67	1389	557	41.40	12	14	26	269	262	531	
Total												1040	2139
Mean			9.86			52.18							

Table 5. Percentage infestation of MFF & PFF together and separately in apricot fruits during the 2nd season, 2004.

Locations (orchards)	Total % of infestation (MFF&PFF)	Total no. of emerged flies	% Emergence	MFF		PFF		% infestation with MFF	% infestation with PFF
				No. flies	% Emergence	No. flies	% Emergence		
1	9.50	827	52.5	40	4.84	787	95.16	0.46	9.04
2	8.40	903	63.7	82	9.08	821	90.92	0.76	7.64
3	11.67	557	41.40	26	4.67	531	95.33	0.54	11.13
Total	-	2287	-	148	-	2139	-	-	-
Mean	9.86	-	52.18	-	6.47	-	93.53	0.64	9.22

Table 5 clarifies the percentages of infestation with MFF and PFF together and separately. Total percentages of infestation with MFF & PFF together ranged between 8.40% - 11.67%, with mean of 9.86%. By using the forementioned equation (Materials and Methods), percentages of infestation with MFF separately ranged between 0.46% - 0.76% with mean of 0.64 %, and percentages of infestation with PFF separately ranged between 7.64% - 11.13 %, with mean of 9.22%.

From the a forementioned data, MFF population was low compared with PFF population during the two seasons, also MFF population was low in the 2nd season than in the 1st one. PFF population was low during the 2nd season than the 1st season. Percentages of infestation with MFF & PFF together and with MFF and PFF separately were relatively higher in the 1st season than in the 2nd season.

The a forementioned results are in agreement with the findings of Gupta *et al* (1990) who mentioned that the peak adult activity occurred during the 3rd week of June on apricot. The results are in agreement with the data obtained by Amin (2003) who mentioned that the weekly means of *B. zonata* at Fayoum governorate was 73.82 flies and 24.79 flies for the two years of studies.

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دراسات إيكولوجية على ذبابة فاكهة البحر المتوسط وذبابة ثمار الخوخ في حدائق المشمش بمحافظة الفيوم

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تعتبر ذبابة فاكهة البحر الأبيض المتوسط من الآفات الخطيرة في العالم نظراً لتعدد عوائلها والمدى الواسع لانتشارها. وفي مصر تسبب هذه الآفة خسائر كبيرة لثمار المانجو والوخوخ والمشمش والجوافة والتين والموالج. وفي التسعينات من القرن الماضي ظهرت حشرة جديدة هي ذبابة ثمار الخوخ وهي تصيب كل عوائل ذبابة الفاكهة.

وهذا البحث ضمن سلسلة أبحاث أجريت في محافظة الفيوم على المانجو والموالج والمشمش خلال المواسم ٢٠٠٢، ٢٠٠٣، ٢٠٠٤.

وهذا البحث الثالث أجرى على المشمش لدراسة تذبذب تعداد كل من ذبابة فاكهة البحر المتوسط وذبابة ثمار الخوخ بمركزى سنورس وإشواى بمحافظة الفيوم وذلك في موسمين متتاليين (٢٠٠٣، ٢٠٠٤)، وفي نفس الوقت تم تقدير نسبة الإصابة بالحشرتين معا (ذبابة الفاكهة وذبابة الخوخ) في ثمار المشمش، وكذلك نسبة الإصابة بكل حشرة على حدة.

أظهرت النتائج أن تعداد ذبابة فاكهة البحر المتوسط منخفض إذا ما قورن بتعداد ذبابة الخوخ في كلا الموسمين. تراوحت قيم الـ "CTD" (عدد الذباب المنجذب للمصيدة الواحدة في اليوم الواحد) لذبابة الفاكهة ما بين ٠,١ - ٨,٤ ذبابة، بمتوسط قدره ٢,٤ ذبابة في الموسم الأول، وفي الموسم الثانى تراوحت قيم الـ "CTD" لذبابة الخوخ ما بين صفر - ١,٠٥ ذبابة بمتوسط قدره ٠,٤٢ ذبابة.

تراوحت النسبة الكلية للإصابة في ثمار المشمش بالحشرتين معا ما بين ٦,٩٩% - ٢٢,١٧%، بمتوسط قدره ١٥,٠٠%، وما بين ٨,٤٠% - ١١,٦٧% بمتوسط قدره ٩,٨٦% خلال الموسمين على التوالي. تراوحت نسبة الإصابة بحشرة ذبابة الفاكهة فقط ما بين ٠,١٨% - ٥,٨٥% بمتوسط قدره ٢,٢٤% وما بين ٠,٤٦% - ٠,٧٦% بمتوسط قدره ٠,٦٤% خلال موسمي الدراسة. تراوحت نسبة الإصابة بحشرة ذبابة الخوخ فقط ما بين ٦,٨١% - ١٩,٩٣% بمتوسط قدره ١٢,٧٦% وما بين ٧,٦٤% - ١١,١٣% بمتوسط قدره ٩,٢٢% خلال موسمي الدراسة.