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Influence of Methyl Eugenol Diluted with Oleic Acid as Lure for the Peach Fruit Fly (PFF) Males, *Bactrocera zonata* (Saunders) under Filed Conditions

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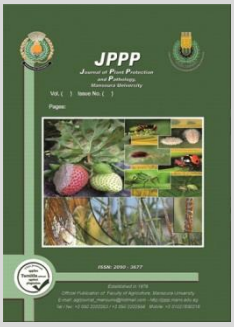

ABSTRACT

The efficiency of methyl eugenol diluted with oleic acid was evaluated against the peach fruit fly, *Bactrocera zonata*(Saunders) in guava and mandarin orchards. Four concentrations (98, 75, 50 and 25 %) weretested by using yellow Jackson trap. The obtained results indicated that *B. zonata* males showed different degrees of attractancy for the different tested concentrations in both orchards.In guava orchards, methyl eugenol attracted the highest numbers of *B. zonata* males at a concentration of 75% followed by 98, 50 and 25% with a general mean of 74.8, 66.37, 51.49 and 29.52 individuals/trap / week, respectively. Also, in mandarin the concentration of75% exhibited the highest attractiveness (19.05) for PFF males, while the concentration of 50% ranked the second group and recorded the moderate level of attractiveness (14.47) followed by 25% (11.78) and 98% (10.68individuals/trap / week) .The regression of the attractiveness of each tested concentration to PFF males over 70 days in guava and mandarin orchards revealed that the potentiality of the tested varied according to the concentration used. However, the efficiency of methyl eugenol at 75% concentration slightly decreased by the time in comparison with other tested concentrations in both orchards.

Keywords: Methyl Eugenol- Oleic Acid-*Bactrocera zonata*-Saunders

INTRODUCTION

Peach Fruit Fly (PFF) *Bactrocera zonata* (Saunders) is one of most dominant and destructive key pests in fruit orchards in different agro-ecosystem in Egypt (Dras, *et al*, 2016). It is a polyphagous species attacking a wide range of fruits that differ in their ripening time stage all over the year (White & Elson-Harris, 1992 and Ghanim2013).Methyl eugenol (ME), 4-allyl-1,2-dimethoxybenzene, is a component of plant essential oil occurs naturally in more than 450 plant species from 80 families that grow mainly in the tropics and is a fundamental nutrient of some *Bactrocera* spp. (Aluja and Norrbom, 1999; Tan, 2000; Vayssieres *et al*., 2007 and Tan and Nishida, 2012).The use of ME as attractant in traps is known globally for the control of PFF; whereas, ME is deployed as power full male-specific lure to PFF in Egypt (Afia, 2007; Abd El-Kareim*et al*.,2009; Ghanim *et al*., 2010; Ghanim, 2013; El-Metwally and Amin, 2015 and El-Metwally *et al*., 2017).Oleic acid is an unsaturated fatty acid that is the most widely distributed and abundant fatty acid in nature. it is used as an emulsifying or solubilizing agent in aerosol products. Also, it used as male annihilation technique (lure and kill) for fruit fly (Zaheeruddin, 2007). Due to the use of large quantity of methyl eugenol in the national program against fruit flies in Egypt, and the high economic cost of it, this study aims to evaluate the efficacy of different concentrations of methyl eugenol diluted with oleic acid.it is used as an emulsifying or solubilizing agent in aerosol products.

MATERIALS AND METHODS

The experiments of the present study were carried out in guava and mandarin orchards at Mansoura district, Dakahlia governorate to evaluate the efficacy of methyl eugenol diluted with oleic acid as olfactory attractants of the peach fruit fly (PFF), *Bactrocera zonata* (Saunders).

Experimental orchards:

To evaluate the efficacy of different concentrations of methyl eugenol as olfactory attractants for PFF adults, an experiment was carried out in an area of eight feddans of a seven-year-old guava (*Psidium guajava*L.) orchard started from the 3rd of August till the 6th of November 2019.Additional experiment was conducted in ten feddans of a ten-year-old mandarin(*Citrus reticulata*) orchard started from the 19th November 2019 till the 22nd of January 2020.Both orchards irrigated through overwhelming system.

Tested concentration of ME:

Methyl eugenol(98% purity, Yasho Industries, India) was diluted with oleic acid((LobaChemie Mie Pvt. LTD). at concentrations of 75, 50 and 25 %

Comparative attractiveness of *B. zonata* males to the tested concentrations of methyl eugenol:

To evaluate the attractiveness and residual effectiveness of each concentration of methyl eugenol as attractants for males of *B. zonata*, field bioassay was carried out by using Jackson traps. The cotton wick of each trap was mounted with 2 ml of each concentration. Each extract was replicated six times. Traps were hung in a shady site within the canopy of the guava or mandarin trees at height of 1.5 – 2 meters from the ground. The distance between every two adjacent traps was not less than 50meters to avoid the interaction between lures.

All the prepared traps were distributed at random in the field without the renewal of the oils. Captured males were collected every seven days for ten successive weeks and

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numbers of *B. zonata* males were counted and recorded with renewing the sticky cardboards.

Statistical analysis:

Data were analyzed by using analysis of variance (ANOVA) followed by least significant difference (LSD) at the probability of 0.05(as considered significant). In addition, the regression analysis was done to the obtained data. All statistical analysis was done with Co Hort Software (2004).

RESULTSAND DISCUSSION

Results

1- Attractiveness of *B. zonata* males to the tested concentrations of methyl eugenol:

In guava orchards:

Data in table (1) showed the weekly mean number of PFF adult males, attracted to different concentrations of methyl eugenol diluted with oleic acid in guava orchard. *B. zonata* adult males showed different degrees of attractancy for the different tested concentrations throughout the inspection period .It exhibited the highest attractiveness at 98 and 75% concentration all over the fifth weeks (with no significant difference between them). At concentrations of 50% and 25% traps harbored significantly the lowest number of PFF males all over the period of investigation. From the 7th till the 10th weeks of treatment statistical analysis revealed that, traps baited with a concentration of 75%. significantly exhibited higher level of a ttractancy to PFF males followed by 98. 50 and 25%, respectively.

Table 1. Mean number of PFF males attracted to different concentrations of methyl eugenol in guava orchards.

Weeks of inspection	Concentrations 98%	75	50	25	L. S.D. (p =5%)
1	47.16 a	45.33a	34.66 ab	26.2 b	17.7
2	44.66 a	38.0a	23.5b	23.0 b	14.18
3	85.5 a	82.4a	49.8b	36.8 b	23.17
4	152.4 a	132.16 ab	98.8b	35.8 c	45.44
5	126.8 a	95.5a	108.2a	25.8 b	55.19
6	103.6 a	136.66a	86.4 ab	33.6 b	61.21
7	28.4 bc	51.33a	43.0 ab	19.6 c	6.90
8	40.4 ab	53.0 a	20.8 bc	3.2 c	20.10
9	28.4 b	66.5 a	25.6 b	7.6 b	22.89
10	6.4 c	47.16 a	24.2 b	7.6 c	15.50

In mandarin orchards:

The weekly mean number of PFF adult males, attracted to different concentrations of methyl eugenol diluted with oleic acid in mandarin orchard is showed in table 2 significantly different degrees of a ttractancy for the different tested concentrations.

According to the obtained data (Table 2) there were no significantly differences between the mean numbers of attracted males of *B . zonata* to the tested concentrations of methyl eugenol during the first fifth weeks , excepted with the 2nd and 3rd weeks. As shown in Table(2) , *B . zonata* males show differences in their response toward methyl eugenol concentrations . Traps baited with 75 and 50% concentration exhibited the highest attractiveness for PFF males all over the first five weeks with no significant differences between them. On the contrary , from the 6th to the 10th weeks baited with concentration of 75% significantly lured the highest number of *B . zonata* males in comparison with the other tested concentrations (98, 50 and 25 %).

Table 2. Mean number of PFF males attracted to different concentration of methyl eugenol in mandarin orchards.

Weeks of inspection	Concentrations 98%	75	50	25	L. S.D. (p =5%)
1	63.66 a	87.83 a	76.0 a	64.0 a	32.35
2	18.16 b	27.83 a	26.83 ab	29.0 a	9.13
3	14.0 b	23.0 a	25.33 a	16.0 b	6.21
4	3.5 a	3.83 a	5.16 a	3.5 a	2.78
5	2.5 a	3.66 a	4.5 a	2.83 a	2.46
6	1.83 b	20.33 a	2.33 b	0.83 b	2.53
7	0.67 b	12.83 a	1.5 b	0.83 b	2.29
8	1.83 b	6.67 a	1.83 b	0.67 b	1.99
9	0.33 b	2.67 a	0.67 b	0.17 b	1.67
10	0.33 b	1.83 a	0.5 b	0.0 b	1.3

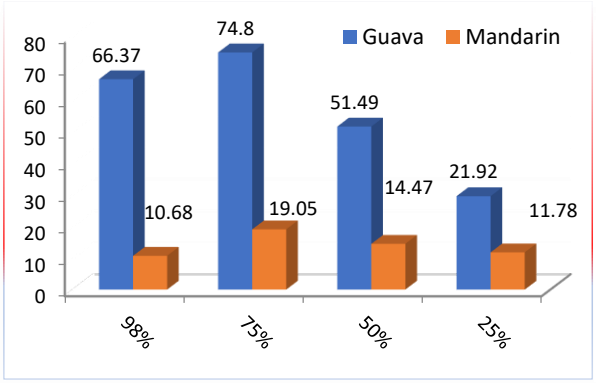

Figure 1. General mean of PFF males/ trap/ week attracted to different concentration of methyl eugenol in guava and mandarin orchards.

Data illustrated in **Figure (1)** indicate that in guava orchard, methyl eugenol attracted the highest general mean of *B. zonata* males at a concentration of 75% followed by 98, 50 and 25%, represented by 74.8, 66.37, 51.49 and 21.92 individuals/trap/week, respectively. Meanwhile, in mandarin orchard attractiveness of methyl eugenol concentrations to PFF males could be arranges discerningly as follows (19.05, 14.47, 11.78 and 10.58 individuals/trap/week) for 75, 50, 25 and 98%, respectively.

2- Residual activity of different concentrations of methyl eugenol against *B. zonata* males in guava and mandarin orchards at Mansoura district.

To evaluate the potentiality of the tested concentrations (as lures for PFF) against time, regression analysis was done between the average number of captured males and time (days).Data illustrated in Figure (2a and b) showed the regression of the attractiveness of each tested methyl eugenol concentration to PFF adults over 70 days in guava and mandarin orchards. Regression analysis revealed that the potentiality of the tested methyl eugenol concentration varied according to the concentration used. However, in guava orchard the efficiency of 75% concentration of methyl eugenol not affected by the time (b = 0.1146). On the contrary, the efficiency at 98% concentration significantly (b = 0.9549) decreased by the time (Figure, 2a). With respect to the other tested concentrations (50 and 25%), the attractiveness for PFF adults slightly affected by the time (b= 0.357 and 0.419), In mandarin orchards (Figure, 2b) data showed that the efficiency of all tested concentration of methyl eugenol affected by the time.

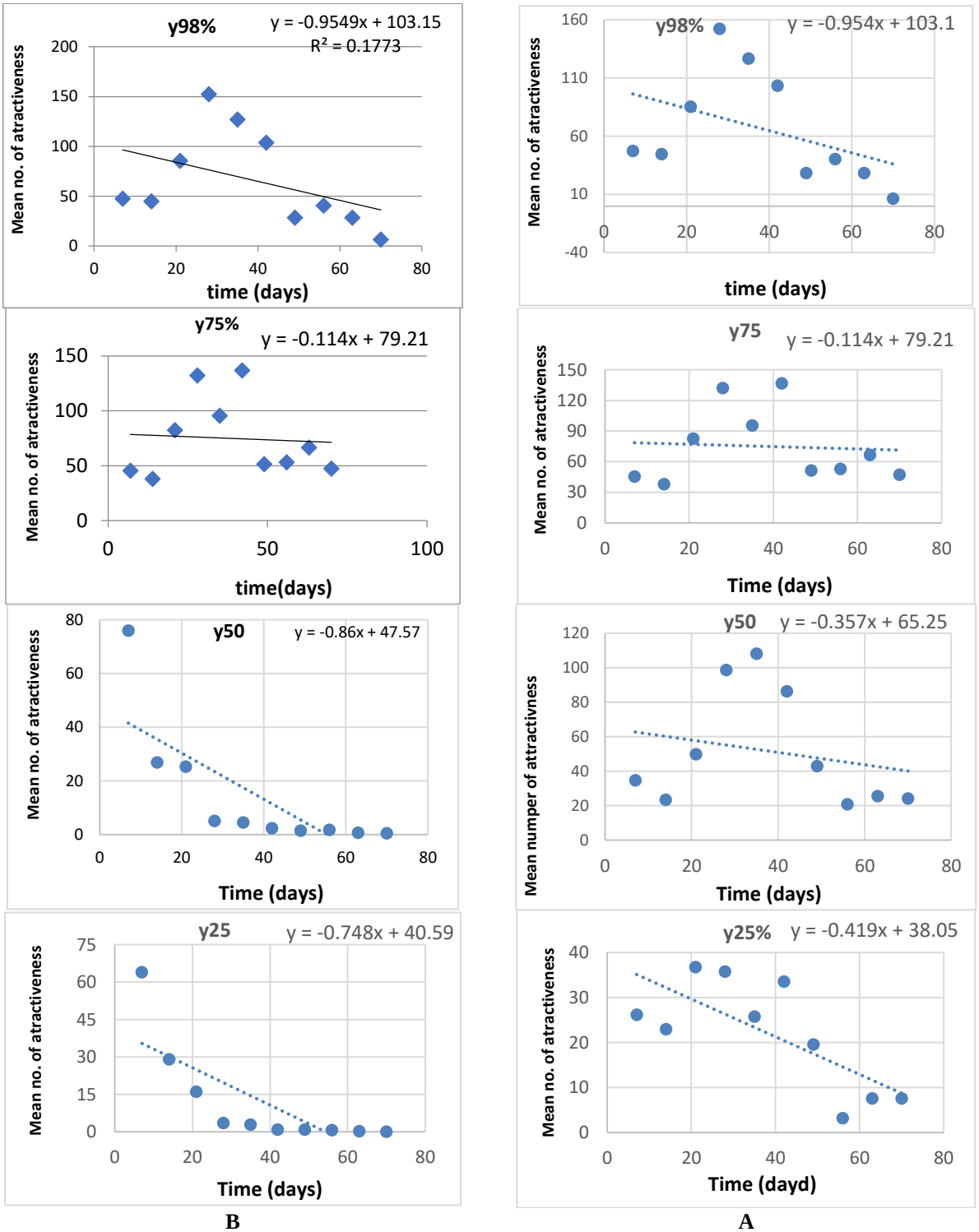

Fig. 2. Mean number of PFF males attracted to yellow Jackson traps baited with different concentrations of methyl eugenol in guava (A) and mandarin (B) orchards (bio- assayed every seven days for 70 days without renewal of the lure)

Discussion

Methyl eugenol (ME) (1,2-dimethoxy-4-(2-propenyl)benzene), a phenylpropanoid compound (Tan and Nishida, 2012), is a powerful attractant for males of many tropical tephritid fruit fly species of the genera *Bactrocera* (White & Elson-Harris, 1992 and Shelly, 2010). The present trap tests indicated that the peach fruit fly, *B. zonata*males showed different degrees of preference for the different tested methyl eugenol concentrations. PFF males showed relative preference for methyl eugenol (at 75% concentration) in comparison with the un-diluted methyl eugenol [as commercial methyl eugenol 98% purity) as well as other tested concentrations. According to El- Mtwally *et al*, (2017) they recorded that the attracting efficiency of ME for *B. zonata* males improved when coating by using some polymers. Also, El-Metwally and Amin (2015) reported that the effectiveness of methyl eugenol as an attractant for *B. zonata* decreased by the time passed under field conditions. The same authors added that methyl eugenol diluted with paraffin oil was more stable against passed time in comparison with that diluted with sunflower oil.

The highest efficiency of ME was recorded at 75 followed by 98% concentrations in guava and mandarin orchards all over the first month with no significant between them.Also, in Egypt, (El-metwally 2014) mentioned that *B. zonata* males were more attracted to ME at concentration of 98,75, and 50% with no significant between them.

According to (El-Adly, *et al*, 2018) that efficacy of a novel composite as a dispenser for methyl eugenol to attract the peach fruit fly did not significantly affected by the time passed after hanging traps; while, ME released from cotton wick dispenser decreased significantly by the time passed. The present study revealed that the most stable treatment all over ten weeks wasmethyl eugenol75% diluted with oleic acid; where, , at a concentration of 75% exhibited approximately similar potentiality towards *B. zonata* adult males with time. This may be attributed to the degree of methyl dilution by oleic acid is the ideal proportion .

So, it could be concluded that adding oleic acid to methyl eugenol with a concentration of 75% attracted significantly higher numbers of *B. zonata* males and give methyl eugenol relatively most stable against time under field conditions.

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تقييم كفاءة الميثيل إيجينول المخفف بحامض الأوليك في جذب ذكور ذبابة ثمار الخوخ تحت الظروف الحقلية

مصطفى مهران المتولى و سالمة خيرى رجب*

معهد بحوث وقاية النباتات- الدقى- الجيزة

تعتبر ذبابة الخوخ من الافات الهامة في مصر، حيث أنها تهاجم عدد كبير من محاصيل الفاكهة، وبالتالي كان الهدف من هذه الدراسة هو تقييم كفاءة الجاذب الجنسي لذبابة الخوخ (ميثيل ايجينول) المخفف بحمض الاوليك بتركيزات 98، 75، 50 و 25 % تحت الظروف الحقلية في بساتين الجوافة واليوسفي باستخدام مصائد جاكسون. أظهرت النتائج في بستان الجوافة ان ميثيل ايجينول تركيز 75 % كان الاعلي جذبا لذباب الخوخ، يليه 98، 50 و 25 % علي التوالي. وكان المتوسط العام للجذب 34.71، 31.01، 24.05، 10.24فرد/ مصيدة/ اسبوع علي التوالي. أيضا في بستان اليوسفي كان تركيز 75% هو الافضل بمتوسط جذب 34.03% يلية 50، 25، 98 % بمتوسط جذب 25.84، 21.05، 19.08 % فرد/ مصيدة/ اسبوع علي التوالي.. وفى النهاية يوصى باستخدام تركيز 75% من الميثيل ايجنول مخفف بحمض الاوليك. وبتقدير ثبات فاعلية (جذب الذكور) التركيزات المختلفة بالنسبة للزمن أظهرت النتائج ان تركيز 75% فى بستان الجوافة أقل تأثرا بعامل الزمن مقارنة بالتركيزات الأخرى , بينما فى بستان اليوسفى كان تركيز 50% أقل تاثرا مقارنة بتركيز 98, 50 و 25%.