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SEASONAL OCCURRENCE OF THE MEDITERRANEAN FRUIT FLY, *CERATITIS CAPITATA* IN SOME ORCHARDS OF CENTRAL AND SOUTHERN REGION OF IRAQ

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Abstract

The results of the field study of the seasonal appearance of Mediterranean Fruit Fly *Ceratitis capitata* during the growth seasons 2014-2015 in the citrus and stone fruits orchards in central Iraq showed that the highest rate of males was caught during November of the season 2014, 279 insect / trap / week, due to the increase in the availability of host plant host of this pest, including the fruits of mandarin variety Clementine, while the lowest rate of males caught was during the month of January of the year 2015 was 7 insect/ trap/ week, decreases in the population density of this pest did not reach to zero for the study sites throughout the season.

The highest percentage of infestation was recorded on the fruits of kaki (83.3%) and the highest mean number of larvae was 32.75 larva/ fruit on the persimmon fruit too. Furthermore the study also showed that through personal observations in the laboratory that the infestation of the Mediterranean fruit fly did not develop on the local variety of orange.

***Keywords*:** Population density, Mediterranean Fruit Fly, Seasonal appearance

Introduction

The Mediterranean fruit fly *Ceratitis capitata* (Wiedemann) (Diptera, Tephritidae). It is considered as one of the most important damaging pests of fruit and vegetables crops worldwide (Liquido *et al*., 1991). The Medfly is a polyphagous species attacking over three hundred and fifty different hosts (Campos *et al.*, 1987 and Anonymous, 2003a). As it caused significant economic losses due to loss of production and reduced marketing opportunities, due to damage caused by the infestation of the fruits and restrictions on the quarantine imposed by importing States to prevent the entry of this pest into their countries (Zeki *et al*, 2008). Although Citrus are the main preferable host of this insect, it infests peach, pear, apple, grape, apricot, coffee, pomegranate, date palm, moreover, it infests cucurbits and some flowers, It also infests a lesser degree of cucumbers and varieties of roses and cacti, where the number of families about 200-350 hosts plant (Liquido *et al.*, 1990 and Liquido *et al.*, 1991). During the 19th and 20th centuries it became a widespread pest in the Mediterranean, Hawaii, Atlantic and many Indian Ocean islands and most of the major continental regions (White and Elson–Harris, 1992) as a result of multiple introductions (Malacrida *et al*., 2007), the emergence of this pest in the Mediterranean area It is due to the climate's suitability for this life cycle. As well as the availability of hosts plant throughout the year. In Iraq *C. capitata* was first recorded in 1947, in Diyala province (Iraqi Agriculture Journal, 1947). The pest returned again at the end of 2006, in the orchards of Diyala province (the center of the city of Baquba), since then it spread to all citrus and other stone fruits orchards in the central and southern regions of Iraq. (Jubouri, 2006). The rates of infestation with the Mediterranean fruit fly on citrus varies according to the variety, as it reaches 31.1% for Clementine, 23.8% for Navel orange and 14.12% for Valencia orange (Saleh and El-Hamalawii, 2004). In Iraq, the percentage of infection with this lesion amounts to 34.5% on apricot fruits, 39.5% on summer pear, while it reaches 77% on Clementine and 65% on yellow figs (Al-Jabouri, 2009).

The monitoring of the pest distribution using Pheromone traps and a follow-up presence is an important means that helps in taking appropriate decisions that relates to integrated pest control operations. Therefore, this study was conducted to tracking the presence of the Mediterranean fruit fly in the citrus and stone fruits orchards throughout the year in some areas of central Iraq.

Materials and Methods

Determination of population density and rates of infestation for Mediterranean fruit fly in citrus orchards and stone fruits

- **Population density :** In order to study the seasonal presence of the Mediterranean fruit fly in the orchards of citrus fruits and stone fruits, An orchard of citrus was selected in the area of Alsuwira in Wassit province south of Baghdad about 25 acres planted with different kinds of citrus (*Citrus* spp.) and some persimmon trees furthermore another orchard planted with stone fruits in the same region of 30 acres was selected too. The McPhail trap was used with sexual parapheromone Trimedlure and DDVP by 1 trap per 4 acers. Traps were inspected once time every week. The numbers of flies captured by the Mcphail traps were counted and the average / trap/ month were represented and the parapheromone Trimedlure was changed every 5 weeks in each trap. The study began in September 2014 and ended in September 2015.
- **Infestation rates :** Samples of fruits were collected from both orchards, one from citrus orchard and the other for stone fruit orchard. These fruits were examined and the number of infested fruits was calculated to the non-infested, and the number of larvae was counted within each fruit and each host plant.

Statistical analysis

All experiments were done with triplicate and statistical analysis was applied using ANOVA statistical program where the confidence level was set at 95%. Any significance difference ($p \leq 0.05$) was analyzed using LSD test.

Results and Discussion

Population density

The results of Table (1) showed the population density of the Mediterranean fruit fly *Ceratitis capitata* using pheromone traps (McPhail), the highest mean of population density was observed during November, December and October of the 2014 season, was reached 279 male/ trap / week, 186 male / trap/week and 126 male/trap/ week respectively, and 123 male/trap/week during May of the 2015 season.

Through the above results it was clear that the reason for the high density of the Mediterranean fruit fly during the months mentioned above, maybe due to the availability of host plants of this pest of citrus fruits, especially the mandarin fruits, which is one of the main hosts infested by this pest. These results were agree with that mentioned by Saleh and Abd-Elaziz (2002) who reported that the heavy infestations which recorded by Mediterranean fruit fly in the Gaza Strip were on several fruit crops and mainly citrus fruit. As for the high population density of the same pest during the month of May, June and July 2015, this may be due to the availability of apricot fruits, which was highly infested with this pest, In addition to the availability of some of the other summer hosts plant which attacked by this pest too, such as summer pear (Khattoni) and figs. Hashem *et al.* (1987) stated that this pest adapted to different climates and it attacks most citrus varieties and subtropical fruits as well as some vegetables.

Table 1 : Population density of the Mediterranean fruit fly in citrus orchards and stone fruits using pheromone traps for the period from September 2014 to September 2015.

Date	Host plant	Average number of adults captured (adult/ trap/ week) ± SE
September/ 2014	Stone fruit	28 ± 2.60
October	citrus	126 ± 1.20
November	citrus	297 ± 4.04
December	citrus	186 ± 3.46
January/ 2015	citrus	7 ± 0.94
February	citrus	12 ± 1.52
March	citrus	10 ± 1.73
April	Stone fruit	38 ± 6.02
May	Stone fruit	123 ± 1.70
June	Stone fruit	97 ± 2.08
July	Stone fruit	54 ± 2.18
August	Stone fruit	38 ± 1.15
September/ 2015	Stone fruit	24 ± 3.78

Through the foregoing turns out that the presence of this pest in the fields and orchards throughout the season and the increase or decrease in population density of the Mediterranean fruit fly is mainly due to the availability or absence of host's plant, In addition to the impact of other environmental factors. In general these results are in agreement with those obtained by Saleh and EL-Hamalawii (2004) Availability of hosts plant of fruit flies affects population density fluctuation Furthermore, there is a relationship between the number of flies captured and environmental conditions.

Infestation rates

The results of Table (2) were shown through a sampling program that the Mediterranean fruit fly Infest a wide range of hosts plant present in the orchards of Baghdad, Diyala and Kut province, the mainly infestation of citrus fruit was recorded in October for a year 2014, Where the percentage of infestation on the fruits of mandarin was 65%, as for the rate of infestation on the fruits of local orange variety was 18%. The infestation in oranges fruits has recorded by 28%, where as the percentage of fruit infestation reached 22% on the grapefruit.

Table 2 : Mean percentage of the *Ceratitis capitata* infestation on citrus fruits and rates of larval presentation per fruit.

Host plant	Percentage of infestation (%)	Rates of larval/ fruit ± SE	Collection region
Mandarin	65	16.0 ± 1.15	Al-keraat, Alsuwira
Sour orange	28	28.8 ± 2.31	Al-keraat
Grapefruit	22	25.5 ± 1.60	Al-keraat
orange	18	13.75 ± 2.10	Alsuwira
Persimmon	83.3	32.75 ±1.22	Alsuwira
Lemon sour local	7	10.67 ± 0.88	Alsuwira, Diyala
Sweet lemon	13	11.0 ± 1.73	Al-keraat

Value less significant difference LSD at $P \leq 0.05$ for the percentage of infested fruit = 4.971
Value less significant difference LSD at $P \leq 0.05$ for the rates of larval = 5.780

At the end of the citrus season, especially when ripening the fruits of mandarin, oranges, sour orange and grapefruit from the orchard, the infestation was recorded on the Lemon sour local fruits variety by 7%, note that the infestation of the Mediterranean fruit fly not previously registered on the Lemon sour fruit. The results showed that the Mediterranean fruit fly was attacked to Persimmon and sweet lemon fruits at the beginning of their presence in the orchard of citrus, the infestation rate was 83.3% of the Persimmon fruits (Picture 1).

Fig. 1 : Fruits of Persimmon, infested with Mediterranean fruit fly *C. capitata*

As for the presence of the pest in the other fruit orchards and described in Table (3), the infestation has recorded on the apricot fruits and was reached 45%, the presence of the pest was also observed in the apple orchard variety (western) where the percentage of fruit infestation was reached to 37.3% (Picture 2). The infestation of the Mediterranean fruit fly has not recorded on the two apples variety al- Agami and Sharabi which coincides with the presence of apricot fruits. The infestation was recorded on the fruits of yellow figs and it was 42% and was not recorded on the black fig fruits, whereas the rate of infestation on the winter pear fruits was 15.3%, while the rate of infestation was 23% on the summer pear fruits. Also infestation on the fruits of pomegranate was recorded by 21%.

Table 3 : Percentage of infested fruit by Mediterranean Fruit Fly *C. capitata* on the stone fruits and the rate of presentation of larvae per fruit.

Host plant	Percentage of infestation (%)	Rates of larval / fruit ± SE	Collection region
Pomegranate	21	13.33 ± 0.33	Diyala
Apricot	45	9.25 ±1.15	Alsuwira
Western apple	37.3	11.00 ± 1.14	Alsuwira
Pear summer	23	15.67 ± 0.66	Alsuwira
Pear winter	15.4	12.67 ± 1.45	Alsuwira
Yellow fig	42.0	7.50 ± 1.16	Diyala, Alsuwira
Red fig	No infestation reported	No infestation reported	Alsuwira

Value less significant difference LSD at $P \leq 0.05$ for the percentage of infested fruit = 19.59
Value less significant difference LSD at $P \leq 0.05$ for the rates of larval = 3.248

Fig. 2 : Fruits of apple western variety infested with Mediterranean fruit fly *C. capitata*

Through the foregoing turns out that the highest percentage of infestation of the Mediterranean fruit fly was on the kaki fruits then on the mandarin and apricot fruits, while the lowest percentage of infestation was on the lemon sour fruits. Liquiod *et al.* (1990) stated that the Mediterranean fruit fly is considered a most important pest to citrus and other fruits because they develop in most species of high commercial value. While Saleh and El-Hamalawii (2004) stated that the Mediterranean fruit fly infests a wide range of citrus and stone fruits in northern Gaza, including Valencia orange, peach, fig, guava, Clementine and the highest mean percentage of *C. capitata* infestation was 35.1% on figs and the lowest was an apple 12.5%. Al-Jubouri (2009) reported that the rate of infestation of apricot fruits reached to 34.5%, while 77% on Clementine fruit. While Mustafa and Abd-Jabar (1996) reported that the rate of

infestation rate was 90% for the pear fruits, 52% for the apples and 35% for the figs in Jordan. Perhaps the reason in disparities in infestation rates to the high or low rate of population density of the pest during of the presence of the crop, in addition to the speed of the impact of some types of fruits and may reach the rate of infestation to 100%, Fimiani (1989) reported that damage caused by fruit fly infestation to fruit crops may often reach 100%. As for the recorded of the infestation on the fruits of lemon sour was recorded on the fruit at the end of the season and the absence of any other type of citrus fruits or stone fruit in the orchard. Quayle (1938) and Liquido *et al.* (1990) note that the fruits of lemon are considered to be the hosts plant of the Mediterranean fruit fly in China and Japan, while Cowley *et al.* (1992) stated that citrus fruits are not considered to be the hosts plant of the Mediterranean fruit fly depending on the samples field fruits and field cages, as for APPPC (2005) reported that citrus fruits are not considered to be hosts plant of the Mediterranean fruit fly but infestation to this type of fruit occurs under special laboratory conditions such as holes action in lemon fruits which are used in controlled laboratory experiments. Also the above results showed that the oranges fruits variety (local) can be considered as unsuitable species for the growth and development of the Mediterranean fruit fly, Where it was observed in the laboratory of the did not development of infestation for samples of orange fruits (local variety) Infested which has brought from the field. Whereas all the first hatching larvae were found dead (personal observations).

The results of Tables 2 and 3 also showed that the average number of larvae per fruit of citrus fruits and other fruits differed significantly during the study period the highest rate of larvae on the Persimmon fruits was 32.3 larvae/fruit (Fig. 3). While average number of larvae 25 larvae / fruit on the grapefruit fruits, whilst average number of larvae was 18.8% for the fruits of the pineapple and 17.6% for the Mandarin fruits and average number of larvae was 9.4 larva / fruit on apricot fruit, whereas 8.6 larva / fruit was on lemon sour, the lowest average number of larvae for Figs was 7.5 larva / fruit.

The results showed that the highest rate of larval presentation was on the fruits of the Persimmon and then the fruits of grapefruit, while the lowest rate of presentation of the larvae was on the figs yellow fruits.

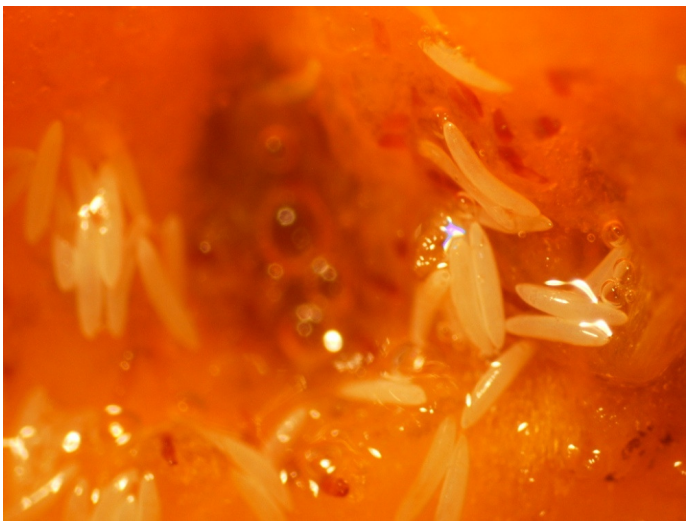

Fig. 3 : Eggs of Mediterranean fruit fly *C. capitata* in the fruits of Persimmon.

We conclude from the above that the size of the fruit of the vegetarian host is directly proportional to the average number of larvae where they are located, fruits of large size containing more larvae which are contained in small-sized fruits, as well as the effect of host plant species on the number of larvae per fruit. Results are in harmony with that mentioned by McDonald and Mclnis (1985) the number of position eggs by the Mediterranean fruit fly is high in large-sized fruits, while Medeiros *et al* (2007) mentioned that the type of host plant can significantly affect the number of pupa and the number of adults per fruit.

It was found that the presence of the Mediterranean fruit fly during the months of the winter season is mainly in citrus orchards and the high or low population density of the Mediterranean fruit fly depending on the type of plant host present, as for during the months of the summer season began in April Until the month of August, it is located in the stone fruit orchards. As the results showed Permanent presence of this pest throughout the season.

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