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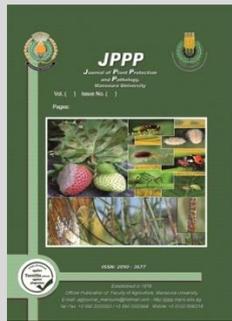
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### Innovation of a New Trap, for Catching Mediterranean Fruit Fly, *Ceratitis capitata* (Wied.) and Peach Fruit Fly, *Bactrocera zonata* (Saund.) in Egypt

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#### ABSTRACT

The present investigation was carried out during two periods, from 28 May to 25 June and 18 November to 16 December 2019, conducted in orchards at El-Qanater\_Elkhairia district, Qalubya Governorate. Field experiments evaluation of attracting both *Ceratitis capitata* (MFF) and *Bactrocera zonata* (PFF), to Gazia trap compared with two types of traps, Jackson and McPhail traps was, during the first period the attraction rate for Gazia trap recorded 61.72 and 50.5% males fruit flies of *C. capitata* and *B. zonata* comparing with Jackson traps, also recorded 30.39 and 59.39% fruit flies of *C. capitata* and *B. zonata* respectively comparing with McPhail traps. While the attraction rate for the Gazia trap during the second period recorded 23.4 and 9.75 males fruit flies of *C. capitata* and *B. zonata* comparing with Jackson traps. But when compared to McPhail traps, the results cleared 15 and 206.64% fruit flies of *C. capitata* and *B. zonata* respectively. 5% Bominal solution was the most attractive bait for MFF and PFF comparing with 3% of di-ammonium phosphate solution.

**Keywords:** *Ceratitis capitata*, *Bactrocera zonata*, Gazia trap, Jackson trap and McPhail trap.

#### INTRODUCTION

Fruit fly *Bactrocera zonata* (Saunders) and Mediterranean fruit fly (MFF), *Ceratitis capitata* (Wiedemann) (Diptera: Tephritidae) are of the most serious insect pests of fruits. In Egypt, *B. zonata* became a serious pest since 90's of the last century attacking a wide range of fruits that differ in their ripening time stage all over the year (El-Minshawy *et al.*, 1999 and Hashem *et al.*, 2007). Methyl eugenol (4-allyl-1,2-dimethoxybenzene-carboxylate) is a kairomone, that is attractive to many species of the Subfamily Dacinae (Tephritidae) in the South Pacific Region (Hardy 1979 and Metcalf 1992). Methyl eugenol was used for male annihilation or killing of sexually immature males before they were able to mate with females (Steiner 1952). Mediterranean fruit fly (MFF), *Ceratitis capitata* (Wiedemann) are the most dominant and serious pests on fruit attack of many fruit species such as; guava, peach, mango, citrus, apricot, fig and apple, attach some vegetables such as tomato and pepper also, Jackson traps used as monitoring population methods for fruit fly males (El-Minshawy *et al.*, 1999; Hashem *et al.*, 2004 and Ghanim, 2009). Trimedlure (tert-butyl 4 [and 5]- chloro-trans-2-methylcyclohexane-1-carboxylate) is the most attractive synthetic male lure known for Mediterranean fruit fly *C. capitata* (Beroza *et al.* 1961), it is important for survey, detection, and monitoring purposes (Mitchell and Saul 1990). The standard trap for trapping both of *Anastrepha* species and *Anastrepha suspense* (Loew) is the McPhail trap, (an invaginated glass bottle baited with an aqueous protein (yeast) hydrolysate solution (McPhail, 1939). Ammonium compounds successfully attract fruit flies; these compounds can be used in monitoring populations of fruit flies and mass trapping of integrated control (Hafez and Ezzat, 1967; Saafan, 2001 and Mohamed, 2002).

This study aims to invent a new trap named Gazia trap, to obtain numbers of a live flying insects or field strains of specifically adult fruit flies *Bactrocera zonata* and *Ceratitis capitata* (Diptera: Tephritidae), for the purposes of scientific research, whether it is to strengthen the laboratory strain or other research purposes.

#### MATERIALS AND METHODS

##### 1. Experimental area:

Experiments were conducted in orchards at El-Qanater\_Elkhairia district, Qalubya Governorate during the period from 28 May to 25 June and 18 November to 16 December 2019.

##### 2- Used traps :

Experiments were conducted by designing a new trap to attract fruit flies, named Gazia trap. This trap has been field tested by comparing with Jackson and McPhail traps with three replicates.

##### a - Gazia traps :

This trap is two plastic containers Fig. (2), they are separated by a joint cap, with a drop of about 2 cm perforated to prevent insects from falling down. The dimensions of the trap was about 34 cm<sup>3</sup> length \* 8 cm diameter, the upper part has four holes were made at the end of the upper third of the container, the diameter of each hole was about of 3 mm. The lower part is applied with a piece of cotton wick saturated with sex attractant 2 ml of methyl eugenol or trimedlure when comparing with Jackson traps, or put in 3% of di-ammonium phosphate solution during the first period or a 5% Bominal solution, during the last period of investigation when comparing with McPhail traps.

##### b - Jackson traps :

Three Jackson traps Fig. (1), were used for both *Bactrocera zonata* and *Ceratitis capitata* in each reloaded specific for each traps were mounted with a piece of cotton

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wick loaded with 2 ml of methyl eugenol or trimedlure for *Bactrocera zonata* and *Ceratitidis capitata* respectively . Traps were reloaded once, during four weeks, each treatment was replicated three times . All prepared traps were distributed in a completely randomized design. The distance between two adjacent traps was about 50 meters.

**c - McPhail traps :**

Three McPhail traps Fig. (1), were used and put in 3% of di-ammonium phosphate solution during the first period or a 5% Bominal solution , during the last period of investigation , traps were reloaded every two weeks (change the solution ) , during four weeks , each treatment was replicated threetimes . The distance between two adjacent traps was about 15 meters . All the traps were hanged at about 2 meters height at mid canopy level in shady and airy places . Every week, traps were inspected and numbers of captured PFF and MFF were counted and recorded .



**Fig. 1. Jackson and Mcphail traps**



**Fig. 2. Gazia traps**

**3 . Statistical Analysis :**

The experiments were planned as complete randomized design and the data was analyses by using ANOVA in SAS (SAS Institute 2003).

$$\text{Attraction rate} = \frac{\text{No. of flies attracted to the Gazia trap}}{\text{No. of flies attracted to the standard trap}} \times 100$$

**Table 1. Mean numbers males fruit flies of *Bactrocera zonata* and *Ceratitidis capitata* captured in the Gazia and Jackson traps during the period from 28 May to 25 June 2019**

Traps	Flies	Date	Mean no. Insects				Total	Mean	Attraction %
			Weeks						
			1 <sup>st</sup> week	2 <sup>nd</sup> week	3 <sup>rd</sup> week	4 <sup>th</sup> week			
Gazia	MFF		3	8	6	5	22	5.5	61.72
	PFF		2.33	2.66	60	33.66	98.66	24.66	50.5
Jackson	MFF		6	13.66	12.66	3.33	35.65	8.91	
	PFF		26	7.33	113.66	48.33	195.32	48.83	
LSD For MFF					5.44				
LSD For PFF					12.52				

**b- Mean numbers fruit flies of *B. zonata* and *C. capitata* captured in Gazia and McPhail traps :**

Data represented in Table (2) showed that cumulated mean number of MFF and PFF Captured in Gazia and McPhail traps which contains 3% of di-ammonium phosphate solution , within four weeks at , El-Qanater\_Elkhairia district Qalubya Governorate was less than use Jackson traps loaded with 2 ml of Trimedlure or methyl eugenol . (Ghanim, 2009) mentioned that Jackson

**RESULTS AND DISCUSSION**

**1- Response fruit flies to tested traps during the period of 28 May to 25 June 2019**

**a- Mean numbers males fruit flies of *B. zonata* and *C. capitata* captured in Gazia and Jackson traps :**

The obtained data in Table (1), indicated that mean number of males MFF and PFF adults captured /trap within four weeks at El-Qanater\_Elkhairia district Qalubya Governorate .The obtained results indicated that mean numbers of *B. zonata* was high during the third and fourth weeks of investigation , these results are agreement with those obtained by (Amin, 2003 & 2008 ) reported the numbers of PFF was high , the insect population reached the maximum level during summer and spring seasons, at Fayoumgovernorate , also ( Afia, 2007 ) mentioned that in Qualyobia and Giza governorates, the highest abundance of *B. zonata* was during summer and Autumn seasons .Traps attracted both males of *C.capitata* and *B. zonata* ,

However , more males of *B. zonata* were attracted in all tested traps the , highest mean number of cumulated attracted males flies of *C.capitata* was obtained in traps loaded with 2 ml of trimedlure was in 2<sup>nd</sup> week recorded 8 and 13.66 males/trap inside Gazia and Jackson trap respectively , however the lowest mean cumulated numbers of captured was recorded three males /trap in 1st week for Gazia trap and 3.33 males /trap in 4th week for Jackson trap . The general mean was recorded 5.5 and 8.91 males/trap inside Gazia and Jackson trap respectively.

Statistical analysis showed that, no significant differences between Gazia and Jackson trap where the Least Significant Difference was 5.44 . Also the Attraction rate for Gazia trap recorded 61.72 % comparing with Jackson trap. However the highest number of attracted males flies of *B. zonata* , was obtained in traps loaded with 2 ml of methyl eugenol recorded in 3<sup>rd</sup> week recorded 60 and 113.66 males / trap inside Gazia and Jackson trap respectively , with general mean was recorded 24.66 and 48.83 males /trap inside Gazia and Jackson trap respectively . Statistical analysis cleared that, significant differences between Gazia and Jackson trap where the least significant difference was 12.52. The attraction rate for Gazia trap recorded 50.5 % comparing with Jackson trap.

traps yielded good indicator method for *B. zonata* males. The potency and specificity of good pheromone traps, Jackson traps appeared to be suitable for luring PFF males evidently can be used as monitoring population methods for PFF males. The highest number of cumulated attracted flies of *C.capitata* was in the first week recorded 4 and 18.33 flies / trap inside Gazia and McPhail trap respectively. However during the third and fourth week the numbers of insects inside the traps was zero, with general

mean was recorded 2 and 6.58 flies /trap inside Gazia and McPhail trap respectively , attraction rate recorded 30.39 % . Statistical analysis showed significant differences between Gazia and McPhail trap where the Least Significant Difference was 4.49. The highest number of attracted flies of *B. zonata* was in the fourth week ,

recorded 3.33 and 6.33 flies / trap inside Gazia and McPhail trap respectively . The general mean was also recorded 1.58 and 2.66. But the efficiency of the attraction rate of Gazia trap was 59.39 % . Also showed significant differences between Gazia and McPhail traps L S D was 0.98.

**Table 2. Mean numbers fruit flies of *Bactrocera zonata* and *Ceratitis capitata* captured in the Gazia and McPhail traps during the period from 28 May to 25 June 2019**

Traps	Flies	Date	Mean no. Insects				Total	Mean	Attraction %
			Weeks						
			1st week	2 <sup>nd</sup> week	3 <sup>rd</sup> week	4 <sup>th</sup> week			
Gazia	MFF		4	4	0	0	8	2	30.39
	PFF		0.33	0.33	2.33	3.33	6.32	1.58	59.39
McPhail	MFF		18.33	8	0	0	26.33	6.58	
	PFF		0.33	1.33	2.66	6.33	10.65	2.66	
LSD For MFF					4.49				
LSD For PFF					0.98				

**2- Response fruit flies to tested traps during the period of 18 Nov. to 16 Dec. 2019:**

**a- Mean numbers males fruit flies of *B. zonata* and *C. capitata* captured in Gazia and Jackson traps:**

Data represented in Table (3) revealed that cumulated mean numbers of MFF and PFF males was high comparing with mean numbers of MFF and PFF males during the first period of experiments. Also mean numbers of MFF and PFF males during the first and second weeks was high, compared to the third and fourth week. These results are agreement with those obtained by (Amin, 2003; Afia, 2007 and Amin, 2008) , reported that the lowest abundance was recorded in winter months at Fayoum governorate and during spring season at Qualyobia and Giza governorates .Qureshi *et al.* (1975) reported that the monthly means of captured PFF males were recorded the lowest level in January-February and increased gradually to reach a peak in March-May. (Ghanim, N. M. 2009), indicated that *B. zonata* population was active throughout the year, except in winter (in the first season) and spring (in the second season) . Highest mean numbers of MFF males cumulated attracted was obtained captured/trap/week

within four weeks in traps loaded with 2 ml of trimedlure was in the first week were recorded 12.33 and 42.33 males / trap / week inside Gazia and Jackson trap respectively, however the lowest mean numbers of MFF males cumulated attracted captured inside traps was in the fourth weeks, recorded 1.66 and 15.66 males /trap/week inside Gazia and Jackson trap respectively. The general mean was also recorded 8 and 34.16 inside Gazia and Jackson trap respectively, while efficiency of the attraction rate of Gazia trap was 23.4 % comparing with Jackson trap. Statistical analysis showed significant differences between Gazia and Jackson trap where the Least Significant Difference was 13.31. The highest number of attracted males flies of *B. zonata* , was obtained in traps loaded with 2 ml of methyl eugenol recorded in the first week recorded 11 and 155 males/trap inside Gazia and Jackson trap respectively, with general mean was recorded 8.24 and 84.49 males /trap inside Gazia and Jackson trap respectively. Statistical analysis showed significant differences between Gazia and Jackson trap where the Least Significant Difference was 34.63, the lowest attraction rate for Gazia trap recorded 9.75 % comparing with Jackson trap.

**Table 3. Mean numbers males fruit flies of *Bactrocera zonata* and *Ceratitis capitata* captured in the Gazia and Jackson traps during the period from 18 November to 16 December 2019**

Traps	Flies	Date	Mean no. Insects				Total	Mean	Attraction %
			Weeks						
			1st week	2 <sup>nd</sup> week	3 <sup>rd</sup> week	4 <sup>th</sup> week			
Gazia	MFF		12.33	9.33	8.66	1.66	32	8	23.4
	PFF		11	10.66	8	3.33	32.99	8.24	9.75
Jackson	MFF		42.33	49	29.66	15.66	136.65	34.16	
	PFF		155	146.66	22.33	14	337.99	84.49	
LSD For MFF					13.31				
LSD For PFF					34.63				

**b- Mean numbers fruit flies of *B. zonata* and *C. capitata* captured in Gazia and McPhail traps :**

Table (4) show the high response of MFF and PFF flies Captured inside Gazia with McPhail traps which contains 5% Bominal solution was recorded 38.32 and 47.49 MFF and PFF flies respectively, while response of MFF and PFF flies Captured inside Gazia with McPhail traps which contains 3% of di-ammonium Phosphate solution was less, in Table (2) recorded 34.33 and 16.97 MFF and PFF flies respectively. These results are agreement with those obtained by (Ghanim 2009) mentioned that traps baited with Buminal lured significantly higher number of PFF adults than the other tested compounds, (Amin 2003; Saafan 2001 and Afia 2007) mentioned that Buminal was the main food

attractant used in attracting fruit flies . Data represented in table (4) showed cumulated mean numbers of MFF and PFF, began to increase and reached the maximum level of mean numbers during the first week, after that, the mean numbers of flies tended to decrease gradually towards the end within the last three weeks. Mean numbers of MFF captured flies/trap/week within four weeks recorded the highest cumulated attracted 4 and 25.66 flies / trap inside Gazia and McPhail trap respectively, while the lowest mean cumulated numbers of captured flies/trap/week was 0 and 1.33 inside Gazia and McPhail trap respectively in the fourth Week, with general mean was recorded 1.25 and 8.33 inside Gazia and McPhail trap respectively, efficiency of attraction rate was also recorded 15 % . Significant differences between

Gazia and McPhail trap where the Least Significant Difference was 6.11. Gazia trap recorded the highest attraction rate for PFF flies comparing with McPhail trap 206.64 % .The highest number of attracted flies of *B.zonata* was in the first week, recorded 18.66 and 10.66 flies / trap

inside Gazia and McPhail trap respectively . The general mean was recorded 8.08 and 3.91 inside Gazia and McPhail respectively. Significant differences between Gazia and McPhail trap where the Least Significant Difference was 6.13.

**Table 4. Mean numbers fruit flies of *Bactrocera zonata* and *Ceratitis capitata* captured in the Gazia and McPhail traps during the period from 18 November to 16 December 2019**

Treatments	Mean no. Insects				Total	Mean	Attraction %
	Flies	Date	Weeks				
1 <sup>st</sup> week			2 <sup>nd</sup> week	3 <sup>rd</sup> week	4 <sup>th</sup> week		
Gazia	MFF	4	1	0	0	5	1.25
	PFF	18.66	11	1.33	1.33	32.32	8.08
McPhail	MFF	25.66	7.66	1.33	1.33	33.32	8.33
	PFF	10.66	4.33	0.33	0.33	15.65	3.91
LSD For MFF					6.11		
LSD For PFF					6.13		

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## دراسة لابتكار مصيدة جديدة لجذب نصابة الفاكهة البحر الأبيض المتوسط *C. capitata* ونصابة الخوخ *B. zonata* في مصر عصام فؤاد جازيه معهد بحوث وقاية النباتات – مركز البحوث الزراعية – وزارة الزراعة.

تم إجراء هذا البحث ببساتين القناطر الخيرية بمحافظة القليوبية خلال فترتين الأولى من ٢٨ مايو وحتى ٢٥ يونيو ٢٠١٩ والثانية من ١٨ نوفمبر وحتى ١٦ ديسمبر ٢٠١٩، وذلك لاختراع مصيدة جديدة اسمها جازيه وذلك للحصول على أعداد حية من نصابة الفاكهة والخوخ لتقوية السلالة المعملية أو لأغراض البحث الأخرى. وكانت النتائج الحقلية المتحصل عليها خلال الفترة الأولى من التقييم أن نسب الجذب للمصيدة جازيه مقارنة بالمصيدة جاكسون بلغت ٦١,٧٢% و ٥٠,٠٥% لنصابة الفاكهة والخوخ وحين مقارنة المصيدة جازيه بمصيدة ماكفيل بلغت نسب الجذب ٣٠,٣٩% و ٥٩,٣٩% لنصابة الفاكهة والخوخ على التوالي. وخلال الفترة الثانية من التقييم كانت نسب الجذب للمصيدة جازيه مقارنة بجاكسون ٢٣,٤% و ٩,٧٥% وعند مقارنتها بمكفيل بلغت ١٥% و ٢٠,٦٤% لنصابتي الفاكهة والخوخ على التوالي. كما كان محلول ٥% بومينال أكثر جذباً لنصابة الفاكهة مقارنة بمحلول ٣% داي امينيوم فوسفات.