Population Fluctuations of The Peach Fruit Fly on Certain Apricot Cultivar Fruits

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ABSTRACT

The peach fruit fly, *Bactrocera zonata* (Saunders) is a destructive insect pest attacking a wide range of economic important fruits. This study aimed for monitoring population fluctuations and infestation rates of *B. zonata* on certain cultivars of apricot fruits included "Balady", "Amar" and "Canino" varieties in Fayoum governorate during the two seasons 2010 and 2011.Population fluctuation was weekly monitored by using modified "Nadel trap" baited with a solution of di-ammonium phosphate 3% as an attractant. Percentage of infested fruits was estimated in the field, also, weekly samples of infested fruits were kept under laboratory conditions for adult flies identification after eclosion. The cultivar "Canino" fruits received the highest population comparing with cultivars of "Balady" and "Amar". During the growing season 2010, the highest peaks were 13.83, 27.33 and 27.5 flies/trap/ week recorded on the 4th week of April, 3rd week of May and 3rd week of June, respectively, for Balady, Amar and Canino cultivars, respectively. During the 2nd season 2011, the highest means were 19.33, 27.33 and 38.50 flies/trap/week, respectively, occurred on the 2nd week of May, late of May and late of June for for Balady, Amar and Canino cultivars, respectively. The obtained results suggest avoidance of mixed-cultivation cultivars maybe reducing the population density and infestation levels of *B. zonata*.

Keywords: *Bactrocera zonata* - *Ceratitis capitata* - *Tephritidae* - Fruit fly- apricot – *Prunus domestica*- cultivar-population- stone fruits.

INTRODUCTION

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

The population dynamics and infestation rates of the tephritids on different fruit cultivars were previously studied in various parts of the world. In India, different cultivars of pear and guava had no variation in pest infestation of the oriental fruit fly, *Bactrocera dorsalis*(Hendel), however, in case of peach, early ripening cultivar "Parbhat" escaped the attack of fly due to its low initial population but cultivars such as the Australian Dwarf, Florida Sun and Florida Red which ripen late had higher fruit fly population during 1994-95 (Paramjit and Mann 2003).

The mango cultivar 'Alphonso' was the most susceptible fruits to have infestation by *Bactrocera correcta* Bezzi compared with other cultivars such as 'Kesar', 'Rajapuri', and 'Dasheri' (Sushil and Bhatt 2002). In Italy, the peak of maximum density of *C. capitata* adult was found in the months of September and October 2006 inside the late cultivars of peach orchards (Sciarretta *et. al.*, 2009). In Brasil, the peach cultivar, 'Aurora 2' presented the highest infestation by *C. capitata*, during 2004 and 2006, (Montes *et. al.* 2011).

The fruit flies, *Ceratitis quinaria* (Bezzi) and *Ceratitis silvestrii* (Walker) cause the damage only to early cultivars of mango fruits. While, *C. cosyra* attacked both early mango cultivars or mid season cultivars. A consistent population increase of *B. invadens* (Drew Tsuruta and White) in the early rainy season caused considerable damage to mid season and late cultivars. The seasonal increase of the *B. invadens* population coincided with the fruiting period of the main mango cultivars in this Northern Guinean savannah (Vayssieres *et. al.*, 2009).

In Egypt, apricot, *Prunus domestica* L. fruits represents one of the most fruit hosts attacking by both of the peach and Mediterranean fruit fly, such preference due to the thin layer of fruit skin, also, availability of climatic requirements for apricot fruit maturation and ripening period coinciding with the optimal thermal of requirements of both of the peach and Mediterranean fruit flies (Saafan *et. al.*, 2005, Afia 2007, Amin 2008 and Abdel-Galil 2010). Moreover, the apricot trees are cultivated either in aggregated areas or in distributed randomly trees among the other fruit orchards .

Apricot cultivar fruits differ, relatively, in their fruit maturation and ripening time, such variation may affect the population density and infestation rate of fruit flies, the previous studies of fruit flies on apricot fruits in Egypt confined only on the Balady and Amar cultivars fruit(Saafan 2005, Afia 2007 and Amin 2008).

The present work was designed for monitoring population fluctuations of the mentioned fruit flies, particularly, the peach fruit fly on apricot fruits cultivars in Fayoum governorate including the late cultivar "Canino". Availability of such information through the ecological studies could support the specialists in order to save more information as a base of fruit fly management programme.

MATERIALS AND METHODS

The study included monitoring the population fluctuations and infestation rates of *B. zonata* and *C. capitata* flies for two successive growing seasons 2010 and 2011 on three of apricot cultivars including Balady, Amar and Canino. The study was carried out in Dekm, Sennoris district, Fayoum governorate. The experimental orchard was about 70 feddans of limon, mandarin, olive, mango and apricot. The total area of apricot crop was about 10 feddans dividing into three separated adjacent cultivations of Balady, Amar and Canino cultivars with an area of 3, 4 and 3 feddans, respectively.

A. Determination the population fluctuation of the two flies:

Nadel traps were modified by using cylindrical transparent plastic container (12 x 28 cm) supplied by 8 side holes (1 cm diameter) around the top on the upper third part as entrances of the attracted flies (Hanafy *et. al.*, 2001). The traps were baited with 3% diammonium phosphate as an attractant and 2% sodium benzoate as a preserved agent were used for detecting both of fruit flies (Saafan, 2005) in rate of 6 traps / cultivar. The traps were hanged on a height of 1.75-2 m in a shady place of the selected trees (18 trees) with the adjacent distance of 20-25 m. Each trap solution was weekly renewed and the captured adult flies of *B.zonata* and *C. capitata* were counted.

The daily mean of maximum temperature, minimum temperature and relative humidity were obtained from the Fayoum Meteorological Station. The daily records of each climatic factor were grouped into weakly means according to the date of traps inspection. Data obtained was subjected to analysis using SPSS ® software programme (ver. 12).

B. Infestation percentage determination:

Symptoms of infestation for both fruit flies are so similar to be individually distinguished for each of them, therefore, the infestation percentages was estimated for both fruit flies together. Infestation percentages was estimated by examining 150 fruit at least for each cultivar randomly.

The percentages of infestation were estimated according to the symptoms of infestation including female stings; the fruit secreted gummy drops, the watery spot and larvae observation. Infested fruits were transferred to the laboratory in polyethylene bags, placed on plastic trays over a layer of soft sand (7-10 cm) until larvae pupation. The resulted pupae were reserved in a plastic tubes until emergence to identify the adults of *B. zonata* and *C. capitata.*

RESULTS AND DISCUSSION

A- The population fluctuations of *B. zonata* and *C. capitata*:

1- *B. zonata*:

a-The 1st Season (2010):

The illustrated data of fig (1) shows that the 1st flies of *B. zonata* were observed during the 1st week of April on the traps that placed in the Balady cultivar orchard, in the same time, the traps recorded absence of the flies during the 1st and 2nd weeks of April on the two other cultivars of apricot fruits (Amar and Canino).

For Balady cultivar, the population of *B. zonata* started gradually from 3.67 flies/trap/week to reach its peak during the last week of April with a mean number of 13.83 flies/trap/adult. Then, the flies population declined gradually to disappear during the 1st week of June. On Amar cultivar fruits, the population of *B. zonata* begin with a weekly mean number of 5.83 flies/ trap/ week and recorded its peak on the 3rd week of May. The trend of *B. zonata* recorded its minor numbers during the 2nd week of July(0.33 fly/trap/week).

Similarly to its trend on Amar cultivar fruits , the *B. zonata* flies started its peak on Canino cultivar fruits with a weekly mean number of 1.83 flies/trap/week during the 3rd week of April. The flies population increased gradually to reach its peak during the 3rd week of June with a weekly mean number of 27.50 flies/trap/week following by a marked decline to disappear during the 3rd week of July.

b-The 2nd Season (2011) :

The illustrated data of fig (2) shows that the first flies *B. zonata* were observed on the traps that located in the Balady cultivar during the 3rd week of April, In the same time, the traps recorded absence of the flies on the other apricot cultivar fruits of Amar and Canino until the 3rd week and 4th week of April, respectively. For Balady cultivar, the population of *B. zonata* started gradually from 5.33 flies/trap/week to reach its peak during the 2nd week of May with a mean number of 19.33 flies/trap/week. Then, the flies population declined gradually to disappear during the 2nd week of June.

On Amar cultivar fruits, the population of *B. zonata* begin with a weekly mean number of 1.33 flies/trap/week and recorded its peak (27.33 flies/trap/ week) on the late of May. The trend of *B. zonata* recorded its minor number during the last week of July (2.50 flies/trap/week). On Canino cultivar fruits, the *B. zonata* flies started its population with a weekly mean number of 2.67 flies/ trap /week during the last week of April. The flies of *B. zonata* increased gradually to reach its peak during the last week of June with a weekly

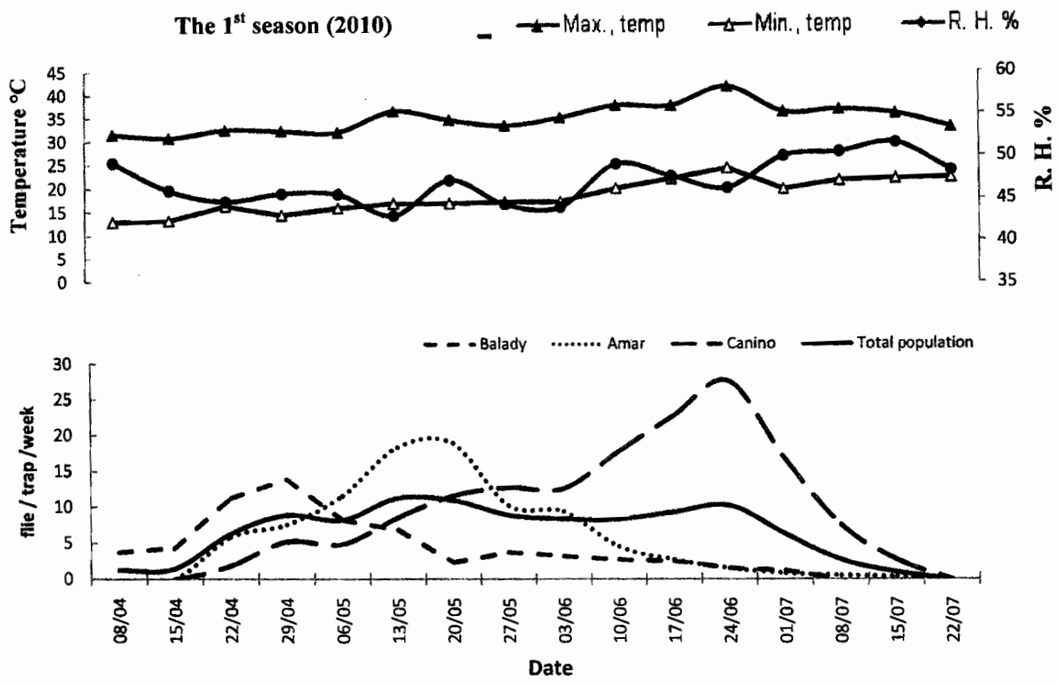

Fig. 1: Weekly means of *B. zonata* attracted flies /trap by using modified Nadel traps baited with di-ammonium phosphate hanged on certain apricot cultivars in Sennoris district, Fayoum governorate for season 2010.

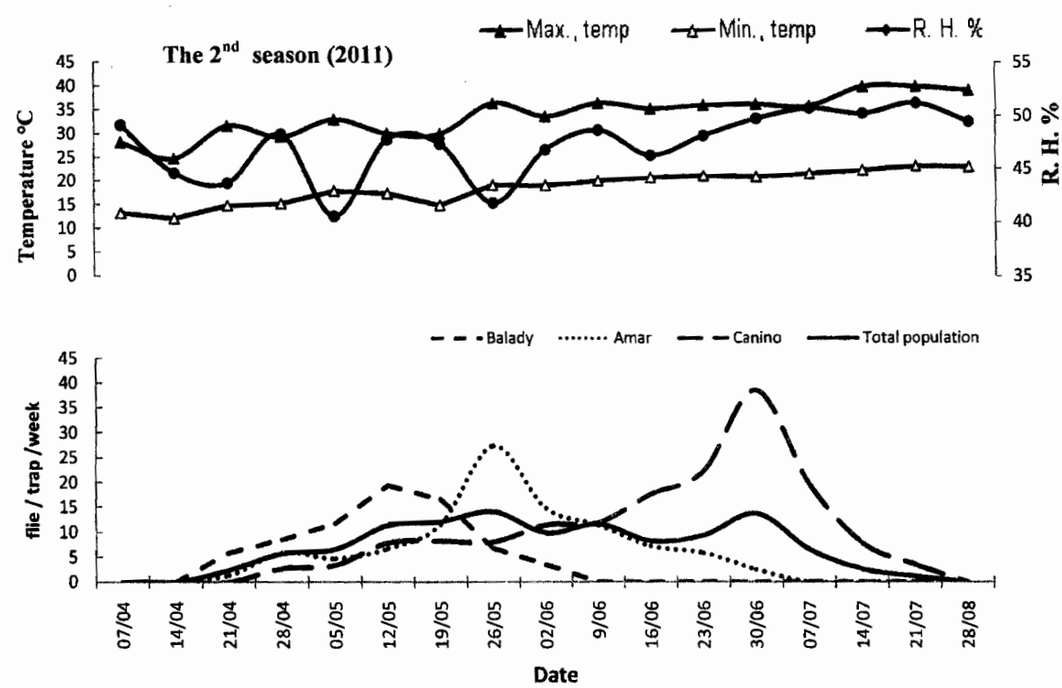

Fig. 2: Weekly means of *B. zonata* attracted flies/trap by using modified Nadel trap baited with di-ammonium phosphate hanged on certain apricot cultivars in Sennoris district, Fayoum governorate for season 2011.

mean number of 38.50 flies/trap/week following by a marked decline to disappear during the 3rd week of July.

Generally, throughout the studied two growing seasons, the obtained results indicated that the early cultivar apricot fruits (Balady and Amar) received the immigrant fertile females of the peach fruit fly with a relative advantage of Balady cultivar fruits. Also, the fly population accumulated in increasing coinciding with apricot cultivar Canino fruits ripening whereas the highest peaks were 13.83, 27.33 and 27.5 flies/trap/ week on the 4th week of April, 3rd week of May and 3rd week of June, respectively, for Balady, Amar and Canino cultivars, respectively, for the season 2010.

Also, during the 2nd season (2011), the highest numbers of the fly population was observed in the cultivar Canino comparing to the previous cultivars. The highest means were 19.33, 27.33 and 38.50 fly/trap/week, respectively, occurring on the 2nd week of May, late of May and late of June, respectively, for Balady, Amar and Canino cultivars, respectively.

Notably, after fruit harvesting, the attracted flies of traps due to the emerged flies that resulted from infested apricot fruits of Balady and Amar cultivars, therefore, the late cultivar Canino fruits received the highest levels of *B. zonata* populations.

2- *C. capitata* :

Concerning the population fluctuations of *C. capitata*, the obtained results indicated the presence of *C. capitata* flies on fruit cultivars of Balady (2010 and 2011)and Amar (2011)only in low numbers comparing to that of *B. zonata* during April of the tested two seasons. The highest mean number of *C. capitata* flies on Balady fruits were 2.17 and 0.83 flies /trap /week, respectively, recording on the 3rd and 2nd weeks of April, respectively, during the two growing seasons, 2010 and 2011, respectively. While on Amar cultivar fruits, the *C. capitata* flies were observed only on the first three weeks of April with the highest number of 0.33 fly/trap/week during the 2nd season (2011). On all tested cultivar fruits, the traps indicated absence of *C. capitata* flies during the rest of experimental period.

3-The general population trend of the two tested seasons (2010 &2011):

Concerning the general trend of the peach fruit fly population on the apricot, Fig (1) and Fig (2) present the population fluctuation of *B. zonata* flies during the two seasons, 2010 and 2011, respectively. During the 1st season (2010), two peaks were observed, the 1st peak occurred on the 2nd week of May with a mean of 11.22 flies/trap/week and the 2nd peak was observed on the 3rd week of June. While, during the 2nd season (2011), the peaks occurred on the 4th and last weeks of May and June, respectively, recording 14.00 and 13.67 flies / trap / week, respectively. Statistically, the samples independent *t*-test indicated an insignificant variation (P=0.05, df=32, t_{calc}= 0.457, and t_{table}=2.036) between the population means of *B. zonata*, 6.05 and 6.76 flies / trap for the studied two seasons, 2010 and 2011, respectively.

The obtained data ensured the population dominance of *B. zonata* in high density compared to that of *C. capitata*, such dominance of *B. zonata*, such dominance agreed with that previously reported by Saafan 2005, Afia 2007 and Amin 2008. In same time, the obtained results are in disagreement with the same previous authors for determination the population peaks of *B. zonata* apricot fruits in Egypt, in particular, Fayoum governorate which were reported during May only. This variation maybe resulted for being the previous studies of fruit flies were not including the late cultivar Canino, confining only on the Balady and Amar cultivars fruit.

The obtained results agreed with that reported by Sciarretta *et. al.,* 2009 who indicted that maximum density of *C. capitata* was inside the late cultivars of peach orchards. Contrary to that, the fruit flies, *C. quinaria* and *C. silvestrii* cause the damage only to early cultivars of mango fruits, while, *C. cosyra* attacked both early mango cultivars or mid season cultivars(Vayssieres *et. al.*, 2009).

The presented study highlighted the impact role of late cultivar Canino fruits ripening time to indicate extending the population during June and early weeks of July. Such adult population either that attacking Canino fruits or that would be emerged from soil under Canino trees during the late weeks of July is supposed to attack seriously the successive ripen fruits, namely mango fruits, particularly, that are mix-cultivated with apricot trees or neighboring the Canino cultivar orchards. The knowledge of cultivars fruit ripening time and their cultivated areas are much important for avoiding the infestation by fruit flies such as reported for the early peach cultivar "Parbhat" who escaped from infestation by *B. dorsalis* (Paramjit and Mann 2003).

B. Effect of temperature and relative humidity on population fluctuations:

Concerning the effect of climatic factors, statistically, an insignificant correlation was observed between the population of the *B. zonata* flies and the two climatic factors (maximum, minimum temperature and relative humidity) during the two studied seasons(2010 and 2011).The correlation coefficients "r" of maximum, minimum, temperature and relative humidity were 0.409,

-0.004 and -0.590 (p>0.05) respectively, for the 1st season (2010) and, 0.104, 0.149 and -0.175(p>0.05), respectively, for the 2nd season (2011). Such insignificant correlation could be interpreted through examining the recorded means for both of max., and min., temperature that occurred around the optimal thermal levels (34.9 °C and 18.4 °C for max., and min., temperature, respectively with average of 26.6 °C for the 1st season and 33.5 °C and 18.5°C for max., and min., temperature, respectively with average of 26.2 °C for the 2nd season) during the monitoring month. Previous studies of *B. zonata* development at different temperatures showed that no stages developed at temperatures of 15°C or under and the optimum temperature being at 25–30°C (Qureshi *et al.,* 1993). Also, Afia 2007 stated the 25°C was the preferable temperature for rearing both of *B. zonata* and *C. capitata* under laboratory conditions.

C. Rate of infestation for the three tested apricot cultivars:

Regarding the infestation rates through the two studied seasons 2010 and 2011, the infestation percentage are shown in tables 1 & 2.

1-The 1st Season (2010):

The presented data of table (1) indicated that the apricot Balady cultivar fruits were the firstly infested, the infestation percentage was sharply increased from 13.65% to be 56.72% coinciding with fruit ripening. The infestation occurred for 4 weeks. On the other side, the first infestation of Amar fruits was observed during the last week of April and extended for the last week of May reaching 68.95%. Subsequently, the first Canino fruit infestation was observed during the third week of May extending to the 3rd week of June.

All the emerged adult fruit flies were belonged to *B. zonata*, thus indicating the absolute infestation of the mentioned apricot cultivars by *B. zonata* females only for the mentioned season.

2-The 2nd Season (2011):

The presented data of table (2) indicated that both of apricot Balady and Amar cultivar fruits were the firstly infested during the 1st week of May (17.82 and 7.60%, respectively). The infestation percentage of Amar cultivar fruits increased sharply to be 47.62% occurring for 3 weeks coinciding with fruit ripening stage. While, the Amar cultivar fruit infestation occurred for 5 weeks and increased recording 62.77% of the total examined fruits. On the other side, the first infestation of Canino fruits was observed during the early of June and extended for the 1st week of July reaching 58.60%.

Contrary to the previous season (2010), *C. capitata* flies were observed emerging from the obtained pupae of Balady and Amar infested fruits in minor numbers only in the 2nd week of May. However, the emerged flies of obtained pupae ensured the dominance of *B. zonata*, for the present season.

Table 1: Infestation % and mean emerged flies / 1 infested fruit of *B. zonata* and *C. capitata* for apricot cultivars from Sennoris district, Fayoum governorate for season 2010.

Date of inspection		Balady			Amar			Canino		
		Infestation % of *B. zonata* and *C. capitata*	Mean of emerged flies/ 1 infested fruit		Infestation % of *B. zonata* and *C. capitata*	Mean of emerged flies/ 1 infested fruit		Infestation % of *B .zonata* and *C. capitata*	Mean of emerged flies/ 1 infested fruit	
Month	Week		*B. zonata*	*C. capitata*		*B. zonata*	*C. capitata*		*B. zonata*	*C. capitata*
April	1st	0.00	-	-	0.00	-	-	0.00	-	-
	2nd	0.00	-	-	0.00	-	-	0.00	-	-
	3rd	13.65	1.87	0.00	0.00	-	-	0.00	-	-
	4th	23.52	2.64	0.00	5.64	1.85	0.00	0.00	-	-
	Mean	9.29	2.25	0.00	1.41	1.85	0.00	0.00	-	-
May	1st	48.80	3.24	0.00	7.42	2.89	0.00	0.00	-	-
	2nd	56.72*	4.28	0.00	19.45	2.67	0.00	0.00	-	-
	3rd	-	-	-	28.29	3.22	0.00	3.82	1.08	0.00
	4th	-	-	-	42.48	3.85	0.00	12.62	3.12	0.00
	5th	-	-	-	68.95*	4.74	0.00	28.80	3.82	0.00
	Mean	52.76	7.52	0.00	33.32	3.47	0.00	9.05	2.67	0.00
June	1st	-	-	-	-	-	-	43.72	3.62	0.00
	2nd	-	-	-	-	-	-	48.62	4.12	0.00
	3rd	-	-	-	-	-	-	55.82*	4.44	0.00
	Mean	-	-	-	-	-	-	49.39	4.06	0.00

* End of fruit harvesting

Table 2: Infestation % and mean emerged flies / 1 infested fruit of *B. zonata* and *C. capitata* for apricot cultivars from Sennoris district, Fayoum governorate for season 2011.

Date of inspection		Balady			Amar			Canino		
		Infestation % of *B zonata* and *C. capitata*	Mean of emerged flies / 1 infested fruit		Infestation % of *B. zonata* and *C. capitata*	Mean of emerged flies / 1 infested fruit		Infestation % of *B. zonata* and *C. capitata*	Mean of emerged flies / 1 infested fruit	
Mouth	Week		*B. zonata*	*C. capitata*		*B. zonata*	*C. capitata*		*B. zonata*	*C. capitata*
April	1st	0.00	-	-	0.00	-	-	0.00	-	-
	2nd	0.00	-	-	0.00	-	-	0.00	-	-
	3rd	0.00	-	-	0.00	-	-	0.00	-	-
	4th	0.00	-	-	0.00	-	-	0.00	-	-
	Mean	0.00	-	-	0.00	-	-	0.00	-	-
May	1st	17.82	3.82	0.00	7.60	2.68	0.00	0.00	-	-
	2nd	34.42	4.65	0.16	17.63	3.58	0.22	0.00	-	-
	3rd	47.62*	4.32	0.00	33.50	4.32	0.00	0.00	-	-
	4th	-	-	-	48.38	5.17	0.00	·,··	-	-
	5th	-	-	-	62.77*	4.46	0.00	0.00	-	-
	Mean	33.29	4.26	0.05	33.98	4.04	0.04	0.00	-	-
June	1st	-	-	-	-	-	-	3.70	2.22	0.00
	2nd	-	-	-	-	-	-	23.82	2.50	0.00
	3rd	-	-	-	-	-	-	35.60	3.32	0.00
	4th	-	-	-	-	-	-	37.44	4.68	0.00
	Mean	-	-	-	-	-	-	25.14	4.24	0.00
July	1st	-	-	-	-	-	-	58.60*	4.88	0.00
	Mean	-	-	-	-	-	-	58.60	4.88	0.00

* End of fruit harvesting

The tested apricot cultivars differed in their occurrence time, that difference may due to its maturation and ripening of apricot fruits. The nature of apricot fruits including the thin layer and flashy pulp support the extensive damage by *B. zonata*, particularly, coinciding with the improving of climatic weather factor during this period of the year.

Generally, the obtained results of the infested apricot fruits for the tested cultivars provide the existence of insect infestation. The previous studies ensured the infestations of various fruits and their cultivars by many tephritids(Paramjit and Mann 2003, Sciarretta *et. al.*, 2009, and Montes *et. al.* 2011). The exception of attack escape was recorded on the peach early cultivar "Parbhat" as a result of low initial population of *B. dorsails* flies(Paramjit and Mann 2003)

In the conclusion, mixed-cultivation of different apricot cultivars that are successive in their maturation times in same orchard or the aggregated area causing growing the population density and infestation rates of the peach fruit fly, thus, causing considerable damage for apricot fruits. Severity of such population availability is threaten hazard for the next crop hosts, specially mango and guava early cultivars. Recommend of fruit cultivar integration and avoidance of mixed-cultivation cultivars maybe reducing the population density and infestation levels.

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الملخص العربى

تقلبات تعداد ذبابة ثمار الخوخ على بعض ثمارأصناف المشمش

علي أحمد أمين

معهد بحوث وقاية النباتات– مركز البحوث الزراعية

تهاجم ذبابة ثمار الخوخ العديد من ثمار الفاكهة ذات الأهمية الاقتصادية. وقد هدفت هذه الدراسة الى رصد تعدادها ومعدات الاصابة بها على بعض ثمار أصناف المشمش والتي شملت أصناف البلدي والعمار والكانينو بمحافظة الفيوم خلال موسمي ٢٠١٠ و ٢٠١١، تم رصد تقلبات التعداد اسبوعياً باستخدام مصائد نادل المعدلة والمزودة بمحلول مادة ثنائي فوسفات الامونيوم ٣% كجاذب وتم تقدير نسب الاصابة للثمار في الحقل وكذلك جمع ثمار مصابة وحفظها تحت ظروف المعمل لتعريف الذباب الناتج منهابعد خروجه. وقد أستقبل الصنف "كانينو" أعلى تعداد مقارنة مع صنفي البلدي والعمار، وخلال موسم ٢٠١٠ كانت أعلى تعداد ١٣,٨٣ و٢٧,٣٣ و ٢٧,٥٠ ذبابة / مصيدة/ أسبوع وذلك في الاسابيع الرابع من ابريل والثالث من مايو والثالث من يونيو على الترتيب على الاصناف البلدي والعمار والكانينو على الترتيب. بينما خلال موسم ٢٠١١ كانت أعلى متوسطات ١٩,٣٣ و٢٧,٣٣ و ٣٨,٥٠ ذبابة/ مصيدة/ أسبوع في الاسابيع الثاني من مايو والاخير من مايو والاخير من يونيو على الترتيب على الاصناف البلدي والعمار والكانينو على الترتيب. وتوصي النتائج بتجنب الزراعة المختلطة لاصناف المشمش وهو الامر الذي قد يخفض من كثافة تعداد ذبابة ثمارالخوخ ومعدلات الاصابة بها.