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Studies on the Control of *Bactrocera zonata* (Saunders) by Male Annihilation Techniques in Two Locations

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Abstract: The effectiveness of the field performance of fiber blocks were impregnated with the solution of Sumithion 95% (mixed with methyl eugenol in the ratio of 1:4), Sumithion 50% (mixed with methyl eugenol in the two ratios (2:4) and (2:3)), in addition to commercial Malathion (57% EC mixed with methyl eugenol in two ratios (1:4) and (2:3)) compared to cotton wicks as an alternative dispenser of methyl eugenol either in plastic bottles with two sites (upper of 10.5 cm and lower of 7 cm of bottom of jar) or directly exposed to weather factors as in sticky-double sheet boards. Treatments were evaluated under field conditions as male annihilation technique (lure and kill) of *Bactrocera zonata* (Saunders) (Diptera: Tiphritidae). These treatments were assayed at two Egyptian governorates (Qalubia and Fayoum) over 8 successive weeks. Efficiency (as lured and killed male fruit flies) of all treatment deceased over time regardless of the area. The obtained results revealed that Sumithion 95% (mixed with methyl eugenol in the ratio of 1:4) and sticky double sheets were significantly superior to all other treatments (34.45 and 32.8). Sumithion 95% mixture blocks and sticky double sheets were relatively effective for up to 8 weeks. Remaining treatments had little or no effect. Commercial Malathion (57% EC mixed with methyl eugenol in two ratios of (1:4) and (2:3)) technical. Malathion was the worth. It was recommended that Sumithion 95% mixture can be used successfully in *B. zonata* male annihilation technique and it has to be renewed every two months. All treatments and inspection in Fayoum were the highest site attraction of male flies compared to Qalubia Governorate. In the second experiment, fiber blocks were impregnated with the solution of (T1): Malathion 57% (mixed with methyl eugenol in the ratio of (2:3)), (T2): Sumithion 50% (mixed with methyl eugenol in the ratio of (2:3)) and (T3): Sumithion 95% (mixed with methyl eugenol in the ratio of 1:4) under pressure of 1 bar through 12-15 m gave 10 g/cm^3 Saturation/block. Finally using (T4): Sumithion 50% (mixed with methyl eugenol in the ratio of (2:3)) but under pressure of 0.5-0.6 bar through 30m gave 10 g/cm^3 Saturation /block. Those were evaluated under field conditions as male annihilation technique (lure and kill) of *Bactrocera zonata* (Saunders) in two Egyptian governorates (Qalubia and Fayoum).The obtained results revealed that (T4):[Sumithion 50% & Me at ratio (2:3)]was significantly superior to all treatments in the two governorates. All treatments and inspection indicated that Fayoum was the highest site for attraction of male flies compared to Qalubia governorate.

Key words: *Bactrocera zonata* insect · Insecticides (Sumithion, Malathion) · Methyl eugenol (ME)

INTRODUCTION

Peach fruit fly *Bactrocera zonata* (Saunders) is one of the most serious polyphagous insect pests. It attacks a large host range of fruit and vegetable hosts; such as mango, peach, guava, citrus, tomato and apple [1]. Methyl eugenol (ME) (4-allyl-1,2-dimethoxybenzene-carboxylate) is a kairomone. Metcalf and Metcalf [2] reported that it is attractive to *B. zonata* males and has been tested to suppress the fly population through male annihilation technique (MAT) concept of insect control [3]. The MAT aims to reduce the male fruit fly population to such a low level that no mating occurs. This may be achieved by distributing, at regular intervals over a wide area, a carrier containing a male lure plus a toxicant. The effectiveness of the MAT may be severely reduced if the carrier loses

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its attractiveness or toxicity before the end of the interval selected. Carriers may be made of fibre board blocks [4]. The insecticides used in MAT are generally organophosphorus compounds, such as Naled, Malathion and Dichlorvos (DDVP) [5]. This method is applied as spot treatments by using many dispensers as carriers of methyl eugenol and toxicant (such as cotton cord, neutral gel, plant fiber blocks and felt blocks). The use of lure-and kill stations (i.e. plant fibers and felt blocks impregnated with the methyl eugenol-insecticide mixture) is often preferred [6, 7, 8]. Male flies are attracted to the blocks, feed from their surfaces and killed [9].

Fiberboard blocks impregnated with methyl eugenol and various insecticides (e.g., Naled, Malathion and Fipronil) were used successfully to eradicate oriental fruit fly, *Bactrocera dorsalis* (Hendel) in Rota [10], Saipan [11] & Okinawa [12]. In Egypt, the National Area Eradication Program was applied for *B. zonata* control depending upon MAT by using plant fiber blocks as carriers of methyl eugenol and toxicant. Male flies are attracted to the blocks, feed from their surfaces and killed [9]. Sumithion as a killing agent was recommended to be used in *B. zonata* male annihilation technique and monthly renewed [13].The mixture methyl-eugenol: Malathion usually remains effective in the field for one month and traps need to be serviced twice a month. A review of the biological aspects of male lures was presented by Cunningham [14] and the use of lures is described more fully by Drew [15]. As part of a program to develop area wide integrated pest management methods for *B. zonata*, the usefulness of male annihilation through fiber plant, plastic bottles and sticky-double sheet were examined. The objective of this study was to evaluate the performance of fiber block with methyl eugenol and two insecticide mixtures; plastic bottles and sticky double sheets with methyl eugenol only. Treat fiber blocks with ME & two insecticides was under pressure before using the two governorates.

MATERIALS AND METHODS

The experiments of the present work were conducted during the period from October 2012 till January 2013 in two Governorates; Qalubia and Fayoum. The cultivated host plants at both locations were mango and citrus.

The First Experiment: This experiment was designed to evaluate the efficiency of fiber wooden blocks as dispenser of two insecticides and ME compared to plastic bottles to reduce the gradual loss, or directly exposed to weather factors as in sticky-double sheet boards. The experiment was conducted in peach fruit fly located in Shebin El Qanater, Qalubia Governorate, Egypt and in (Land islands), Fayoum Governorate from October 18th to December13rd2012. Each treatment was replicated 5 times in randomized complete block design. Relative attractancy of each dispenser was expressed as the ratio of its weekly total number of male flies caught to the total number of caught fruit flies for each week.

The Plant Fiber Blocks: Plant fiber blocks (5 x5 x 1.1cm) were impregnated with the solution of Sumithion 95% & (ME) at ratio of (1:4), Sumithion 50% & ME at ratios of (2:4) and (2:3) and Malathion 57% & ME as at ratios of (1:4) and (2:3) for about four hours in the laboratory. These blocks were transferred to the field in plastic bags. To collect the dead insects, plastic containers (measuring 20 cm height and 10 cm diameter) were fixed under the treated blocks by metallic wire to count the dead *B. zonata* males weekly for a period of 8 weeks.

The Plastic Bottles: Plastic bottles (25 cm height and 10 cm diameter) had 4 entrance holes of 8 mm diameter were prepared with two sides (upper of 10.5 cm and lower of 7 cm of the bottom of jar). All traps were alternatively hung at random in 5 replicates within the canopy of trees. A cotton wick was fixed and supplied with the methyl eugenol. The bottles were supplied with a removable cover for obtaining and counting the weekly attracted male preach fruit flies.

The Sticky-Double Sheets: Cartoon Sheets (21.5 x 21.5 cm) of sticky-double surfaces were applied with fixing the impregnated cotton wicks on circular holes (1 cm diameter) in the center of the sheet with the methyl eugenol. The attracted and killed insects were weekly counted and removed. This treatment was replicated 5 times and distributed in completely randomized design.

The Second Experiment: This experiment was designed to evaluate the efficiency of fiber wooden blocks of insecticide and ME under pressure in laboratory. These blocks were transferred to the field in plastic bags. Insecticide diffusion under pressure is a commercial process because the fiber block reduced the saturated amount of insecticide by dipping when application of pressure. This treatment results in limited penetration into fiber block. The experiment was conducted in peach fruit fly located in Qalubia and Fayoum Governorates from November 21st, 2012 to January 16th, 2013. Each treatment

was replicated 5 times. Fiber blocks impregnated with solution of (T_1):Malathion 57% &ME at ratio of (2:3), (T_2): Sumithion 50% & ME at ratio (2:3) and (T_3): Sumithion 95% & ME at ratio (1:4) under pressure of1 bar through 12-15 m gave 10 g/cm^3 saturation/block. Finally using (T_4): Sumithion 50% & ME at ratio (2:3) but under pressure of 0.5-0.6 bar through 30m gave 10 g/cm^3 Saturation /block. These blocks were transferred to the field in plastic containers. To collect the dead preach fruit fly males, plastic containers (measuring 20 cm height and 10 cm diameter were fixed under the treated blocks by metallic wire to collect the dead males of *B. zonata* males which were counted and recorded weekly for 8 weeks.

Statistical Analysis: The obtained data were subjected to regular analysis of variance of randomized complete block design by using Duncan's test at the probability of 5%, T- test distribution outlined by Gomes and Gomez [16].

RESULTS

The First Experiment: The obtained results are summarized in Tables 1 and 2 as mean values of weekly collected *B. zonata* males by fiber block for different methyl eugenol insecticide mixtures, plastic bottles and sticky double sheets at the two tested sites.

Effect of Time on The Efficiency: Data in Tables 1 and 2 shows that all of the tested methyl eugenol-insecticides mixtures, plastic bottles and sticky-double sheets exhibited their highest efficiency (as lure and kill) over the first (1 to 3 weeks). After that, the efficiency degraded as time progressed regardless of site.

Effect of Different Treatments: Data in Tables 1 and 2 shows the average numbers of captured *B. zonata* male flies to fiber block, plastic bottles and stick double sheet treatments. Generally, during the period of investigation (8 weeks), the mean numbers of males attracted to wooden block with Sumithion 95% & Me at ratio (1:4) and sticky double sheets were significantly the highest (34.45 and 32.8) followed by the bottle holes lower and upper (16.13 and 12.13 male flies). On the contrary, lower efficacy of *B. zonata* male resulted from fiber block treatments by Malathion 57% & Me at ratio (2:3),Sumithion 50% & Me at ratio (2:4), Malathion 57% & ME at ratio (1:4) and Sumithion 50% &Me at ratio (3:2), showing 0.03, 0.05, 0.1 and 0.13 Male flies respectively (Table 1). In Fayoum Governorate, the mean numbers of males attracted to wooden block with Sumithion 95% & Me at ratio (1:4) was significantly the highest (147.4 male flies), followed by the sticky double sheets (48.78 male flies). The same trend was obtained in Qalubia. *B. zonate* cuptures were lowest with the plastic bottle holes (lower and upper), Sumithion 50% &ME at ratio (2:4), Sumthion 50% &ME at ratio (3:2), Malathion 57% & ME at ratio (1:4) and Malathion 57% & ME at ratio (2:3) showing 30.98, 10.25, 2.37, 2.0, 0.85 and 0.25 male of *B. zonata,* respectively (Table 2).

Effect of Interaction: With respect to persistence, *B. zonata* captures for Sumithion 95% & ME (1:4, plastic bottle holes upper & lower and sticky sheets at week 8 were greater than or equal to those at first week. In Qalubia the highest attraction of *B. zonata* male was obtained in the first week by sticky double sheets followed the first week by Sumithion 95% &ME (1:4). While, the lowest one was obtained by Sumithion 50% & ME (2:4), Sumithion 50%&ME (3:2), Malthion 57%&ME (1:4) and Malathion 57% & ME (2:3) in all weeks. In Fayoum, the highest attraction of *B. zonata* male was obtained in the second and first weeks by Sumithion 95% & ME (1:4). The same trend was obtained in Qalubia. *B. zonata* captures were lowest with Sumithion 50% & ME (2:4), Sumithion 50% & ME (3:2), Malthion 57%&ME (1:4) and Malthion 57% & ME (2:3) in all weeks.

Effect of Site: The results presented in Table 3 demonstrated significant differences between the two governorates in attraction of *B. zonata* male per week. All treatments and inspections showed that Fayoum was a higher site for attraction of male flies compared to Qalubia governorate.

The Second Experiment: The obtained results are summarized in Tables 4 and 5 as effect of interaction between four treatments and time on the numbers of *B. zonata* in the two locations.

Effect of Time on the Efficiency: Data in Tables 4 and 5 show the average of weekly captured *B. zonata* males after application of four treatments. The highest attraction of *B. zonata* males occurred in the 1st and 2nd weeks in Qalubia. However, the highest values of attraction of *B. zonata* flies in Fayoum occurred in the 2nd week followed 3rd week. After that, the efficiency decreased as time progressed regardless of the site.

Effect of Different Treatments: Tables 4and 5 show the average of captured *B. zonata* male flies throughout 8 weeks. The treatment of fiber block with different methyl

Table 1: Mean number of *B. zonata* males attracted to eight male annihilation techniques in Qalubia governorate during October 18th to December13th 2012

			Mean no. *B. zonata* captured after (8) weeks exposure								
Treatments			1	2	3	4	5	6	7	8	Mean
Sumithion 95%&Me (1:4)			90.4b	56.6c	46.0cd	10.0fg	12.2fg	40.6cde	16.2efg	3.6g	34.45 A
Sumithion 50% &Me(2:4)			0.0g	0.0g	0.0g	0.0g	0.0 g	0.2g	0.2g	0.0g	0.05 C
Sumithion 50%&Me (3:2)			0.0g	0.2g	0.4g	0.0 g	0.0 g	0.2 g	0.2g	0.0 g	0.13 C
Malathion 57%&Me (1:4)			0.0g	0.0g	0.0g	0.0 g	0.0 g	0.4 g	0.4 g	0.0 g	0.10 C
Malathion 57%&Me (2:3)			0.0g	0.0g	0.2g	0.0 g	0.0 g	0.0g	0.0g	0.0g	0.03 C
Plastic bottle	Site holes	Upper	37.2cdef	15.0efg	12.8efg	4.6g	7.4g	13.2efg	5.0g	1.8g	12.13 B
		Lower	55.4c	23.4defg	15.8efg	6.2g	12.2fg	7.2g	6.4g	2.4g	16.13 B
Sticky double sheets			141.0a	46.6cd	38.2cdef	11.4fg	11.4fg	6.8g	4.8g	2.2g	32.8 A
Mean			40.5 A	17.73 B	14.18 BC	4.02 CD	5.40 CD	8.58 D	4.15 D	1.25 D	--
LSD 0.05	Treat.						8.378				
	Week						8.378				
	Inter.						23.70				

Means within interaction followed by different lower case letters. The different capital letters treatment or inspection were significantly different by fisher's LSD test ($p<0.05$)

Table 2: Mean number of *B. zonata* males attracted to eight male annihilation technique in Fayoum Governorate during October 18th to December 13th 2012.

			Mean no. *B. zonata* captured after (8) weeks exposure								
Treatments			1	2	3	4	5	6	7	8	Mean
Sumithion 95%&Me (1:4)			265.0b	682.4a	124.0de	55.8f	23.2fg	20.8fg	6.8g	0.8g	147.4A
Sumithion 50% &Me(2:4)			4.6g	7.6g	2.4g	0.8g	1.6g	1.2g	0.6g	0.2g	2.375D
Sumithion 50%&Me (3:2)			5.4g	5.6g	1.4g	1.0g	1.2g	1.4g	0.0g	0.0g	2.0 D
Malathion 57%&Me (1:4)			2.4g	2.2g	1.2g	0.2g	0.2g	0.4g	0.0g	0.2g	0.85 D
Malathion 57%&Me (2:3)			0.2g	0.6g	0.4g	0.4g	0.0g	0.2g	0.0g	0.2g	0.25 D
Plastic bottle	Site holes	Upper	20.6fg	24.6fg	10.2g	10.2g	3.0g	9.4g	2.4g	1.6g	10.25 D
		Lower	44.00fg	111.0e	43.8fg	26.4fg	11.8g	8.6g	1.8g	0.4g	30.98C
Sticky double sheets			150.6d	192.6c	19.8fg	10.2g	4.8g	8.4g	2.0g	1.8g	48.78B
Mean			61.6B	128.3A	25.4C	13.13CD	5.725 D	6.3 D	1.7 D	0.65 D	--
LSD 0.05	Treat.						12.92				
	Week						12.92				
	Inter.						36.53				

Means within interaction followed by different lower case letters. The different capital letters treatment or inspection were significantly different by fisher's LSD test ($p<0.05$)

Table 3: Effect of site on the attraction of *B. zonata* males

Variables				Qalubia	Fayoum
Treatments	Sumithion 95%&Me (1:4)			34.45	147.4
	Sumithion 50% &Me(2:4)			0.05	2.375
	Sumithion 50%&Me (3:2)			0.13	2.0
	Malthion 57%&Me (1:4)			0.10	0.85
	Malthion 57%&Me(2:3)			0.03	0.25
	Plastic bottle	Site holes	Upper	12.13	10.25
			Lower	16.13	30.98
	Sticky double sheets			32.8	48.78
T value				12.83	
Inspection	1st week			40.5	61.6
	2nd week			17.73	128.3
	3rd week			14.18	25.4
	4th week			4.02	13.13
	5th week			5.40	5.725
	6th week			8.58	6.3
	7th week			4.15	1.7
	8th week			1.25	0.65
T value				12.62	

Table 4: Mean numbers of lured and killed male flies per block weekly overtime at Qalubia when treated the block with different methyl eugenol-insecticide mixtures under pressure before using in the field

		Mean no. *B. zonata* captured after 8 weeks exposure								
Treatments		1	2	3	4	5	6	7	8	Mean
T_1		2.8bcde	2.8cde	1.4de	0.2e	0.8e	0.0e	0.0e	0.0e	1.0B
T_2		4.4bcd	4.8bc	1.0e	0.8e	0.4e	0.0e	0.0e	0.0e	1.425AB
T_3		5.8ab	4.4bcd	0.6e	0.4e	0.6e	0.0e	0.0e	0.0e	1.475AB
T_4		8.0a	5.6ab	2.4cde	2.4cde	0.4e	0.0e	0.0e	0.0e	2.35A
Mean		5.25A	4.4A	1.35B	0.95B	0.55B	0.0B	0.0B	0.0B	--
LSD 0.05	Treat.				1.344					
	Week				0.95					
	Inter.				2.689					

Means within interaction followed by different lower case letters. The different capital letters treatment or inspection were significantly different by fisher's LSD test ($p<0.05$. (T_1: Malathion 57%& ME at ratio (2:3). T_2: Sumithion 50% & ME at ratio (2:3). T_3: Sumithion 95% & ME at ratio (1:4)) under 1bar of pressure throughout 12-15m gave 10 g. T4: Sumithion 50% & ME at ratio (2:3) under 0.5-0.6 bar of pressure throughout 30m gave 10 g.

Table 5: Mean numbers of lured and killed male flies per block weekly overtime at Fayoum when treated the block with different methyl eugenol-insecticide mixtures under pressure before using in the field

		Mean no. *B. zonata* captured after 8 weeks exposure								
Treatments		1	2	3	4	5	6	7	8	Mean
T_1		2.8h	5.4fg	2.8h	0.6ij	0.4ij	0.2j	1.0hij	0.2j	1.67D
T_2		4.8g	18.4c	18.8c	2.00hij	0.8hij	0.0j	1.4hij	0.8hij	5.87B
T_3		6.8f	12.8e	15.4d	0.8hij	1.2hij	0.4ij	2.0hij	0.6ij	5.00C
T_4		17.2c	33.0a	28.4b	4.6g	2.4hi	1.0hij	0.2j	0.2j	10.88A
Mean		7.9C	17.4A	16.35B	2.0D	1.2DE	0.4E	1.15DE	0.45E	--
LSD 0.05	Treat.				0.84					
	Week				0.61					
	Inter.				1.72					

Means within interaction followed by different lower case letters. The different capital letters treatment or inspection were significantly different by fisher's LSD test ($p<0.05$. (T_1: Malathion 57%& ME at ratio (2:3). T_2: Sumithion 50% & ME at ratio (2:3). T_3: Sumithion 95% & ME at ratio (1:4)) under 1bar of pressure throughout 12-15m gave 10 g. T4: Sumithion 50% & ME at ratio (2:3) under 0.5-0.6 bar of pressure throughout 30m gave 10 g.

Table 6: Effect of site on the attraction of *B. zonata* males

Variables		Qalubia	Fayoum
Treatments	T1	1.00	1.67
	T2	1.43	5.87
	T3	1.48	5.00
	T4	2.35	10.88
T value		6.10	
Inspection	1st week	5.25	7.90
	2nd week	4.40	17.40
	3rd week	1.35	16.35
	4th week	0.95	2.00
	5th week	0.55	1.20
	6th week	0.00	0.40
	7th week	0.00	1.15
	8th week	0.00	0.45
T value		2.00	

eugenol- insecticide mixtures were exposed to reduced pressure in laboratory before using in the field. During the period of investigation (8 weeks), in Qalubia the mean number of males attracted to (T4) (Sumithion 50% & ME at ratio (2:3) under pressure of 0.5-0.6 bar through 30m gave 10 gm/cm^3 Saturation/block) was significantly the highest 2.35 followed by T2 (Sumithion 50% & ME at ratio (2:3)under pressure of 1 bar through 12-15 m) and T3 (Sumithion 95% & Me at ratio (1:4) under pressure of 1 bar through 12-15 m) were equally attractive. On the contrary, T1 (Malathion 57% & ME at ratio of (2:3) under pressure were 1 bar through 12-15 m) males capture was significantly lower than all other treatment (Table 4). Also, in Fayoum Governorate the T_4 was again ranked the top in the 8weeks followed by T_2 and T_3 were the second efficient treatment. But T_1 was always the lowest treatment in male flies' attractiveness (Table 5).

Effect of Interaction: In both Governorates the highest attraction of *B. zonate* male was obtained in the first and second week by T4. While, the lowest one was obtained from the 4th week to week 8 by T1, T2, T3 and T4.

Effect of Site: The results presented in Table (6) demonstrated that in the two governorates revealed significant differences on attraction of *B. zonate* male per week. All the treatment and all the week in Fayoum was the highest site attraction of male flies compared to Qalubia governorate which showed lower attraction of male flies in the treatment and inspection (8 weeks).

DISCUSSION

Sumithion 95%-methyl eugenol mixture exhibited the highest efficiency in attracting *B. zonata* males in comparison with the mixtures of the other tested insecticides with fiber block, plastic bottles and the sticky-double sheets. The obtained results are in agreement with those previously reported by Ghanim *et al.* [13] who reported that Commercial Malathion mixture was recommended and Naled mixture can be used successfully in *B. zonata* male annihilation technique and it has to be renewed every two months. Lambada, Lebaycid, Sumithion, commercial Malathion (2:3) mixtures could be used with monthly renewal. Also, the obtained results are in consistent with those reported by Ghanim *et al.* [13] who reported that Sumithion as a killing agent was recommended to be used in *B. zonata* male annihilation technique and it has monthly renewed. EPPO [17] pointed out the insecticides used in MAT for *B. zonata* are generally organophosphorus compounds such as Malathion or Sumithion. Vargas *et al.* [5] reported that Naled is one of the most effective insecticides against *B. dorsalis* and *B. cucurbutae* in Hawaii. Lambada, Lebaycid, Sumithion, commercial Malathion (2:3) had the second rank of efficiency against *B. zonata* males. Amin [18] Stated that, fibered blocks treated by methyl eugenol and Sumithion as a toxicant were the highest efficient for attracting and killing the highest numbers of *B. zonata* males for up to 4 weeks. This method is applied as spot treatments by using many dispensers as carriers of methyl eugenol and toxicant (such as cotton cord, neutral gel, plant fiber blocks and felt blocks). Also, the use of lure-and-kill stations (i.e. plant fibers and felt blocks impregnated with the methyl eugenol-insecticide mixture) is often preferred [6, 7, 8]. Male flies are attracted to the blocks, feed from their surfaces and killed [9].

Sumithion 50% & ME at ratio (2:3) under pressure of 0.5-0.6 bar through 30 m gave 10 g/cm^3 Saturation/block gave highest efficiency against *B. zonata* males in comparison with the mixtures of the other tested insecticides mixture with fiber block under pressure of 1 bar through 12-15 m gave 10 g/cm^3 Saturation /block. There was evidence that Pacific fruit fly does not feed as readily stated on methyl eugenol as other flies attracted to this lure (e.g., the dorsalis complex of fruit flies). In Fiji Islands, fruit fly workers observed alive Pacific fruit flies in traps that were newly baited with methyl eugenol and Malathion on many occasions [19]. Also, binning the two lures on one block may reduce the effectiveness of each lure. The amount of methyl eugenol impregnated into each block was reduced to about 4-5 ml when both lures were impregnated into the same blocks, compared to 10-12 ml, when the block was treated with methyl eugenol alone. Previous evidence showed that too little methyl eugenol added to carriers might reduce the attractant for the full period [12, 14, 20]. In Egypt, the National Area Eradication Program was applied for *B. zonata* control depending upon MAT by using plant fiber blocks as carriers of methyl eugenol and toxicant. Male flies are attracted to the blocks, feed from their surfaces and killed [9].

CONCLUSION

In conclusion, the obtained results support using the fibered blocks as a dispenser of methyl eugenol for suppression *B. zonata* males by MAT applications depending upon its high performance of attracting and killing *B. zonata* male flies. In the same time, performance development of alternatives is a necessity to improve the trapping quality.

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