



Activity of mediterranean fruit fly, *ceratitis capitata* wied (diptera: tephritidae), in response to some weather factors at Assuit governorate

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ABSTRACT

A field study was carried out on the population dynamics of the Mediterranean fruit fly (MFF) *Ceratitis capitata* Wied. males in Assuit governorates (upper Egypt) during 2011/2012 and 2012/2013 seasons in mixed orchards by using Jackson trap. The obtained data revealed that the occurrence of MFF was relatively all over the two seasons with some exceptions. The abundance of the pest was higher in the second season than that in the first one. The higher appearance of the pest was recorded on September-November in both first and second seasons. Temperature had significant negative correlation ($r=-0.105$) in the first season and insignificant negative correlation ($r=-0.076$) in the first and second seasons, respectively. However, R.H.% had high significant positive ($r=0.451$) and insignificant positive ($r=0.203$) in the first and second seasons, respectively. Results obtained could be exploited in management of this insect pest especially, in the control programs.

Key words: *Ceratitis capitata*, MFF, Jackson traps, temperature, R.H. %.

INTRODUCTION

Family Tephritidae (true fruit flies) includes about 4000 species arranged in 500 genera. It is the largest families of Diptera and it is considered as one of the most economically important. The larvae of most species attack soft fruits, including many commercial fruits (White and Elson-Harris, 1994).

The Mediterranean fruit fly (MFF), *Ceratitis capitata* Wied (Diptera: Tephritidae), known also as the med fly, is one of the most widespread and damaging pests of horticulture in the fruit fly group and is recognized by some as the worst pest of citrus and other fruits (Hill, 1983, Enkerlin & Mamford, 1997 and Teresa *et al.*, 2002). *C. capitata* is adapted to various climates and it attacks most citrus varieties, deciduous and subtropical fruits as well as some vegetables (Liquido, 1991). The variability in host range is influenced mainly by the habitat, environment factors and by chemical and physical characteristics of the fruits (Harris, 1975, Eskafi & Kolbe, 1990 and Perry &

Yuva, 1997). In Egypt, *C. capitata* attacks several fruits which are available all over the year causing considerable damage which inflicts significantly economic losses to peach, apricot, guava, mango, fig and citrus all over the governorates of Egypt (Saafan, 1986).

The appearance, biology, distribution, behavior, natural enemies, control and life history of *C. capitata* in different geographical regions have been described in many studies (White & Elson-Harris, 1992, Anonymous, 1988, and Papadopoulos *et al.*, 2001a). The population dynamics of the med fly have been studied extensively in the tropics and subtropics to a lesser extent in temperate areas of its current geographical distribution. Tropical studies deal primarily with adults trapping in different habitats, although some examined the effect of host fruits on population dynamics (Campos *et al.*, 1989, Eskafi, 1990 and Papadopoulos *et al.*, 2001a).

In areas such as the Mediterranean region, host fruits (e.g. various citrus species) are available around the year and therefore, the main factors regulating level of

populations in these areas were the relatively low winter temperatures (**Campos et al., 1989, Mustafa & Abdul-Jabbar, 1996, Mogahed, 1999 and Ahmed & Mofleh, 2003**).

The different methods used to control insect population must be integrated by a strategy addressed towards greater protection of the cultures with respect to ecological, toxicological and economic principles (**Neuenschwander & Paraskakis, 1980**)

The purpose of the present contribution is to broaden and more closely examine current knowledge concerning the population fluctuations of *C. capitata* in relation to some weather factors.

MATERIAL AND METHODS

Study area and fruit types

The study was carried out in Assuit district during 2011/2012 and 2012/2013 seasons with mixed orchards. Present fruit species are mandarin *Citrus reticulata*, Orange *C. sinensis*, Guava *Pisidium guajava* and Mango, *Mngifera indica*

Effect of weather factors on population fluctuations of MMF

Effect of weather factors on the population fluctuation of med fly was studied. Mean temperature and mean relative humidity was obtained from the (Agro meteorological Station at Assuit region). The daily records of each weather factor were grouped into weekly means according to the date of traps inspection. The climate of study area was characterized by a warm dry summer and winter low temperatures but over zeros degree.

Traps and lures

Jackson sticky traps described by (**Harris et al., 1971**), were used for monitoring population of *C. capitata* males. This trap is a delta shaped object made of waxed cardboard material. The additional parts include (1) a white rectangular insert of waxed cardboard covered with a thin layer of sticky material used to trap *C. capitata* males. 2) A polymeric plug and a plastic basket that holds the lure plug and 3) a wire hanger placed at the top of the trap body.

For monitoring the population fluctuations of the *C. capitata*, Jackson sticky traps were used and baited with trimedlure as male lure of *C. capitata* males

All traps were distributed uniformly and hanged at a height of 150-200 cm on the southern external branches of trees (in a shadow and aerated places on trees). The distance between every two adjacent traps was 60 meters to avoid interactions among traps.

Inspection of traps

The traps were inspected weekly and number of attracted flies on each sticky cardboard insert was counted, recorded, and replaced with fresh inserts. The number of captured flies per trap per day (CTD) was considered the parameter of efficiency.

Statistical analysis

Minitab computer program (1998) was used to compute the effect of these weather factors on the population fluctuations of *C. capitata* population.

RESULTS AND DISCUSSION

1. The distribution of *Ceratitis capitata* in Assuit district during two seasons:

1.1. In the first season 2011/2012:

The population studies of the first season (2011/2012) started from 24th of April 2011 up to 14th of April 2012. Data was illustrated in fig (1) and table (1). During this season, the population was low in the beginning and the end of season from the 24th of April 2011 (CTD=0.514) up to 3rd of July 2011 (CTD=0.3428), the population was low with a relative stable decreasing of the number of the pest in the beginning of the season until appearance of the first peak that was weak (CTD=1.23). The population dropped to zero through 30th December 2011 until 10th of February 2012.

The population decreased and became stable in the decreasing until appearance of the second wide moderate peak on September 2011 at CTD = 2.114. Then, decreasing with stability of the pest population and returned to the gradual increasing up to appearance a sharp high peak with CTD=6.57 and adjacent

short peak at CTD = 4.285 on November 2011. Finally, slight decreasing of the pest until 31st of December 2011 and the pest relatively disappeared till the end of the season 2011/2012.

The population fluctuation was occurred and lower peak was in the end of December (CTD=0.971). So, the population decreased at the end of the first season.

Table (1). Monthly means of captured *C. capitata* in Assuit district during 2011/12 and 2012/13 seasons.

Month	Mean ± S.D.	
	2011/2012	2012/2013
April	0.57 ± 0.05	0.04 ± 0.05
May	0.65 ± 0.65	0.04 ± 0.03
June	0.42 ± 0.10	0.14 ± 0.11
July	0.80 ± 0.29	0.97 ± 0.168
August	0.69 ± 0.33	1.26 ± 0.86
September	1.24 ± 0.74	2.19 ± 1.94
October	1.26 ± 0.92	3.66 ± 0.96
November	3.93 ± 1.60	4.66 ± 1.03
December	3.06 ± 0.27	2.26 ± 0.96
January	0.00 ± 0.00	0.45 ± 0.34
February	0.00 ± 0.00	0.51 ± 0.24
March	0.04 ± 0.04	1.41 ± 0.99
General mean	1.05 ± 0.42	1.55 ± 0.77

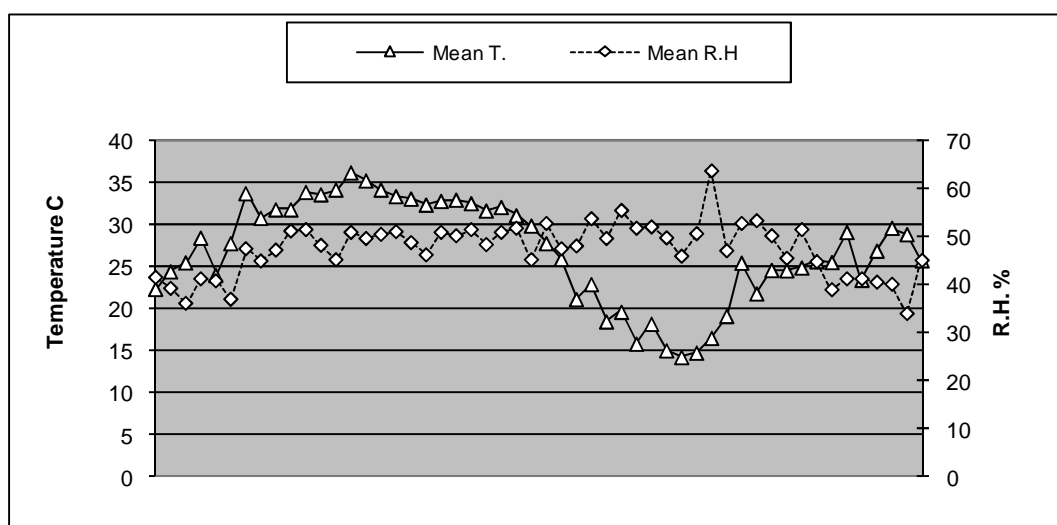
1.2. In the second season 2012/2013:

The second season began from 22nd of April of 2012 to 14th of April 2013, whereas more peaks were occurred during this season. Data was in table (1) and fig (2) was

illustrated captured males per trap per day (CTD). At the beginning of the second season, the population was low and suddenly, increased recording the first high peak with CTD=3.77 at 22nd of July 2012.

Two weak waves forming peak was occurred at 26th of August 2012 and 16th of September 2012 (CTD=2.08 and 1.66 respectively). Two higher peaks was recorded in the period from 23rd of September- 31st of December 2012; the first described as a sharp high peak and adjacent short peak with CTD=5.057 and 3.65 on 30th of September 2012 and 14th of October 2012, respectively. The second highest peak was divided to two waves with CTD= 5.34 and 5.828 on 4th of November and 18th of November 2012, respectively. Decreasing of the number of the pest was occurred until the end of the season then, appearance an obvious peak in 31st of March 2013 with CTD =2.68.

Finally, the occurrence of MFF was relatively all over the two seasons with some exceptions. Also, the abundance of the pest was higher in the second season than that in the first. The higher appearance of the pest was on September-November in the first and second season, This result is in agree with Safaan (2000), Bjelis, *et al.*, (2007), Afia (2007) and Amin (2008).



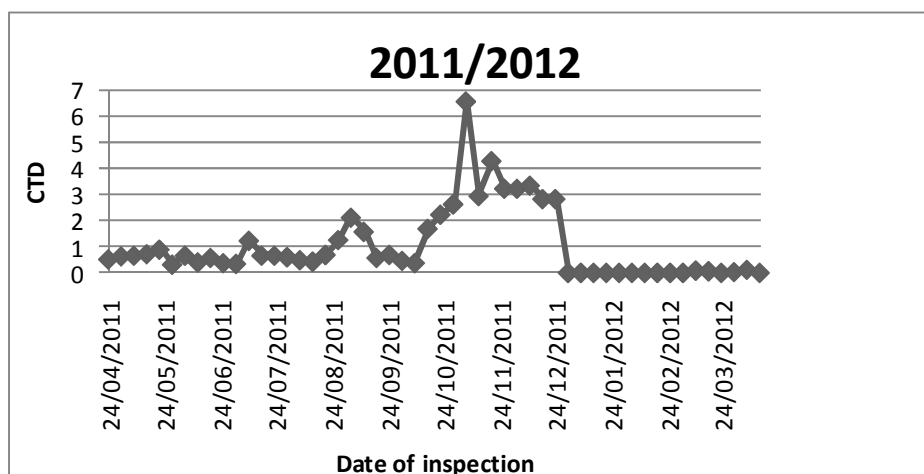


Fig. (1): Captured males / trap / day "CTD" of MFF males at Assuit region during 2011/12 in response to change of mean temperature and relative humidity.

Katsoyannos et al. (1998) monitored that captures of *C. capitata* males were low in June and most of July and also in December and January, high from August through November, and absent from February through May. **Hafez et al. (1973)** reported that captured flies were recorded in November and absent in July and a few numbers in August and September. In Upper Egypt, **Hashem et al. (1986)** reported a high Medfly population during August/December (CTD = 3.25-19.00); while it tended to be lower from January until July 1985 (CTD = 0.0.68-1.58). The Med fly has two main peaks in Upper Egypt area, one through September, October and November on guava, fig, mango, and citrus fruits and the second was through May/June on the citrus fruits and early peaches.

2. Effect of mean temperature and relative humidity on population fluctuations of MFF:

The relationship between the population of MFF adult males (estimated as CTD) and the prevailed weather factors (**mean temperature and relative humidity**) was studied during two seasons (2011/12 and 2012/13) (Table.2).

In summer, MFF exhibited insignificant positive correlation ($r=0.025$) and significant positive correlation ($r=0.591$) response to increase of mean temperature, while the effect of mean R.H.% on MFF was insignificant negative ($r= -0.005$) and insignificant positive ($r=0.544$) during the two seasons of studied.

For autumn, statistical analysis showed that insignificant negative correlation between the fly population and mean temperature ($r= -0.666$) and highly significant negative correlation ($r= -0.821$) in two seasons of study. While the effect of mean R.H. % was significant positive ($r =0.554$) and insignificant positive ($r= 0.502$) in the first and second seasons, respectively.

In winter: the effect of mean temperature was significant positive ($r= 0.594$) and insignificant negative ($r =-0.302$) on population of MFF, while the effect of R.H. % was insignificant negative ($r= -0.401$) and ($r=-0.043$) in the first and second seasons.

In spring, the temperature was insignificant negative ($r=-0.097$) and insignificant positive ($r=0.121$) in the first and second seasons, respectively while R.H. % was insignificant negative during two seasons 2011/2012 and 2012/2013 ($r=-0.401$ & -0.043), respectively. Finally, temperature had significant negative correlation ($r=-0.105$) in the first season and insignificant negative ($r=-0.076$) in the first and second seasons, respectively. However R.H. % had high significant positive correlation ($r=0.451$) and insignificant positive correlation ($r=0.203$) in the first and second seasons, respectively.

The resistance of insect to cold is affected by its micro habitat, which determines the availability of moisture, the developmental temperature and parameters such as humidity and desiccation tolerance (**Danks, 2006**). Other biological factors involved are age,

body size during adult development, and feeding. In our study, low temperature led to a reduction in medfly movements until they kept relatively still, at which point they might be unable to feed; because they were provided with food ad libitum, **Penarrubia-Maria et al. (2012)** assumed that when they kept still they had enough energy reserves to withstand extreme temperatures. **Israely et al. (1996)** reported that population levels decrease to zero through winter. Also, **Penarrubia-Maria (2012)** showed that med fly adults were unable to survive the entire winter season in the Girona area.

Papadopoulos et al. (2001a) observed high occurrence of the pest in autumn. In Spain, **Martinez-Ferrer et al. (2006)** observed two main adult population peaks in

each year; one in summer and the other in autumn. **Manrakhan & Addison (2007)** in South Africa mentioned that *C. capitata* was peaked at the end of summer. **Herrera & Vinas (1977)** in Peru mentioned that the density of *C. capitata* being positively correlated with temperature and negatively humidity.

Bateman, (1972), Harris & Lee (1989), Nikulas- Ruiz Borge & Besedow (1997), (Papadopoulos et al. (2001a) and Papadopoulos et al. (2001b) had shown that the main factor affecting population buildup in the tropics is the abundance and availability of fruit, whereas in temperate areas, such as northern Greece, low winter temperatures and the absence of host fruits are the two main factors that inhibit overwintering .

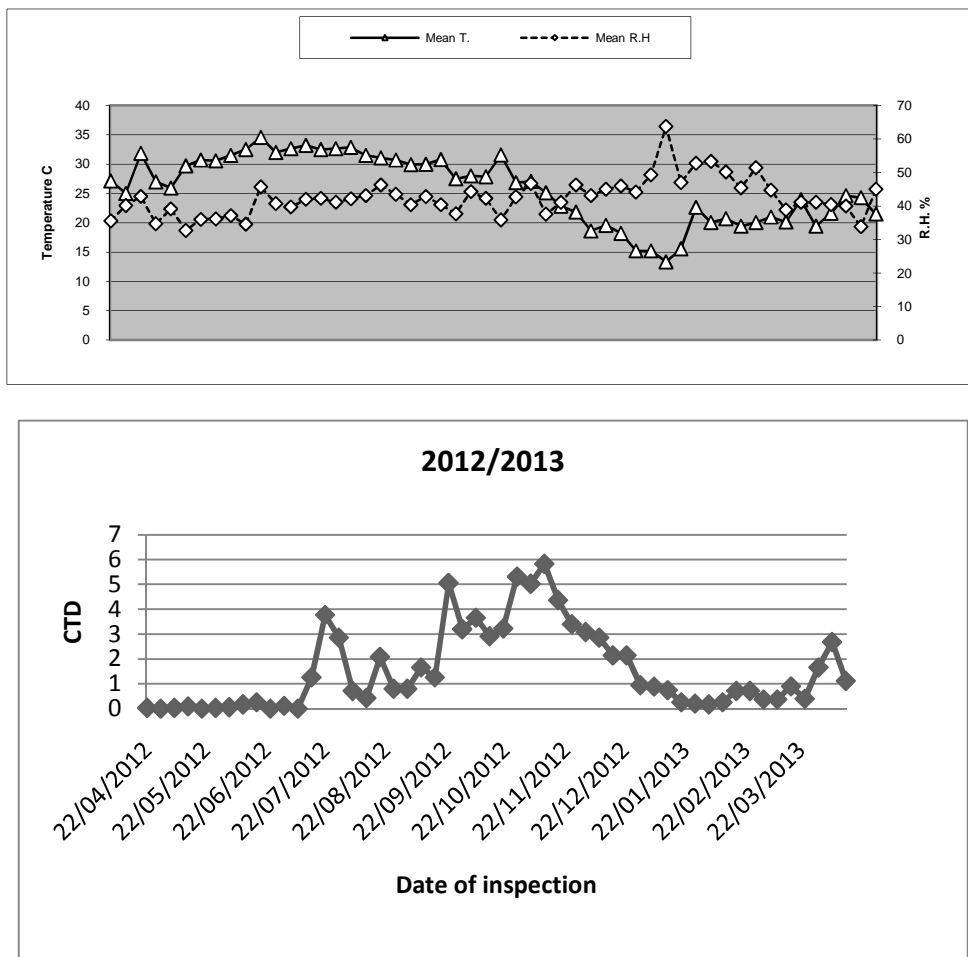


Fig. (2): Captured males / trap / day "CTD" of MFF males at Assuit region during 2012/13 in response to change of mean temperature and relative humidity.

Table (2). Simple correlation coefficient between changes of *C. capitata* population and both of mean temperature and relative humidity during 2011/12 and 2012/13 years.

Season	2011/12				2012/13			
	Temp.		R. H		Temp.		R. H.	
	r	p	r	p	r	p	r	p
Summer	0.025	0.935	-0.005	0.988	0.591	0.034*	0.544	0.055*
Autumn	-0.666	0.013*	0.554	0.049*	-0.82	0.001**	0.502	0.080
Winter	0.594	0.032*	0.414	0.159	-0.302	0.317	0.319	0.287
Spring	-0.097	0.752	-0.401	0.175	0.121	0.709	-0.043	0.894
All year	-0.105	0.457	0.451	0.001**	-0.076	0.595	0.203	0.153

r = correlation coefficient

* = significant with varied degree

p = probability

In conclusion, med fly population was occurred all over the year in Assuit district during two seasons, but the lowest distribution to the pest was in winter because of the reduction of temperature that had an effect in overweening of the pest. However, high numbers of the captured flies were recorded throughout autumn season.

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المخلص العربي

نشاط ذبابة فاكهة البحر المتوسط بالنسبة لاستجابتها لبعض العوامل الجوية في محافظة أسيوط

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أجريت دراسة حقلية حول ديناميكيه تغير أعداد ذكور ذبابة فاكهة البحر المتوسط في منطقه أسيوط في بستان فاكهة نو عوائل متعددة للآفة خلال موسمين متتاليين ٢٠١٢/٢٠١١ و ٢٠١٣/٢٠١٢ وذلك باستخدام مصائد جاكسون مشبعه بالجاذب الجنسي للحشرة وهو ترايميدلور. أوضحت النتائج وجود الحشرة طوال موسمي الدراسة مع وجود بعض الإستثناءات وان أعلى تعداد للآفة كان في الفترة بين شهري سبتمبر إلى نوفمبر من كل سنة. ودراسة تأثير بعض العوامل الجوية على التذبذب العددي للآفة، وهى متوسط درجة الحرارة والرطوبة النسبية خلال مدة الدراسة، وجد أن لدرجة الحرارة تأثير معنوي في الموسم الأول في تعداد الحشرة عنه في الموسم الثاني بينما كان للرطوبة النسبية تأثير معنوي عالي في الموسم الأول وعدم وجود تأثير معنوي للرطوبة النسبية في الموسم الثاني. و يمكن استثمار النتائج التى تم الحصول عليها في إدارة الحشرة وخاصة في برامج المكافحة.