Seasonal activity of Mediterranean fruit fly (Ceratitis capitata) (Wiedemann 1824) Tephritidae in Fruit orchards around Benghazi city

Khadija Moftah El-shekhi*
Prof. Abdalla Fadhl**

abstract

Seasonal incidence and activity of Medfly adults were monitored around Benghazi city at four different sites during the period from April to December 2010 using McPhail trap with pheromone and food attract-ants(ammonia salts solution 3%) .

Statistical analysis were applied to trap catches at different sites, the results indicated that there were significant differences in all trap catches between different areas (F = 14.405; df = 3; P= 0.000) and months (F = 2.017; df =8; P = 0.046). which might be due to changes in climatic conditions during study period and differences in host plant between areas.

INTRODUCTION

Horticultural crops are subjected to attacks by different pests among them fruit flies. Most flies belong to family (Tephritidae) which are glo- bally distributed, consist of more than 4000 species described ranks am- ong the most diverse groups of the true flies, almost all phylophagous, with larvae developing in the seed bearing organs of plant and take a place in other parts of the host as well as fruits(Seewooruthun *et al*.,2007; De Meyer *et al*.,2008). The

*doga249@gmail.com
**University of Benghazi- faculty of science - department of zoology- Libya. abdullfadel@yaho.com

mediterranean fruit fly (Medfly), *Ceratitis capitata* (Wiedemann 1824) (Diptera: Tephritidae), is considered as one of a serious economic pest, infesting over 350 species of fruits and veget- ables worldwide most of which are high commercial value (Braham *et al*.,2007).

Since it has discovered in united states (Hawaiian Islands) in 1910, Medfly was widely distributed over the world. because of its ability totolerate colder climate compared with other species.

The most attacked hosts are deciduous tropical and subtropical fruits and vegetables by this fly including : apple, apricot, avocado, fig, plum, peach pear, grape, grapefruit, orange, lemon, bell pepper, pomegranate and tomato (Alameda Agency, 2009; Jang *et al*., 2003; CDFA, 2008).

However life cycle of Medfly begins when adult female pierces the skin of fruits to lay from one to ten eggs per fruit. Eggs hatch and develop into maggots which feed on fruit pulp. Decaying infested fruit usually falls on the ground, maggots leave fruit and burrow into the soil to pupate, adults emerge from ground and mate to complete the life cycle.

Adults can live up to 2 months, total life span range from five weeks to five months, depending on temperature (CDFA, 2008).

Adults feed on nectar, thin skinned ripe succulent fruit are preferred, but it choose the hard or semi-ripe fruit to lay their eggs (Steck ,2002).

The direct damage is caused by female ovipositing into the fruit and the larvae feeding on fruit flesh. In addition to direct losses,severe quarantine policies are imposed by importing countries to avoid importation and est- ablishment of exotic pests. This Tephritid fly find optimal climatic condi- tion in warmer area of Mediterranean basin, mainly in heterogenerous agricultural landscapes with mixed-fruit growers, where ovipositing fem- ales can find host fruits to lay eggs throughout the year Economic impacts can be enormous, and costs of control or eradication can require substant- ial budgets (Seewooruthun *et al*.,2007; De Meyer *et al*.,2008; Ortu *et al*., 2009).

MATERIAL AND METHODS

The study conducted in four different areas around Benghazi city, between April and December 2010. These sites have a little difference in local environmental conditions, almost with same plant diversity and soil type. The selected sites were :

1- Bodizera: it's actually a small backyard, about 1000 m^2, surrounded by complex crops fields, this site consist of fruit trees include fig , grape , olive and citrus.

2- El-kwarsha (El-afakat): which is located 14 km west of Benghazi city, in $^{\circ}$32,1' ,15 latitude north and $^{\circ}$20, 04' ,30 longitude east, and about 25 m above sea level.The field was about 9 hectare , cultivated fig, olive, grape and pomegranate trees.

3- Wadi El-katara: located in south of Benghazi, about 100 to 150 m above sea level.

This site is a great plantation of different fruits and vegetables such as peach, apricot, fig, lemon, tomato, pepper, almond and many other vegetables.

The trial was conducted on peach orchards which consisted of about 600 tree that cultivated in organized rows, the distance between trees along the row 5m.

4- Bouatny site, it's a large flat farm, about 3 hectare, in addition to diffe -rent vegetables crops in green houses like pepper and tomato, as well as fruit trees such as: fig, grape, guava and a few pear trees, blue berry and citrus. Number of Mcphil traps were used 6,15, 25,15 respectively.

Laboratory tools :-

Digital balances type Nahita (serie 5041) capacity 200g, petri dishes, plastic containers capacity 125 ml, a small glassy vials, binocular type Olympus (VMT 1x, 4x).

Traps and attractants :-

The Multilure trap was the only type used in this trial (McPhail traps) Plate (1). 61 trap were used in 3 different ways :

1- as a pheromone traps, by putting the pheromone dispensers in the upper transparent part of the trap.

2- combined traps by putting alimentary attractant in the yellow base with pheromone dispenser in the same trap.

3- alimentary traps.

The alimentary attractants were basically ammonium salts including :

ammonium acetate, dihydrogen ammonium phosphate, and sometimes ammonium sulfate. These salts usually use as solid lure when they comes from biological origin like Torula Yeast (Martinez *et al*., 2007).

But in this experiment were used as salt solution 3% (Braga-Sobrinho and Guimara'es, 2007; Edwards *et al*., 2003).

Seasonal activity.

Each site was divided into randomized block design according to the total area and number of target trees :

in Wadi El-ktara, 25 traps were used in five replicates, 1middle phero mone trap with 4 alimentary in each block, including combined traps. In Bouatny site, they were 15 traps as well as El-Kwarsha, and just 6 traps in Bodezera.

The distance between selected trees were at least 15m. The trap hange at 1.5 to 2m on ground level, orientated to north-east during summe season and to south-west at winter season.

Traps were inspected fourth nightly, capsules of sexual pheromone (Russell IPM) were replaced every 6 weeks. Collected flies were kept I a plastic and glass vials at (70 % alcohol). Collected samples counted a identified in the laboratory.



Plate (1): McPhail trap hanged in study site.

Results

Adult *Ceratitis capitata* incidence in all study sites around Benghazi city were conducted for a full season i. e. from April up to December 2010, using MacPhil traps for different types of fruit trees .

Trap catches in Bodizera indicated that, the fly started to appear in a very low numbers count 3, 5 and 6 during April, May and June respectively.

Suddenly fly incidence rise up to the high peak at 186 in July, thereafter the numbers declined to reach 136 during August and kept down in September, the second peak was in October which counted 129 adult fly followed by declining in November which count 49 individuals.

The fly almost disappear in December since only 2 adults were caught in the traps.

In EL-Kwarsha area, the incidence of *C.capitata* started in April with only 2 adults which were disappeared in May.

In June catch number resumed with 22 adults, which raised up to 167 in July, the highest peak was in August 463 adults, and then catch num- bers were declined in September.

Trap catches in the following months declined to only 23 adults in October and November, to become very low in December with just 2 adults.

In Wadi EL-Katara trap catches count 9 adults in April, this number raised constantly over the next two months to reach 30 adults in May, and 127 in June to reach its first peak in July with a count of 213 adults.

Adult numbers were declined in August into 102. Trap catches reach 2nd peak in September were counted 365. In the following three months pest incidence were declining to four adults in December.

Trap catches at Bouatny area showed high incidence in comparison with other sites. Adult incidence started with low number in April and May with cached 7 to 15 respectively.

The number were increased dramatically to show first peak in July with 2853 adults, which followed by drop in catches to 575 in August.

Trap catches started again to increase constantly to reach 2_{nd} peak in October with catch of 2756. Adult incidence dropped down again inNovember to reach 356 individual in December.

Statistical analysis of trap catches indicated that, there was a very high significant difference between the study sites (F = 14.405; df = 3 ; P = 0.000) (Table 1).

ANOVA analysis showed significant differences between sites in view of trap catch number(Table 2).

Table (1): Analysis of various (ANOVA) of pest between area showing

df = 3, F table value = 14. 405 and P value is significant P = 0.000.

Source of variations	Sum of squares	*df*	*F*	*P*
Between regions	1307387	3	14.405	**0.000**
Within regions	6413848	212		
Total	7721235	215		

Table (2): Mean ± std. Error of adults between sites.

Study sites	Mean ± std. Error
Bodizera	**10.98 ± 33.474**[a]
El- Kwarsha	**16.38 ± 33.47** [a.b]
Wadi EL- Katara	**18.61 ± 33.474** [a.b.c]
Bouatny	**194.96 ± 33.474** [d]

Means followed by same letter in column aren't sig. at (P < 0.05) LSD test.

However the activity of Medfly declined during Spring season i.e.

April and May which coincide with temperature at 19.9°C and 46 - 51% RH. This situation continued up to June in all sites.

Gradual increase in trap catches to reach the highest peak of fly activity by the end of summer season i.e. during July, August and September. (Figure 1)

With an average temperature between 26- 26.7°C and relative humidity between 54- 65%. although statistical analysis showed no significant differences due to weather parameters (T °C + RH %) on Medfly activity.

However trap catches were decreased gradually towards Autumn season i.e. during October and November to become very rare by earlywinter season at 15.5 – 23.1°C .

Statistical analysis applied to the trap catch numbers indicated significant difference between months (F = 2.017; df =8; P = 0.046) (Table 3).

As well as the Multiple Comparisons of Mean ± Std. Error, at P< 0.05 between months represented in (Table 4).

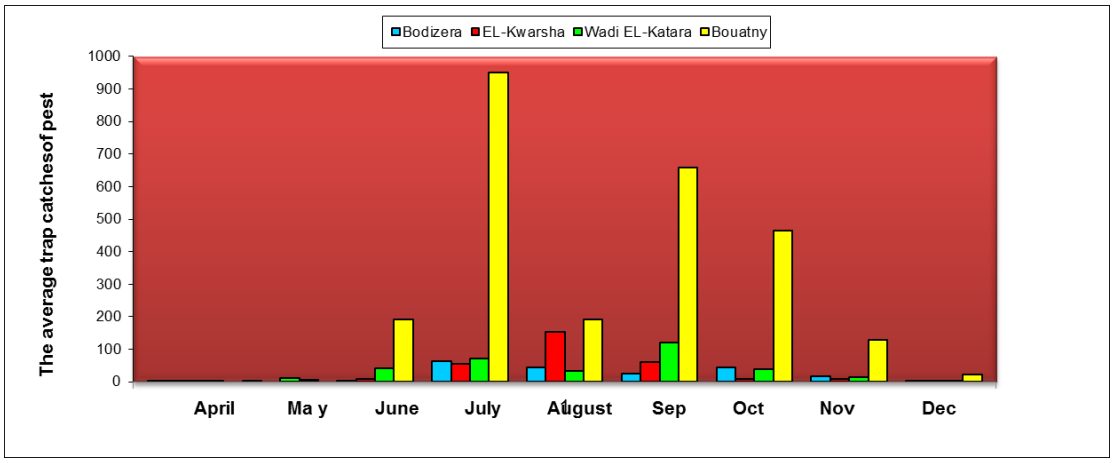


Figure (1): Show the average trap catches of pest across the study period in all area.

Table (3): Analysis of various (ANOVA) of fly incidence across study months, showing *df* = 8, *F* table value = 2.017 and *P* = 0.046.

Source of variations	Sum of squares	*df*	*F*	*P*
Between months	558364.7	8	2.017	**0.046**
Within months	7162870	207		
Total	7721235	215		

Table (4): Mean ± std. Error of adults across study months.

Months	Mean ± std. Error
April	**0.88 ± 53.699** [a]
May	**2.08 ± 53.699** [a.b]
June	**30.33 ± 53.699** [a.b.c]
July	**142.46 ± 53.699** [d]
August	**53.17 ± 53.699** [a.b.c.e]
September	**108.29 ± 53.699** [f]
October	**125.83 ± 53.699** [g]
November	**63.63 ± 53.699** [a.b.c.e.h]
December	**15.17 ± 53.699** [a.b.c.e.h.i]

Means followed by same letter in column aren't sig. at ($P < 0.05$) LSD test.

DISCUSSION

Trap catches result indicated that the adults activity were very low during spring season April, May and early June almost in all sites, followed by gradual increase to reach the highest peak during July, August and Sep- tember, while 2nd peak was in October in Bouatny site which coincide with an average temperature between 23.1- 26.7 ˚C and relative humidity between 54 – 65 % , Thereafter trap catches decreased gradually to be- come very rare by early winter season.

These results were in accordance with those obtained by (2006 ,جبر) who confirmed the same seasonal incidence, activity and disappear time, while in contradicted with high peak of Medfly during July and October, this difference might be due to the local climatic condition.

Statistical analysis indicated that there was a significant difference in trap catches between study sites represented in (Tables 1,2). Results were in agreement with (Saleh and EL- Hamalawii, 2004), who reported that the difference might be due to the effect of host fruit habitats and agricultural habitats, in our study Bouatny site was very distinguished in fly incidence, which might be due to host plant diversity of closest fields.

However the result indicated a significant difference in trap catches between months represent in (Table 3,4) which in accordance with many Studies confirm that summer and autumn seasons were the ideal time for adult activity and dispersion of Medfly, while over winter as a larvae or pupae.

Camacho (2007) reported that the fruit fly population density increased as a result of more favorable climatic conditions and fruit maturation phenology of crop during the months in which the experiment was carried out.

On the other hand the decline in trap catches could be related to the variation of weather conditions (cold days, cloudy days, or strong winds) fallen raps or harvesting ripe fruit. In addition to the present of natural enemies which might lead to drop of trap catch number .

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