

POPULATION DENSITY, DIURNAL ACTIVITY AND EFFECT OF TRAP HEIGHT ON CAPTURING OF PEACH FRUIT FLY, *Bactrocera zonata* (SAUNDERS) AND MEDITERRANEAN FRUIT FLY, *Ceratitis capitata* (WIEDEMANN) IN GUAVA ORCHARDS AT NUBARIA REGION, EGYPT

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ABSTRACT

Field experiments (from December 2012 to December 2013) were carried out to study the population density, the optimum trap height and optimum time for trapping the peach fruit fly (PFF), *Bactrocera zonata* and Mediterranean fruit fly (MFF), *Ceratitis capitata* in Guava orchards at Nubaria district, Beheira Governorate, Egypt, using Jackson traps provided with the sex attractants Methyl eugenol (for PFF) and trimedlure (for MFF). Generally, Males of *B. zonata* were caught in higher number than *C. capitata* and the difference between the two flies was statistically high significant. The traps were hung at the height of 1, 2, 3 and 4 meter from ground level and the captured males were weekly recoded. It was noted that significantly highest number of males of *B. zonata* were captured in the trap hung at 3 m height and the highest number of males of *C. capitata* was recorded at 4 m height. Also, the results revealed that the significantly highest number of male flies of *B. zonata* (1.02 ± 0.11 males /trap /hour) and *C. capitata* (0.59 ± 0.07 males /trap /hour) were recorded during the period from 7.00 -10.00 am.

INTRODUCTION

The tephritid flies are among the major pests of fleshy fruits which affect production throughout the world and represent the most economically important group of polyphagous Diptera (Robinson and Hooper, 1989). The Mediterranean fruit fly or Medfly, *Ceratitis capitata* (Wiedemann), is one of the world's most destructive fruit pests. The species originates in the Mediterranean region of South Europe and North Africa. This pest attacks more than 260 different fruits and nuts. Thin-skinned, ripe, succulent fruits are preferred. Host preferences vary in different regions. An extensive host list is provided by Weems (1981). The peach fly, *Bactrocera zonata* (Saunders) originates in South and South-East Asia, where it attacks many fruit species (more than 50 host plants), including guavas, mangoes, peach, apricots, figs and citrus (White and Elson-Harris, 1992). In Egypt and other countries in the world, the peach fruit fly, *B. zonata* Saunders and the Mediterranean fruit fly, *C. capitata* are a major threat to fruits. These pests attack fruits of many species including guava; peach; mango and citrus, (Khan, 1994 and Fletcher, 1987). The effectiveness and use of traps in capturing and monitoring the population of *C. capitata* in fruit groves and orchards were described and discussed by many researchers such as Harries, *et al.* (1971), El-Sayed *et al.*(1992) and Mogahed (1999). Also, the effect of height of traps on captured fruit flies were studied and discussed by Siddique *et al.* (2003) in Pakistan

and El-gendy (2012) in Egypt. The present study aimed to determine the population DENSITY of fruit flies, the appropriate trap height and to study the diurnal activity of males of both *B. zonata* and *C. capitata* in guava orchard at Nubaria district, Egypt. Previous understanding the behavior and the seasonal fluctuation of the fruit fly population may contribute to improve the integrated management for the pest.

MATERIAL AND METHODS

The present experiments were carried out from the 7th of December 2012 to the 6th of December 2013 in a guava (*Psidium guajava* L.) orchard of sandy soil (about five feddans) that located in Nubaria district, Beheira Governorate, Egypt. The trees (about 14 years old) which cultivated at 7×7 m distances were irrigated by drip irrigation system.

The 1st experiment was planned to determine the population density of the two fruit flies, *C. capitata* and *Bactrocera zonata* and differences between the two fly populations. Twelve Jackson traps for each fly were baited with the sex attractants in capsule lure; methyl eugenol (for PFF) and trimedlure (for MFF) supplemented by Plant Protection Institute. The capsules were fixed on the bottom of the traps. Each sticky board of the trap was weekly replaced by new one. The capsules were regularly exchanged every month. These traps were randomly distributed about 50 M apart on guava trees.

The 2nd experiment was planned to determine appropriate trap height for the two species of fruit flies, where traps were hung at heights of 1, 2, 3 and 4 m from ground level. The experiment was replicated three times (3 traps for each height). The treatments were arranged in a randomized complete block design (RCBD).

In the 3rd experiment, the observations were initiated to note the diurnal activity of males of both MFF and PFF. For this purpose twelve traps were inspected Five times in Friday from each week all over the year of study at 7.00, 10.00, 13.00, 16.00 and 19.00 to determine the number of males /trap /hour during the period from 7.00 to 19.00. The results obtained were subjected to statistical analysis to obtain definite conclusions. Analysis of variance and means were separated by least significant differences test (LSD).

RESULTS AND DISCUSSION

Population DENSITY of Peach Fruit Fly, *Bactrocera zonata* and Mediterranean Fruit Fly, *Ceratitis capitata* in Guava Orchard:

The average values of weekly numbers of the population fluctuation of *B. zonata* and *C. capitata* males were used to calculate the average of monthly CTD (Capture of flies /Trap /Day). The obtained data are summarized in Table (1) and Fig. (1). It was found that the captured males of both species varied from one month to another throughout the year. The maximum abundance of *B. zonata* was recorded during October (20.52%),

but the minimum abundance was recorded during January (1.04%). The fly was active through the whole year. Concerning the medfly *C. capitata*, the highest seasonal incidence of flies of 23.68% was shown in November, while the minimum seasonal incidence of the pest (0.57%) was recorded in February. Mohamed (2002), at Sohag Governorate in Egypt mentioned that the caught flies of *B. zonata* were concentrated at August, September and October, while in the rest of the year the flies disappeared or were in shown few numbers during the three successive years of investigation of 1999-2001. But, the present results disagreed with those obtained by Mohamed (2003) who recorded the highest peak of *B. zonata* was on September 26th on guava fruits.

The results also indicated that the attracted males of both *B. zonata* and *C. capitata* occurred in high numbers in August, September, October and November (ripening and maturity stages of Guava fruits). Statistical analysis showed that the differences between the CTD numbers of *B. zonata* and *C. capitata* were high significant ($P = 0.01$), where the population of *B. zonata* was higher than the population of *C. capitata*. These results are in agreement with Mohammed (2003) and Hashem *et al.* (2001), who demonstrated the population fluctuation of medfly, *C. capitata* and peach fruit fly *B. zonata* by weekly mean captures of males per trap showed that *B. zonata* surpassed the infestation in all the examined orchard. On other hand, Darwish (2012) showed that *C. capitata* surpassed *B. zonata* in citrus orchards.

Table (1): Mean of monthly captured *B. zonata* and *C. capitata* males/trap/day (CTD) by Jackson trap baited with methyl eugenol and trimedlure in guava orchards at Nubaria district:

Months	PFF		MFF	
	CTD±SE	% of Incidence	CTD±SE	% of Incidence
December	0.83±0.416	1.66	1.20±0.27	3.80
January	0.52±0.041	1.04	0.29±0.04	0.92
February	0.61±0.105	1.22	0.18±0.035	0.57
March	1.33±0.121	2.66	1.12±0.37	3.55
April	2.80±0.285	5.59	1.88±0.17	5.95
May	3.09±0.221	6.17	2.05±0.26	6.49
June	4.06±0.189	8.11	2.52±0.15	7.98
July	3.51±0.137	7.01	2.02±0.217	6.39
August	5.13±0.159	10.25	1.86±0.22	5.89
September	8.51±0.787	17.00	4.31±0.21	13.64
October	10.27±0.372	20.52	6.68±0.53	21.15
November	9.39±1.11	18.76	7.48±0.65	23.68
Mean±SE	4.23±0.48		2.69±0.33	

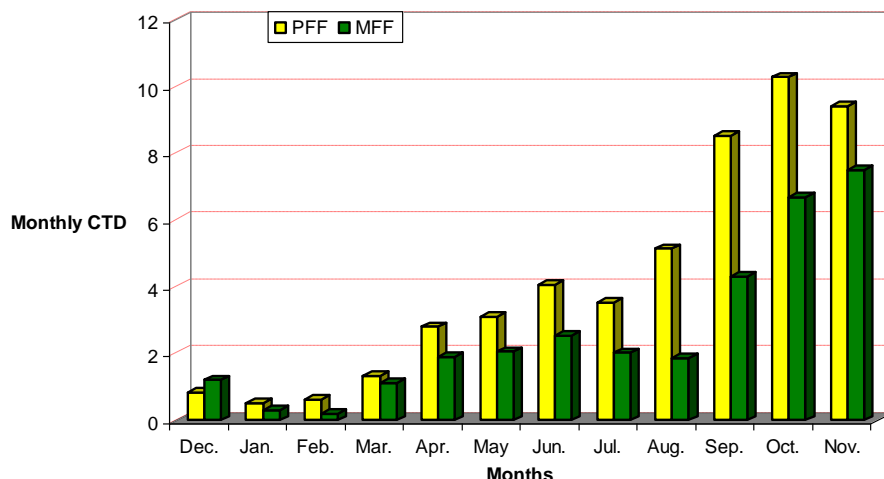


Fig. (1): Monthly fluctuation of *B. zonata* and *C. capitata* on guava trees at Nubaria district, Beheira Governorate, during 2013 year.

Effect of Trap Height on the Captured Males of Fruit Flies:

Effect of height of trap on the catches of adults of *B. zonata* and *C. capitata* (male/trap/day) was studied in guava orchard during 2013 year. Analysis of variance revealed that the variations in the number of trapped flies were significantly varied according to the different heights.

Captures of *B. zonata* males were significantly affected by trap height ($F = 5.93$; $df = 3, 208$; $P < 0.05$), where more *B. zonata* males caught at 3 m within canopies of guava trees than that of traps placed at 2 m (standard trap height) and 4 or 1 m (Table 2). Overall, about two times the numbers of flies were captured by traps placed at 3 m compared to traps hung at lower positions. These results are in disagreement with El-Gendy (2012) who stated that 1.5 m was the best position for hanging traps for more attraction of PFF males in an orchard of 5 feddans contains various host trees; mandarins, navel orange, figs, mangoes and grapefruits at Beheira Governorate. While Siddiqui *et al.* (2003) in Pakistan, stated that significantly highest number of flies of *B. zonata* were captured in the traps hung at 10 feet than 2, 4, 6 and 8 feet.

Concerning *C. capitata*, flies captures were significantly affected by trap location ($F = 4.09$; $df = 3, 208$; $P < 0.05$). Significantly more flies were caught in traps hung at 4 m compared to traps placed at 1, 2 or 3 m heights (Fig. 2). The obtained results revealed that fruit flies (*B. zonata* and *C. capitata*) activity was the greatest in the uppermost portion of guava trees canopy; thus, traps placed higher in the tree may be more attractive to flies that are active in the upper canopy compared to those placed lower in the tree canopy. Finally, the sensitivity and accuracy of monitoring for fruit flies may be improved through trap placement in a location where flies are most abundant. Holbrook and Fujimoto (1969) determined the heights at which lure

traps could attract the fruit flies. They stated that the traps placed at 6 and 15 feet above the ground level captured significantly more number of Mediterranean fruit flies than trap placed at 0.1 – 2 feet. Hooper and Drew (1979) in a rain forest environment found that the captures of tephritid fruit flies responding to cuelure and methyl eugenol increased as the height of the trap above ground was increased from 0.1 to 12.2 m. In an open forest environment dominated by eucalypts no effect of trap height was found. No effect of height on captures of flies with cuelure or methyl eugenol in a citrus orchard or in suburban gardens was found within the range 0.1–3.6 m above ground. Opp *et al.* (2000) during field studies in orchards hung two traps per trees. One of the traps was hung high (5 m from the ground), while the second trap was hung low in the canopy (2 m from the ground). High traps captured greater number of both sexes of flies than low traps.

Effect of time of day (Diurnal Activity):

The effect of time of day or diurnal activity of fruit flies was studied for the two fruit flies, *B. zonata* and *C. capitata*. The variations in the numbers of trapped males of *B. zonata* and *C. capitata* were significantly differed during the periods of study (Table 3). Concerning *B. zonata* the maximum population (1.02 ± 0.11 male /trap / hour) was recorded during the period from 7.00-10.00 h at morning followed by the period from 10.00 to 13.00 (0.18 ± 0.029) then the period from 13.00 to 16.00 (0.16 ± 0.019) and the lowest number (0.11 ± 0.015) was recorded during the period from 16.00 to 19.00 h. Similar results were obtained in case of *C. capitata*.

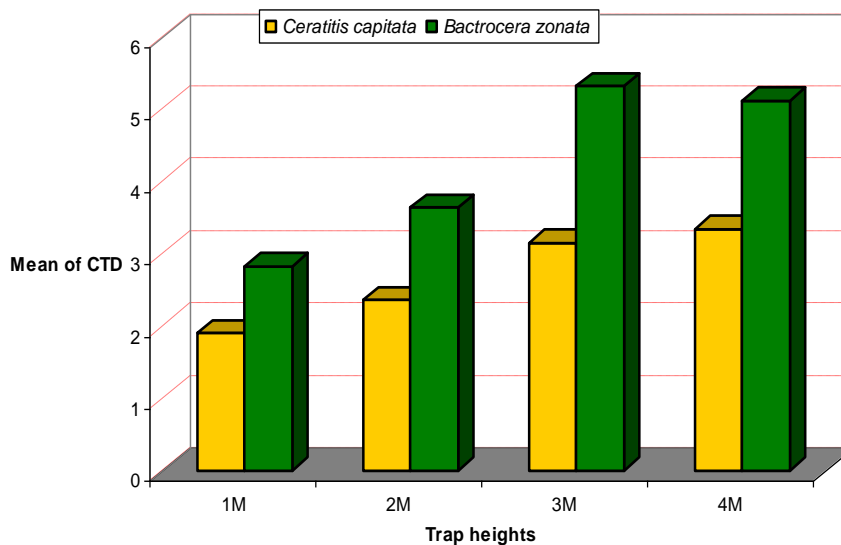


Fig. (2): Effect of height of traps on the captured males of fruit flies (*B. zonata* and *C. capitata*) at Nubaria district, Beheira Governorate, Egypt.

There were significantly different between the tested periods, where the maximum population was recorded during the period from 7.00 to 10.00 (0.59 ± 0.07 male /trap /hour), followed by the period from 13.00 to 16.00 (0.13 ± 0.015 flies /trap /hour) then 0.12 ± 0.014 male /trap /hour during the period from 10.00 to 13.00. The lowest number of male /trap /hour (0.07 ± 0.01) was recorded during the period from 16.00 – 19.00. Therefore, it is suggested that the control methods (partial bait spray) might be adapted during the morning hours to attract and kill sufficient number of flies. Kazi (1976) noted that fruit flies were most active at 10-11 h, adult flies spent much of the day resting on other plants in the vicinity of cucurbit crops, largest population of adult was found in these plants before 8 h and after 17 h. Stegeman *et al.* (1979) noted that the adult fruit flies were attracted to specific chemical lure earlier during the day time and peak attraction and population occurred earlier in the day during summer than spring season.

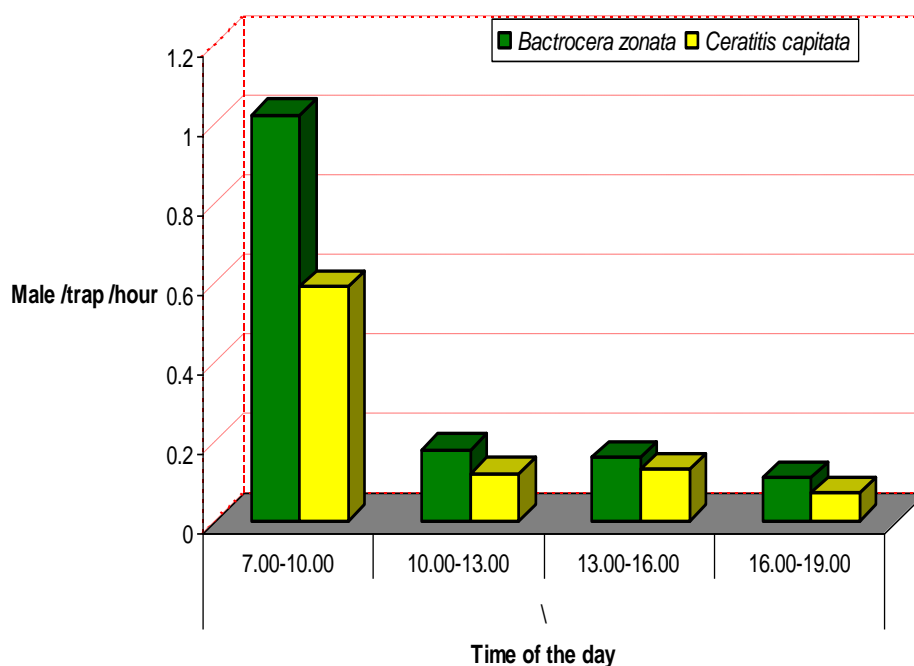


Fig. (3): Effect of the time of the day on the capture males of fruit flies (*B. zonata* and *C. capitata*) at Nubaria district, Beheira Governorate, Egypt.

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كثافة التعداد والنشاط النهاري وتأثير إرتفاع المصيدة علي جذب حشرتي ذبابة ثمار الخوخ و ذبابة فاكهة البحر المتوسط في بساتين الجوافة بمنطقة النوبارية، مصر
عدنان عبدالفتاح السيد درويش
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تم إجراء تجارب حقلية خلال الفترة من ديسمبر 2012 إلى ديسمبر 2013 لدراسة التغيرات العددية والإرتفاع المناسب للمصيدة والوقت من اليوم المناسب لجذب حشرتي ذبابة ثمار الخوخ وذبابة فاكهة البحر المتوسط في بساتين الجوافة في منطقة النوبارية، محافظة البحيرة، جمهورية مصر العربية وذلك عن طريق مصائد جاكسون والتي تم إمدادها بالجاذب الجنسي لذبابة ثمار الخوخ *Methyl eugenol* وكذلك المصائد التي تم إمدادها بالجاذب الجنسي *Trimedlure* الخاص بذبابة فاكهة البحر المتوسط. وقد وجد أن تعداد ذبابة ثمار الخوخ كان اعلي احصائيا من تعداد ذبابة فاكهة البحر المتوسط. وعند تعليق المصائد في الأشجار علي إرتفاعات 1 ، 2 ، 3 ، 4 أمتار من سطح الأرض تبين أن تعداد ذبابة ثمار الخوخ في إرتفاع 3 أمتار أعلي من تعداد الحشرة في باقي الإرتفاعات وكان أكثر إرتفاع للمصائد في جذب الحشرات في حالة ذبابة فاكهة البحر المتوسط هو إرتفاع 4 أمتار. كذلك أشارت النتائج إلي أن أعلي تعداد لذكور الذبابتين تم تسجيله في الوقت من الساعة حتى العاشرة صباحا.

قام بتحكيم البحث
أ.د/ عبد البديع عبد الحميد غانم
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Table (2): Effect of height of traps on the captured males of fruit flies (*B. zonata* and *C. capitata*) at Nubaria district, Beheira Governorate, Egypt during 2013 year:

Months	Trap heights							
	PFF (CTD±SE)				MFF (CTD±SE)			
	1 M± SE	2 M± SE	3 M± SE	4 M± SE	1 M± SE	2 M± SE	3 M± SE	4 M± SE
December	0.57±0.35	0.58±0.17	1.33±0.84	0.83±0.36	0.95±0.24	1.00±0.17	1.44±0.32	1.42±0.35
January	0.29±0.04	0.62±0.12	0.55±0.11	0.63±0.052	0.20±0.05	0.20±0.02	0.40±0.11	0.33±0.02
February	0.43±0.09	0.49±0.17	0.82±0.16	0.71±0.16	0.10±0.03	0.17±0.03	0.25±0.05	0.23±0.05
March	0.93±0.05	1.10±0.14	1.73±0.22	1.54±0.14	0.81±0.27	1.16±0.37	1.27±0.46	1.26±0.41
April	1.51±0.19	2.52±0.37	3.87±0.52	3.30±0.38	1.35±0.06	1.57±0.24	2.10±0.25	2.51±0.23
May	2.08±0.13	2.67±0.21	3.81±0.36	3.79±0.39	1.71±0.24	1.85±0.26	2.16±0.3	2.50±0.34
June	2.63±0.35	4.00±0.58	4.60±0.23	5.02±0.44	1.94±0.28	2.31±0.16	2.85±0.08	2.99±0.26
July	2.52±0.34	2.93±0.21	4.45±0.09	4.12±0.35	1.37±0.15	1.42±0.03	2.46±0.22	2.85±0.52
August	3.65±0.43	4.81±0.38	5.94±0.38	6.11±0.23	1.29±0.15	1.58±0.21	2.10±0.27	2.48±0.42
September	6.30±0.57	6.79±0.64	10.93±0.86	10.04±1.38	2.69±0.16	3.89±0.23	5.13±0.33	5.51±0.52
October	6.80±0.48	8.51±0.54	12.86±0.13	12.93±0.51	4.65±0.31	5.73±0.55	7.88±0.81	8.48±0.59
November	6.10±0.82	7.97±1	11.99±1.49	11.49±1.16	5.16±0.73	6.75±0.53	9.14±0.78	8.88±0.67
Mean±SE	2.83±0.33 a	3.64±0.4 A	5.32±0.606 b	5.12±0.59 b	1.9±0.23 a	2.36±0.29 ab	3.15±0.4 bc	3.34±0.4 c
	L. S. D. _{0.05} =1.356				L. S. D. _{0.05} =0.928			

Table (3): Effect of the time of the day on the capture males of fruit flies (*B. zonata* and *C. capitata*) at Nubaria district, Beheira Governorate, Egypt:

Months	Time of day							
	PFF CTD±SE				MFF CTD±SE			
	7.00-10.00	10.00-13.00	13.00-16.00	16.00-19.00	7.00-10.00	10.00-13.00	13.00-16.00	16.00-19.00
December	0.15±0.1	0.05±0.023	0.03±0.019	0.03±0.027	0.22±0.05	0.07±0.02	0.08±0.019	0.03±0.016
January	0.12±0.045	0.03±0.02	0.01±0.015	0	0.08±0.01	0	0.01±0.013	0
February	0.17±0.028	0.04±0.018	0.01±0.008	0.01±0.008	0.03±0.02	0	0.03±0.013	0
March	0.38±0.05	0.07±0.02	0.05±0.012	0.04±0.007	0.23±0.09	0.03±0.012	0.10±0.025	0.04±0.02
April	0.72±0.12	0.08±0.023	0.10±0.017	0.08±0.023	0.42±0.03	0.09±0.013	0.12±0.017	0.05±0.013
May	0.73±0.084	0.07±0.013	0.16±0.023	0.09±0.023	0.47±0.07	0.10±0.011	0.09±0.016	0.02±0.006
June	1.01±0.034	0.12±0.037	0.13±0.019	0.10±0.035	0.54±0.05	0.12±0.006	0.13±0.013	0.06±0.017
July	0.92±0.08	0.03±0.007	0.08±0.022	0.04±0.025	0.43±0.05	0.11±0	0.11±0.025	0.02±0.007
August	1.28±0.12	0.14±0.025	0.21±0.032	0.15±0.035	0.36±0.05	0.13±0.014	0.07±0.018	0.07±0.018
September	2.05±0.27	0.48±0.106	0.33±0.04	0.19±0.036	0.97±0.1	0.2±0.028	0.13±0.008	0.13±0.017
October	2.40±0.11	0.47±0.032	0.35±0.063	0.32±0.026	1.50±0.15	0.29±0.047	0.32±0.034	0.17±0.03
November	2.15±0.25	0.54±0.076	0.35±0.066	0.23±0.042	1.49±0.21	0.29±0.045	0.38±0.028	0.23±0.03
Mean±SE	1.02±0.11 a	0.18±0.029 b	0.16±0.019 bc	0.11±0.015 bcd	0.59±0.07 a	0.12±0.014 bc	0.13±0.015 b	0.07±0.01 bcd
	L. S. D. _{0.05} =0.161				L. S. D. _{0.05} =0.104			